

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
16 March 2006 (16.03.2006)

PCT

(10) International Publication Number  
**WO 2006/028353 A2**

(51) International Patent Classification:

**D06F 37/26** (2006.01) **D06F 39/12** (2006.01)  
**D06F 37/42** (2006.01)

(21) International Application Number:

PCT/KR2005/002982

(22) International Filing Date:

9 September 2005 (09.09.2005)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10-2004-0072599

10 September 2004 (10.09.2004) KR

10-2004-0074529

17 September 2004 (17.09.2004) KR

(71) Applicant (for all designated States except US): **LG ELECTRONICS INC.** [KR/KR]; 20, Yeouido-dong, Yongdeungpo-ku, Seoul 150-010 (KR).

(72) Inventors: **CHOI, Dong Ha**; #21/3, 330-1188, Junpo3-dong, Busan Jinku, Busan-si 614-043 (KR). **KIM, Soo Bong**; #1009-13, Doksan1-dong, Keumchun-ku, Seoul 153-829 (KR). **LEE, Kyu Hwan**; #H-207 LG Saenghwankwan, Kaeumjung-dong, Changwon-si, Kyungsangnam-do 641-110 (KR). **AHN, Yong Jin**;

#1101 Wonyoung Life, 602-12 Wolyoung-dong, Masan-si, Kyungsangnam-do 631-260 (KR). **KIM, Min Ho**; #602-1502 Hyundai Apt., 610 Gueui3-dong, Kwangjin-ku, Seoul, Rep. of Kore 143-203 (KR).

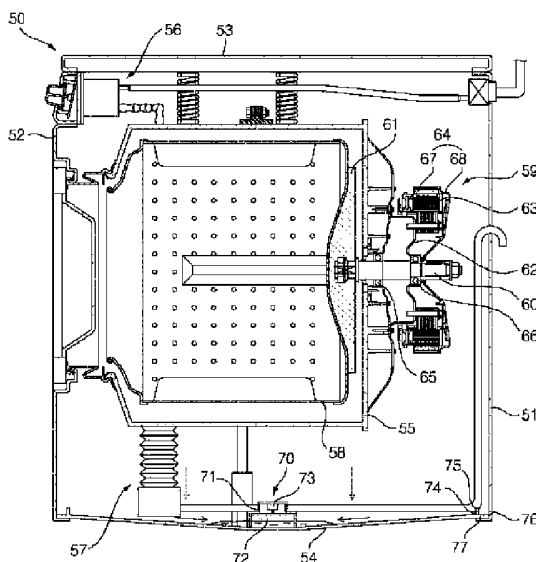
(74) Agent: **PARK, Byung Chang**; 301 Woojin Bldg., 1445-2 Seocho-dong, Seocho-ku, Seoul 137-070 (KR).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: WASHING APPARATUS



(57) Abstract: Disclosed herein is a washing apparatus in which the top of a base pan is inclined downward toward a mounting position of a water leakage sensor, so that water, dropped onto the base pan, is gathered toward the water leakage sensor regardless of a water drop position, thereby enabling prompt operation of the water leakage sensor and achieving an enhancement in reliability. Furthermore, the washing apparatus comprises holders by which the water leakage sensor is vertically caught after being vertically press fitted to the base pan, thereby enabling the water leakage sensor to be mounted to the base pan via a single vertical press-fitting operation, resulting in an enhancement in assembling efficiency.



**Published:**

— without international search report and to be republished  
upon receipt of that report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## **Description**

### **WASHING APPARATUS**

#### **Technical Field**

- [1] The present invention relates to a washing apparatus, and, more particularly, to a water leakage sensing structure of a washing apparatus, in which the top of a base pan is inclined downward toward a water leakage sensor to induce prompt operation of the water leakage sensor and the water leakage sensor can achieve a reduction in assembling costs by virtue of simplified structure and assembling operation thereof.

[2]

#### **Background Art**

- [3] Generally, washing apparatuses are classified into washing machines for washing laundry using detergent and water, drying machines for drying wet laundry using dry hot air, and combined washing and drying machines having both washing and drying functions.
- [4] Considering the configuration of a prior art washing apparatus, it comprises: a casing forming the outer appearance of the washing apparatus; a tub mounted in the casing to receive wash water therein; a drum rotatably disposed in the tub to receive laundry therein; a motor to drive the drum while rotatably supporting the drum; a water supply device located above the tub to supply the wash water, delivered from the outside, into the tub; and a water drainage device located below the tub to drain the wash water received in the tub to the outside.
- [5] The casing includes: a cabinet body having open front and upper sides; a cabinet cover mounted to the open front side of the cabinet body; a top cover mounted to the open upper side of the cabinet body; and a base pan mounted to a lower end of the casing to form the bottom of the casing.
- [6] The operation of the prior art washing apparatus having the above configuration will now be explained.
- [7] If laundry is placed in the drum and, successively, detergent and wash water are supplied into the drum by way of the water supply device, the motor is driven to rotate the drum.
- [8] As the drum rotates, the laundry is raised by lifters, which are mounted in the drum, and then dropped in a sequential fashion, so that the laundry is washed.
- [9] After completion of such a wash cycle, a rinse cycle for rinsing the laundry to remove soap bubbles remaining on the laundry is implemented. For this, clean wash water is supplied into the drum via the water supply device to rinse all the soap bubbles out of the laundry. Then, the used polluted wash water, containing the soap bubbles, is

drained to the outside via the water drainage device.

[10] In succession, the drum is rotated at a high speed in a spin-dry cycle to remove the water from the laundry, so that the water present in the laundry is centrifugally extracted and drained via through-holes of the drum. The water drained from the drum is gathered in the tub, thereby being finally drained to the outside via the water drainage device.

[11] However, the prior art washing apparatus as stated above has a problem in that it often suffers from malfunction of constituent elements thereof when the wash water leaks from the tub, water supply device or water drainage device during operation.

[12] In view of the forgoing problem, although it has been recently proposed to mount a water leakage sensor to the top of the base pan, most conventional water leakage sensors are very troublesome to mount to the base pan, and are unable to accurately sense the leakage of wash water unless the wash water falls in the vicinity of the water leakage sensors.

[13]

## **Disclosure of Invention**

### **Technical Problem**

[14] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a washing apparatus in which a water leakage sensor can be mounted in a simplified manner with high assembling efficiency so that it can accurately sense the leakage of wash water regardless of water leakage position.

[15]

### **Technical Solution**

[16] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a washing apparatus comprising: a cabinet body forming the outer appearance of the washing apparatus; a base pan mounted to a lower end of the cabinet body; and a water leakage sensor mounted on the top of the base pan and adapted to sense the leakage of water from a certain interior location of the cabinet body onto the base pan, wherein the top of the base pan is inclined downward toward a mounting position of the water leakage sensor.

[17] Preferably, the base pan may have pan drainage holes, which are arranged on at least one side of the periphery thereof to drain water gathered in the base pan to the outside.

[18] Preferably, the base pan may have upwardly protruding ribs formed along the periphery thereof, and the pan drainage holes are formed at one of the ribs formed at a rear side of the base pan.

- [19] Preferably, the cabinet body may have cabinet drainage holes formed at positions corresponding to the pan drainage holes.
- [20] Preferably, the washing apparatus may further comprise a plurality of hooks upwardly protruding from the top of the base pan, the hooks serving to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press fitted.
- [21] Preferably, the washing apparatus may further comprise: guide protrusions laterally protruding from opposite outer lateral surfaces of the water leakage sensor; and guide ribs provided at the top of the base pan and having guide grooves for the insertion of the respective guide protrusions.
- [22] Preferably, the base pan may serve as a base pan forming the bottom of a washing machine.
- [23] Preferably, the base pan may serve as a base pan forming the bottom of a drying machine.
- [24] Preferably, the base pan may serve as a base pan forming the bottom of a combined washing and drying machine.
- [25] In accordance with another aspect of the present invention, the above and other objects can be accomplished by the provision of a washing apparatus comprising: a cabinet body; a base pan mounted to a lower end of the cabinet body; a water leakage sensor to sense the leakage of water onto the base pan; and holders to allow the water leakage sensor to be vertically caught after being vertically press fitted to the base pan.
- [26] Preferably, the holders may be hooks, which protrude upward from the top of the base pan and serve to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press fitted.
- [27] Preferably, spacers may protrude from one of the bottom of the water leakage sensor, the top of the base pan, and hooks to space the water leakage sensor apart from the top of the base pan.
- [28] In accordance with yet another aspect of the present invention, the above and other objects can be accomplished by the provision of a washing apparatus comprising: a cabinet body; a base pan mounted to a lower end of the cabinet body; a water leakage sensor to sense the leakage of water onto the base pan; and couplers to allow the water leakage sensor to be coupled to the base pan while sliding on the top of the base pan.
- [29] Preferably, the couplers may include: guide protrusions laterally protruding from opposite outer lateral surfaces of the water leakage sensor; and guide ribs provided at the top of the base pan and having guide grooves corresponding to the respective guide protrusions.
- [30] Preferably, the guide protrusions and guide grooves are configured such that their cross sectional areas are gradually reduced in a direction that the guide protrusions are

slidably inserted into the guide grooves.

### **Advantageous Effects**

- [31] The washing apparatus according to the present invention have the following several effects.
- [32] Firstly, in the washing apparatus according to the present invention, the top of the base pan is inclined downward toward a mounting position of the water leakage sensor. With this configuration, water, dropped onto the base pan, is gathered toward the water leakage sensor regardless of a water drop position, thereby enabling prompt operation of the water leakage sensor and achieving an enhancement in reliability.
- [33] Secondly, since the base pan has the drainage holes arranged on at least one side of the periphery thereof to drain the water gathered in the base pan to the outside, the water gathered in the base pan can be conveniently discharged via the drainage holes by tilting the washing apparatus by a predetermined angle.
- [34] Thirdly, the washing apparatus according to the present invention comprises holders for allowing the water leakage sensor to be vertically caught after being vertically press-fitted to the base pan. With the use of the holders, the water leakage sensor can be mounted to the base pan via a single vertical press-fitting operation, resulting in an enhancement in simplicity and efficiency of the assembling operation.
- [35] Fourthly, the holders take the form of hooks, which protrude upward from the top of the base pan and serve to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press-fitted to the base pan. The hooks can secure the position of the water leakage sensor, and can achieve a reduction in processing costs and material costs by virtue of their simplified structure.
- [36] Fifthly, the washing apparatus according to the present invention comprises spacers, which protrude from one of the bottom of the water leakage sensor, the top of the base pan, and the hooks, so that the bottom of the water leakage sensor is spaced apart from the top of the base pan. Spacing the water leakage sensor from the base pan has the effect of preventing a float of the water leakage sensor from being unintentionally raised by water remaining on the base pan, etc. Thereby, the water leakage sensor can accurately operate only when the amount of water introduced into the water leakage sensor exceeds a predetermined value, thereby eliminating the risk of sensor malfunction.
- [37] Sixthly, the washing apparatus according to the present invention comprises couplers for allowing the water leakage sensor to be coupled to the base pan while sliding on the top of the base pan. This ensures easy mounting of the water leakage sensor.

- [38] Seventhly, the couplers according to the present invention include: guide protrusions provided at the water leakage sensor; and guide ribs provided at the top of the base pan and having guide grooves for the insertion of the respective guide protrusions. With the use of the guide protrusions and the guide ribs, the water leakage sensor can be assembled to the base pan via sliding movement thereof. This achieves an enhancement in simplicity and efficiency of the assembling operation and can reduce manufacturing costs of the water leakage sensor by virtue of simplified structure thereof.
- [39] Eighthly, the guide protrusions and the guide grooves are configured so that their cross sectional areas are gradually reduced in a direction that the guide protrusions slide along the guide grooves, so that the water leakage sensor can be assembled only in a single direction. This enables firm fixation of the water leakage sensor.
- [40] Finally, the water leakage sensor according to the present invention may have a cubic shape. This facilitates connection of a wire to a sensing element of the water leakage sensor, resulting in an enhancement in assembling efficiency.

[41]

### **Brief Description of the Drawings**

- [42] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:
- [43] Fig. 1 is a side sectional view illustrating a water leakage sensing structure of a washing apparatus according to a first embodiment of the present invention
- [44] Fig. 2 is a perspective view illustrating a base pan according to the first embodiment of the present invention
- [45] Fig. 3 is a side sectional view illustrating a washing apparatus according to a second embodiment of the present invention
- [46] Fig. 4 is a side sectional view illustrating a washing apparatus according to a third embodiment of the present invention
- [47] Fig. 5 is a side sectional view illustrating a washing apparatus according to a fourth embodiment of the present invention
- [48] Fig. 6 is a perspective view of a base pan on which a water leakage sensor according to the fourth embodiment of the present invention is mounted
- [49] Fig. 7 is a sectional view illustrating the assembling structure of the water leakage sensor according to the fourth embodiment of the present invention;
- [50] Fig. 8 is a perspective view illustrating a base pan of a washing apparatus according to a fifth embodiment of the present invention;
- [51] Fig. 9 is a perspective view illustrating a base pan of a washing apparatus according

to a sixth embodiment of the present invention;

[52] Fig. 10 is a perspective view illustrating the assembling structure of a water leakage sensor according to the sixth embodiment of the present invention; and

[53] Fig. 11 is a sectional view illustrating the assembling structure of the water leakage sensor according to the sixth embodiment of the present invention.

[54]

### **Best Mode for Carrying Out the Invention**

[55] Now, preferred embodiments of a washing apparatus according to the present invention will be explained with reference to the accompanying drawings.

[56] Fig. 1 is a side sectional view illustrating a water leakage sensing structure of a washing apparatus according to a first embodiment of the present invention. Fig. 2 is a perspective view illustrating a base pan according to the first embodiment of the present invention.

[57] As shown in Figs. 1 and 2, the washing apparatus according to the first embodiment of the present invention is a washing machine for washing laundry using detergent and water. The washing machine comprises: a casing 50 forming the outer appearance of the washing machine and having a laundry entrance/exit opening formed at a front side thereof; a tub 55 supported in the casing 50 in a shock-absorbing manner; a water supply device 56 to supply detergent or wash water into the tub 55; a water drainage device 57 to drain the wash water in the tub 55 to the outside of the casing 50; a drum 58 rotatably disposed in the tub 55 to receive laundry therein; and a motor 59 to rotate the drum 58.

[58] The casing 50 includes: a cabinet body 51 having open front and upper sides; a cabinet cover 52 mounted to the open front side of the cabinet body 51; a top cover 53 mounted to the open upper side of the cabinet body 51; and a base pan 54 mounted to a lower end of the casing 50 to form the bottom of the casing 50.

[59] A spider 61 is provided at a rear end of the drum 58 to constitute a part of the drum 58. The spider 61 is connected to a drive shaft 60 of the motor 59.

[60] The motor 59 is mounted to a rear end of the tub 55. The motor 59 includes: the drive shaft 60; a motor frame 62 fastened to the rear end of the tub 55 and having a through-hole for the penetration of the drive shaft 60; a stator 63 fixedly mounted to the motor frame 62; and a rotor 64 coupled to a certain location of the drive shaft 60 and adapted to rotate by an electromagnetic force generated between the rotor 64 and the stator 63.

[61] One end of the drive shaft 60 is coupled to the spider 61 of the drum 58, and the other end protrudes rearward from the rear end of the tub 55 to penetrate through the tub 55 and the motor frame 62.

- [62] Between the outer periphery of the drive shaft 60 and the tub 55 is interposed a front bearing 65 to rotatably support the drive shaft 60 relative to the tub 55. Also, between the outer periphery of the drive shaft 60 and the motor frame 62 is interposed a rear bearing 66 to rotatably support the drive shaft 60 relative to the motor frame 62.
- [63] The outer edge of the motor frame 62 is bent to radially protrude toward the tub 55, so that the motor frame 62 is fastened to the rear end of the tub 55 by bolts.
- [64] The stator 63 has a hollow cylindrical shape and is fastened to a rear surface of the motor frame 62 by bolts.
- [65] The rotor 64 includes: a cup-shaped rotor frame 67; and a magnet 68 coupled to an inner peripheral surface of the rotor frame 67 while being spaced apart from the stator 63.
- [66] In the present embodiment, a water leakage sensor 70 is mounted to the top of the base pan 54 to sense the water dropped from the tub 55, mounted in the cabinet body 51, to the base pan 54.
- [67] The water leakage sensor 70 includes: a sensor body 71 mounted to the base pan 54 and forming the outer appearance of the sensor 70; a float 72 disposed in the sensor body 71 to be raised or lowered by water introduced from the outside, and a sensing element 73 fixed to an interior location of the sensor body 71 to sense the position of the float 72.
- [68] The top of the base pan 54 is inclined downward toward a mounting position of the water leakage sensor 70. Specifically, the water leakage sensor 70 is mounted at the center of the base pan 54, and the base pan 54 is inclined downward toward the center thereof.
- [69] The base pan 54 has a plurality of pan drainage holes 74, which are arranged on at least one side of the periphery of the base pan 54 to drain water gathered in the base pan 54.
- [70] The base pan 54 is provided with upwardly protruding ribs 75 along the periphery thereof. Here, the plurality of pan drainage holes 74 is formed at one of the ribs 75, which is provided at a rear side of the base pan 54, so that the water gathered in the base pan 54 is able to be drained from a rear side of the washing machine as a user pushes a frontal upper location of the washing machine by a certain force.
- [71] Accordingly, the cabinet body 51 is provided at a rear wall thereof with cabinet drainage holes 76 at positions corresponding to the pan drainage holes 74.
- [72] The ribs 75 are formed at outer surfaces thereof with flange portions 77, which protrude outward to be coupled to the cabinet body 51 or cabinet cover 52 by fastening members.
- [73] Now, the water leakage sensing method of the washing apparatus according to the first embodiment of the present invention will be explained.

- [74] If wash water leaks from the tub 55 during operation of the washing apparatus having the above configuration, the leaked water is dropped onto the top of the base pan 54.
- [75] In this case, since the top of the base pan 54 is inclined downward toward the center thereof, the leaked wash water is gathered in the center of the downwardly inclined base pan 54.
- [76] Thereby, the water leakage sensor 70, which is located at the center of the base pan 54, is able to sense the leakage of wash water based on the wash water gathered in the center of the base pan 54.
- [77] Explaining the operation of the water leakage sensor 70 in detail, as the wash water, gathered in the center of the base pan 54, is introduced into the sensor body 71 via inlet holes formed at the sensor body 71, the float 72 is raised by buoyancy of the wash water to thereby come into contact with the sensing element 73. In this way, the water leakage sensor 70 is able to sense the presence of water leakage.
- [78] With the present invention, even if an extremely small amount of wash water leaks from the tub 55, the leaked wash water flows along the downwardly inclined top of the base pan 54 to thereby be entirely gathered in the center of the base pan 54. This ensures prompt operation of the water leakage sensor 70.
- [79] Meanwhile, when it is desired to drain the wash water gathered in the base pan 54, a certain frontal upper portion of the washing apparatus is pushed rearward to tilt the washing apparatus rearward.
- [80] In a rearwardly tilted state of the washing apparatus, the water gathered in the base pan 54 can be drained via the pan drainage holes 74 of the base pan 54.
- [81] In this way, the water, gathered in the base pan 54, can be conveniently drained as the washing apparatus is tilted rearward by a certain angle without requiring separation of the base pan 54.
- [82] Fig. 3 is a side sectional view illustrating a washing apparatus according to a second embodiment of the present invention.
- [83] The washing apparatus according to the second embodiment of the present invention is a drying machine for blowing dry hot air into a certain space that accommodates wet laundry to dry the laundry. As shown in Fig. 4, the drying machine comprises: a casing 80 forming the outer appearance of the drying machine; a drum 81 rotatably disposed in the casing 80 and having open front and rear sides to put or take the laundry into or out of the drum 81, a plurality of lifters being provided at an inner peripheral surface of the drum 81 to raise and drop the laundry; and a heater assembly 82 mounted to the casing 80 to heat outside air introduced into the casing 80.
- [84] The drying machine further comprises: a supply duct (not shown) to supply dry hot air, having passed through the heater assembly 82, into the drum 81; an exhaust duct

83 to discharge the used air, which became highly humid while drying the laundry, to the outside; a filter 84 to purify the air to be suctioned into the exhaust duct 83; a fan 85 mounted in the exhaust duct 83; and a motor 86 to generate a driving force required to rotate the fan 85 and the drum 81.

[85] The casing 80 comprises: a cabinet body 87; a cabinet cover 88 coupled to a front side of the cabinet body 87 and centrally formed with a laundry entrance/exit opening; a top cover 89 coupled to an upper end of the cabinet body 87 to form the top of the drying machine; and a base pan 90 coupled to a lower end of the cabinet body 87 to form the bottom of the drying machine.

[86] The cabinet body 87 has a plurality of air suction holes 91 formed at a rear wall thereof, so that outside air is introduced into the cabinet body 87.

[87] In the present embodiment, a water leakage sensor 92 is mounted to the top of the base pan 90 to sense the water dropped from the drum 81 or exhaust duct 83, mounted in the cabinet body 87, to the base pan 90.

[88] The water leakage sensor 92 includes: a sensor body 93 mounted to the base pan 90 and forming the outer appearance of the sensor 92; a float 94 disposed in the sensor body 93 to be raised or lowered by water introduced from the outside of the sensor body 93; and a sensing element 95 fixed to an interior location of the sensor body 93 to sense the position of the float 94.

[89] The top of the base pan 90 is inclined downward toward a mounting position of the water leakage sensor 92. Specifically, the water leakage sensor 92 is located at the center of the base pan 90, and the base pan 90 is inclined downward toward the center thereof.

[90] The base pan 90 has a plurality of pan drainage holes 96, which are arranged on at least one side of the periphery of the base pan 90 to drain water gathered in the base pan 90.

[91] The base pan 90 is provided with upwardly protruding ribs 97 along the periphery thereof. Here, the pan drainage holes 96 are formed at one of the ribs 97, which is provided at a rear side of the base pan 90, so that the water gathered in the base pan 90 is able to be drained from a rear side of the drying machine as a user pushes a frontal upper location of the drying machine by a certain force.

[92] Accordingly, the cabinet body 87 is provided at a rear wall thereof with cabinet drainage holes 98 at positions corresponding to the pan drainage holes 96.

[93] The ribs 97 are formed at outer surfaces thereof with flange portions 99, which protrude outward to be coupled to the cabinet body 87 or cabinet cover 88 by fastening members.

[94] If wash water is dropped from the drum 81 or exhaust duct 83 onto the base pan 90 during operation of the drying machine having the above configuration, the water

flows along the downwardly inclined top of the base pan 90 to thereby be gathered toward the water leakage sensor 92. Thereby, the water leakage sensor 92 is able to promptly sense the presence of water leakage.

[95] When it is desired to drain the water gathered in the base pan 90, a certain frontal upper portion of the drying machine is pushed rearward to tilt the drying machine rearward. Thereby, the water gathered in the base pan 90 can be conveniently drained via the pan drainage holes 96 of the base pan 90 and the cabinet drainage holes 98 of the cabinet body 87.

[96] Fig. 4 is a side sectional view illustrating a washing apparatus according to a third embodiment of the present invention.

[97] The washing apparatus according to the third embodiment of the present invention is a combined washing and drying machine for washing laundry using appropriate detergent and water while applying mechanical force and, successively, drying the washed laundry. As shown in Fig. 4, the combined washing and drying machine comprises: a casing 100 forming the outer appearance of the machine; a tub 101 horizontally mounted in the casing 100; a drum 102 mounted in the tub 101 to receive laundry therein; a motor 103 to rotate the drum 102; a water supply device 104 to supply detergent or wash water into the tub 101; a water drainage device 105 to drain the wash water received in the tub 101 to the outside of the casing 100; a drying duct located above the tub 101 and configured to accommodate a heater 106 and a blowing fan 107, which serve to discharge hot air into the tub 101; and a condenser 109 having one end connected to the drying duct 108 and the other end connected to a lateral lower location of the tub 101.

[98] The casing 100 includes: a cabinet body 110 having open front and upper sides; a cabinet cover 111 mounted to the open front side of the cabinet body 110; a top cover 112 mounted to the open upper side of the cabinet body 110; and a base pan 113 mounted to a lower end of the casing 100 to form the bottom of the casing 100.

[99] In the present embodiment, a water leakage sensor 114 is mounted to the top of the base pan 113 to sense the water dropped from a certain interior part of the cabinet body 110 onto the base pan 113.

[100] The water leakage sensor 114 includes: a sensor body 115 mounted to the base pan 113 and forming the outer appearance of the sensor 114; a float 116 disposed in the sensor body 115 to be raised or lowered by water introduced from the outside; and a sensing element 117 fixed to an interior location of the sensor body 115 to sense the position of the float 116.

[101] The top of the base pan 113 is inclined downward toward a mounting position of the water leakage sensor 114. Specifically, the water leakage sensor 114 is located at the center of the base pan 113, and the base pan 113 is inclined downward toward the

center thereof.

[102] The base pan 113 has a plurality of pan drainage holes 118, which are arranged on at least one side of the periphery thereof to drain water gathered in the base pan 113.

[103] The base pan 113 is provided with upwardly protruding ribs 119 along the periphery thereof. Here, the pan drainage holes 118 are formed at one of the ribs 119, which is formed at a rear side of the base pan 113, so that the water gathered in the base pan 113 is able to be drained from a rear side of the combined washing and drying machine as a user pushes a frontal upper location of the machine by a certain force.

[104] Accordingly, the cabinet body 110 is provided at a rear wall thereof with cabinet drainage holes 120 at positions corresponding to the pan drainage holes 118.

[105] The ribs 119 are formed at outer surfaces thereof with flange portions 121, which protrude outward to be coupled to the cabinet body 110 or cabinet cover 111 by fastening members.

[106] If water is dropped from the tub 101 to the base pan 113 during operation of the combined washing and drying machine having the above configuration, the dropped water flows along the downwardly inclined top of the base pan 113 to thereby be gathered toward the water leakage sensor 114. Thereby, the water leakage sensor 114 is able to promptly sense the presence of water leakage.

[107] When it is desired to drain the water gathered in the base pan 113, a certain frontal upper location of the combined washing and drying machine is pushed rearward to tilt the machine rearward. Thereby, the water gathered in the base pan 113 can be conveniently drained via the pan drainage holes 118 and the cabinet drainage holes 120.

[108] Fig. 5 is a side sectional view illustrating a washing apparatus according to a fourth embodiment of the present invention. Fig. 6 is a perspective view of a base pan on which a water leakage sensor according to the fourth embodiment of the present invention is mounted. Fig. 7 is a sectional view illustrating the assembling structure of the water leakage sensor according to the fourth embodiment of the present invention.

[109] The washing apparatus according to the fourth embodiment of the present invention is identical to that of the above third embodiment except that it further comprises holders for allowing a water leakage sensor 130 to be vertically fixed to the base pan 113 after being vertically press-fitted to the base pan 113. Hereinafter, constituent elements of the present embodiment, identical to those of the third embodiment, are designated by the same reference numerals as those of the third embodiment, respectively, and no description thereof will be given.

[110] Explanation of the present embodiment is limited to the case in which the top of the base pan 113 is inclined downward toward a mounting position of the water leakage sensor 130. Specifically, the water leakage sensor 130 is mounted at the center of the base pan 113, and the base pan 113 is inclined downward toward the center thereof.

- [111] The water leakage sensor 130 includes: a sensor body 131 forming the outer appearance of the sensor 130; a float 132 disposed in the sensor body 131 to be raised or lowered by water introduced from the outside; and a sensing element 133 fixed to an interior location of the sensor body 131 to sense the position of the float 132.
- [112] The sensor body 131 has a plurality of inlet holes 134 formed along the periphery thereof, so that the water gathered in the base pan 113 is introduced into the sensor body 131 to raise the float 132.
- [113] Both the sensor body 131 and the float 132 have a cylindrical shape.
- [114] The holders of the present embodiment include a plurality of hooks 135, which protrude upward from the top of the base pan 113. The hooks 135 serve to guide the water leakage sensor 130 into a predetermined assembling position and to allow the water leakage sensor 130 to be caught after being press fitted to the base pan 113.
- [115] The hooks 135 are spaced apart from one another by a certain distance. In the present embodiment, the explanation of the hooks 135 is limited to the case in which four hooks are equally spaced apart from one another by 90 degrees.
- [116] The hooks 135, which protrude upward from the top of the base pan 113, are configured such that upper ends thereof extend toward the water leakage sensor 130, so that the upper end of the press-fitted water leakage sensor 130 is caught by the upper ends of the hooks 135.
- [117] In this case, the upper ends of the hooks 135 are inclined downward toward the water leakage sensor 130 so that the water leakage sensor 130 is able to be press fitted from the upper side of the base pan 113.
- [118] Preferably, each hook 135 is configured such that a radial thickness thereof is smaller than a vertical length thereof. With this configuration, the hook 135 is elastically deformable in a radial direction when the water leakage sensor 130 is press fitted.
- [119] In the present embodiment, a plurality of upwardly protruding guide ribs 136 is further provided at the top of the base pan 113 to guide the water leakage sensor 130 into a predetermined assembling position.
- [120] Also, spacers protrude from one of the bottom of the water leakage sensor 130, the top of the base pan 113, and the hooks 135 to space the bottom of the water leakage sensor 130 apart from the top of the base pan 113. Explanation of the present embodiment is limited to the case in which the spacers are formed at lower ends of the hooks 135.
- [121] The spacers include protrusions 137, which extend from the lower ends of the hooks 135 toward the water leakage sensor 130 to support the bottom of the water leakage sensor 130.
- [122] Now, the assembling method of the water leakage sensor according to the fourth

embodiment of the present invention having the above configuration will be explained.

- [123] After the water leakage sensor 130 is positioned to be assembled between the plurality of guide ribs 136, the water leakage sensor 130 is pushed downward by a certain force to be press fitted between the hooks 135.
- [124] To ensure smooth press-fitting of the water leakage sensor 130, the hooks 135 are elastically deformed to be opened outwardly when they are forced by the water leakage sensor 130. Thereby, the water leakage sensor 130 can be smoothly and stably press fitted between the hooks 135.
- [125] In such a completely press-fitted state, the water leakage sensor 130 is caught by the upper ends of the hooks 135.
- [126] In this way, the water leakage sensor 130 can be mounted to the base pan 113 via a single vertical press-fitting operation, resulting in an enhancement in assembling efficiency.
- [127] Fig. 8 is a perspective view illustrating a base pan of a washing apparatus according to a fifth embodiment of the present invention.
- [128] The washing apparatus according to the fifth embodiment of the present invention comprises holders for allowing a water leakage sensor 140 to be vertically fixed to the base pan 113 after being vertically press-fitted to the base pan 113. The present embodiment is identical to the above fourth embodiment except that the water leakage sensor 140 has a polyhedral shape, more specifically, a cubic shape. Hereinafter, constituent elements of the present embodiment, identical to those of the fourth embodiment, are designated by the same reference numerals as those of the fourth embodiment, respectively, and no description thereof will be given.
- [129] The water leakage sensor 140 includes: a cubic-shaped sensor body 141 forming the outer appearance of the sensor 140; a float (not shown) disposed in the sensor body 141 to be raised or lowered by water introduced from the outside; and a sensing element (not shown) fixed to an interior location of the sensor body 141 to sense the position of the not shown float.
- [130] The sensor body 141 has a plurality of inlet holes 142, which are arranged along the periphery thereof, so that water gathered in the base pan 113 is introduced into the sensor body 141 to raise the not shown float.
- [131] The holders include a plurality of hooks 143, which protrude upward from the top of the base pan 113. In the present embodiment, four hooks 143 are provided to correspond to four peripheral walls of the water leakage sensor 140, respectively.
- [132] In addition to the hooks 143, a plurality of upwardly protruding guide ribs 144 is further provided at the top of the base pan 113 to guide the water leakage sensor 130 into a predetermined assembling position. The guide ribs 144 are provided at positions corresponding to four corners of the water leakage sensor 140, respectively.

- [133] The cubic-shaped water leakage sensor 140 according to the present embodiment has an advantage in that a wire (not shown) can be easily aligned to the not shown sensing element, differently from a cylindrical water leakage sensor. In the case of the cylindrical water leakage sensor, the water leakage sensor should be assembled while being rotated in order to align the positions of the wire and sensing element with each other.
- [134] Fig. 9 is a perspective view illustrating a base pan of a washing apparatus according to a sixth embodiment of the present invention. Fig. 10 is a perspective view illustrating the assembling structure of a water leakage sensor according to the sixth embodiment of the present invention. Fig. 11 is a sectional view illustrating the assembling structure of the water leakage sensor according to the sixth embodiment of the present invention.
- [135] The washing apparatus according to the sixth embodiment of the present invention is identical to that of the above third embodiment except that it further comprises couplers for allowing a water leakage sensor 150 to be coupled to the top of the base pan 113 via sliding movement thereof. Hereinafter, constituent elements of the present embodiment, identical to those of the third embodiment, are designated by the same reference numerals as those of the third embodiment, respectively, and no description thereof will be given.
- [136] Explanation of the present embodiment is limited to the case in which the top of the base pan 113 is inclined downward toward a mounting position of the water leakage sensor 150. Specifically, the water leakage sensor 150 is mounted at the center of the base pan 113, and the base pan 113 is inclined downward toward the center thereof.
- [137] The water leakage sensor 150 includes: a sensor body 151 forming the outer appearance of the sensor 150; a float 152 disposed in the sensor body 151 to be raised or lowered by water introduced from the outside; and a sensing element 153 fixed to an interior location of the sensor body 151 to sense the position of the float 152.
- [138] The sensor body 151 has a plurality of first inlet holes 154, which are arranged along the periphery of the sensor body 151 so that water gathered in the base pan 113 is introduced into the sensor body 151 to raise the float 152.
- [139] The water leakage sensor 150 has a polyhedral shape. More specifically, explanation of the present embodiment is limited to the case in which the water leakage sensor 150 has a cubic shape.
- [140] The couplers according to the present embodiment include: a pair of guide protrusions 160, which protrude laterally from opposite outer lateral surfaces of the water leakage sensor 150; and a pair of guide ribs 162, which are provided at the top of the base pan 113 and have guide grooves 161 corresponding to the respective guide protrusions 160.

- [141] The guide protrusions 160 protrude outward from opposite lateral surfaces of the sensor body 151, respectively. The guide ribs 162 protrude upward from the top of the base pan 113.
- [142] The pair of the guide ribs 162 is located in parallel to face each other.
- [143] With this configuration, the guide ribs 162 completely block opposite lateral sides of the sensor body 151. Therefore, each guide rib 162 is formed with at least one second inlet hole 163 to allow the water gathered in the base pan 113 to be introduced into the sensor body 151.
- [144] Preferably, the second inlet hole 163 is positioned to correspond to an associated one of the first inlet holes 154.
- [145] The guide protrusions 160 and the guide grooves 161 are configured such that their cross sectional areas are gradually reduced in a direction that the guide protrusions 160 slide along the guide grooves 161, so that the water leakage sensor 150 is able to slide only in a single direction.
- [146] Preferably, the guide grooves 161 are spaced apart from lower ends of the guide ribs 162 by a predetermined height, so that the bottom of the water leakage sensor 150 is spaced apart from the top of the base pan 113.
- [147] Now, the assembling method of the water leakage sensor provided in the washing apparatus according to the sixth embodiment of the present invention having the above configuration will be explained.
- [148] As the water leakage sensor 150 slides into a space between the pair of guide ribs 162, the guide protrusions 160 of the water leakage sensor 150 are press fitted into the guide grooves 161 of the guide ribs 162. Thereby, the water leakage sensor 150 is fixed at a predetermined assembling position of the base pan 113.
- [149] Assembling the water leakage sensor 150 to the base pan 113 via sliding movement thereof can achieve an enhancement in assembling simplicity and efficiency, and can eliminate the necessity of other fixtures. Thus, the water leakage sensor 150 can be easily manufactured.

[150]

[151]

### **Industrial Applicability**

- [152] As is apparent from the above description, the washing apparatus according to the present invention configured as stated above provides the following several effects.
- [153] Firstly, in the washing apparatus according to the present invention, the top of a base pan is inclined downward toward a mounting position of a water leakage sensor. With this configuration, water, dropped onto the base pan, is gathered toward the water leakage sensor regardless of a water drop position, thereby enabling prompt operation

of the water leakage sensor and achieving an enhancement in reliability.

[154] Secondly, since drainage holes are arranged on at least one side of the periphery of the base pan to drain the water gathered in the base pan to the outside, the water gathered in the base pan can be conveniently discharged via the drainage holes by tilting the washing apparatus by a predetermined angle.

[155] Thirdly, the washing apparatus according to the present invention comprises holders for allowing the water leakage sensor to be vertically caught after being vertically press-fitted to the base pan. With the use of the holders, the water leakage sensor can be mounted to the base pan via a single vertical press-fitting operation, resulting in an enhancement in simplicity and efficiency of the assembling operation.

[156] Fourthly, the holders take the form of hooks, which protrude upward from the top of the base pan and serve to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press-fitted to the base pan. The hooks can secure the position of the water leakage sensor, and can achieve a reduction in processing costs and material costs by virtue of their simplified structure.

[157] Fifthly, the washing apparatus according to the present invention comprises spacers, which protrude from one of the bottom of the water leakage sensor, the top of the base pan, and the hooks, so that the bottom of the water leakage sensor is spaced apart from the top of the base pan. Spacing the water leakage sensor from the base pan has the effect of preventing a float of the water leakage sensor from being unintentionally raised by water remaining on the base pan, etc. Thereby, the water leakage sensor can accurately operate only when the amount of water introduced into the water leakage sensor exceeds a predetermined value, thereby eliminating the risk of sensor malfunction.

[158] Sixthly, the washing apparatus according to the present invention comprises couplers for allowing the water leakage sensor to be coupled to the base pan while sliding on the top of the base pan. This ensures easy mounting of the water leakage sensor.

[159] Seventhly, the couplers according to the present invention include: guide protrusions provided at the water leakage sensor; and guide ribs provided at the top of the base pan and having guide grooves for the insertion of the respective guide protrusions. With the use of the guide protrusions and the guide ribs, the water leakage sensor can be assembled to the base pan via sliding movement thereof. This achieves an enhancement in simplicity and efficiency of the assembling operation and can reduce manufacturing costs of the water leakage sensor by virtue of simplified structure thereof.

[160] Eighthly, the guide protrusions and the guide grooves are configured so that their

cross sectional areas are gradually reduced in a direction that the guide protrusions slide along the guide grooves, so that the water leakage sensor can be assembled only in a single direction. This enables firm fixation of the water leakage sensor.

[161] Finally, the water leakage sensor according to the present invention may have a cubic shape. This facilitates connection of a wire to a sensing element of the water leakage sensor, resulting in an enhancement in assembling efficiency.

[162] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

[163]

[164]

[165]

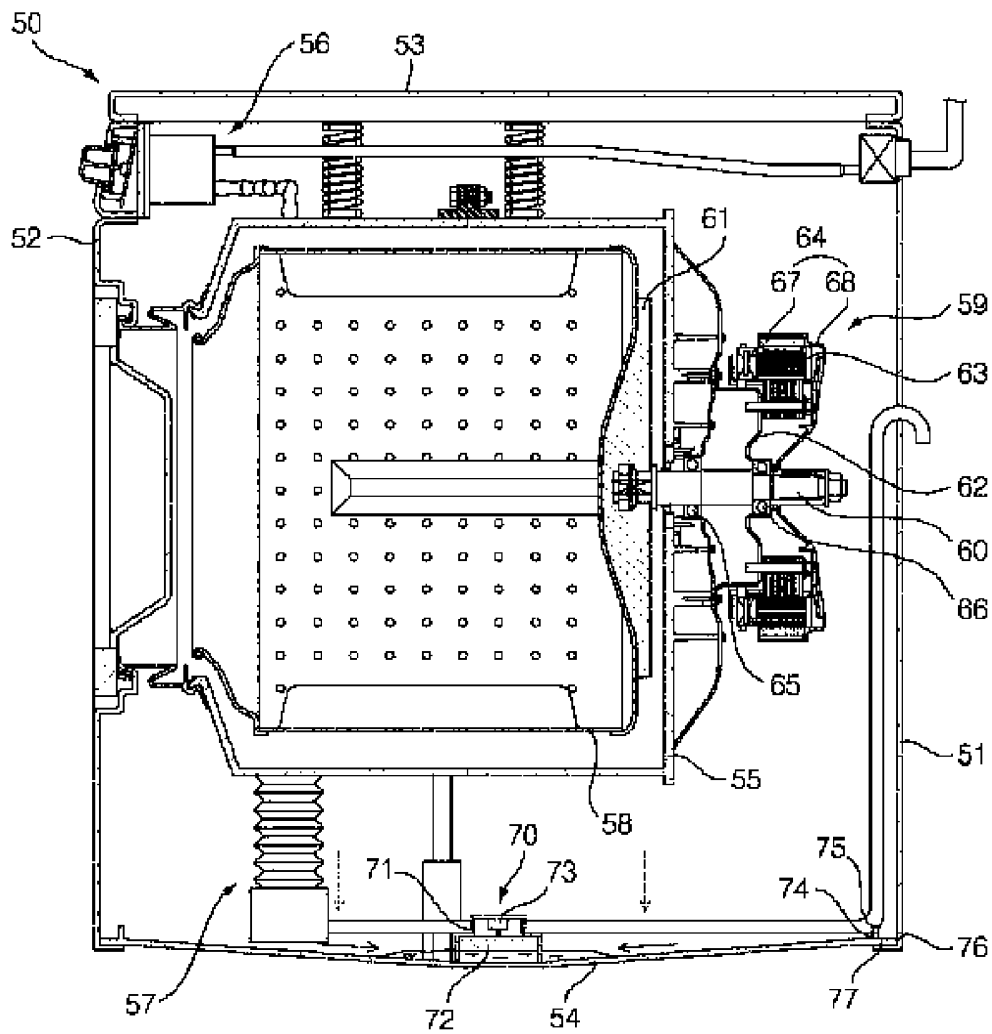
## Claims

- [1] A washing apparatus comprising:  
a cabinet body forming the outer appearance of the washing apparatus;  
a base pan mounted to a lower end of the cabinet body ; and  
a water leakage sensor mounted on the top of the base pan and adapted to sense the leakage of water from a certain interior location of the cabinet body onto the base pan,  
wherein the top of the base pan is inclined downward toward a mounting position of the water leakage sensor.
- [2] The apparatus as set forth in claim 1, wherein the base pan has pan drainage holes, which are arranged on at least one side of the periphery thereof to drain water gathered in the base pan to the outside.
- [3] The apparatus as set forth in claim 2, wherein the base pan has upwardly protruding ribs formed along the periphery thereof, and the pan drainage holes are formed at one of the ribs formed at a rear side of the base pan  
.
- [4] The apparatus as set forth in claim 2, wherein the cabinet body has cabinet drainage holes formed at positions corresponding to the pan drainage holes.
- [5] The apparatus as set forth in claim 4, further comprising:  
a plurality of hooks upwardly protruding from the top of the base pan, the hooks serving to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press fitted.
- [6] The apparatus as set forth in claim 4, further comprising:  
guide protrusions laterally protruding from opposite outer lateral surfaces of the water leakage sensor; and  
guide ribs provided at the top of the base pan and having guide grooves for the insertion of the respective guide protrusions.
- [7] The apparatus as set forth in claim 1, wherein the base pan serves as a base pan forming the bottom of a washing machine.
- [8] The apparatus as set forth in claim 1, wherein the base pan serves as a base pan forming the bottom of a drying machine.
- [9] The apparatus as set forth in claim 1, wherein the base pan serves as a base pan forming the bottom of a combined washing and drying machine.
- [10] A washing apparatus comprising:  
a cabinet body ;  
a base pan mounted to a lower end of the cabinet body ;

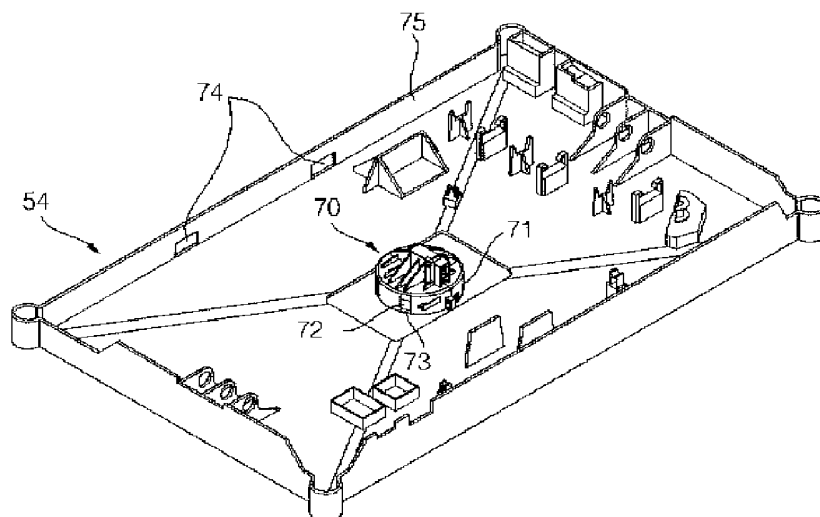
a water leakage sensor to sense the leakage of water onto the base pan; and holders to allow the water leakage sensor to be vertically caught after being vertically press fitted to the base pan.

- [11] The apparatus as set forth in claim 10, wherein the holders are hooks, which protrude upward from the top of the base pan and serve to guide the water leakage sensor into a predetermined assembling position and to allow the water leakage sensor to be caught after being press fitted.
- [12] The apparatus as set forth in claim 10, wherein spacers protrude from one of the bottom of the water leakage sensor, the top of the base pan, and hooks to space the water leakage sensor apart from the top of the base pan .
- [13] A washing apparatus comprising:  
a cabinet body;  
a basepan mounted to a lower end of the cabinet body ;  
a water leakage sensor to sense the leakage of water onto the base pan; and couplers to allow the water leakage sensor to be coupled to the base pan while sliding on the top of the base pan .
- [14] The apparatus as set forth in claim 13, wherein the couplers include:  
guide protrusions laterally protruding from opposite lateral surfaces of the water leakage sensor; and  
guide ribs provided at the top of the base pan and having guide grooves corresponding to the respective guide protrusions.
- [15] The apparatus as set forth in claim 14, wherein the guide protrusions and guide grooves are configured such that their cross sectional areas are gradually reduced in a direction that the guide protrusions are slidably inserted into the guide grooves.

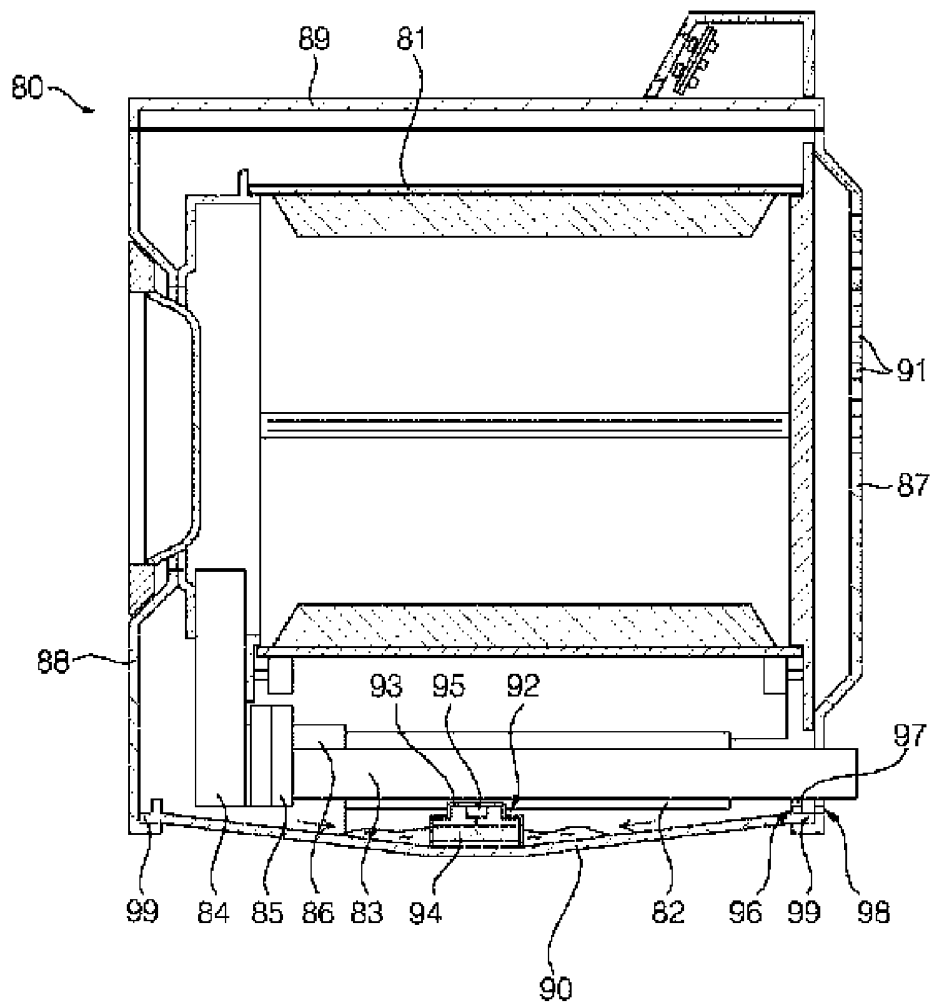
[Fig. 1]



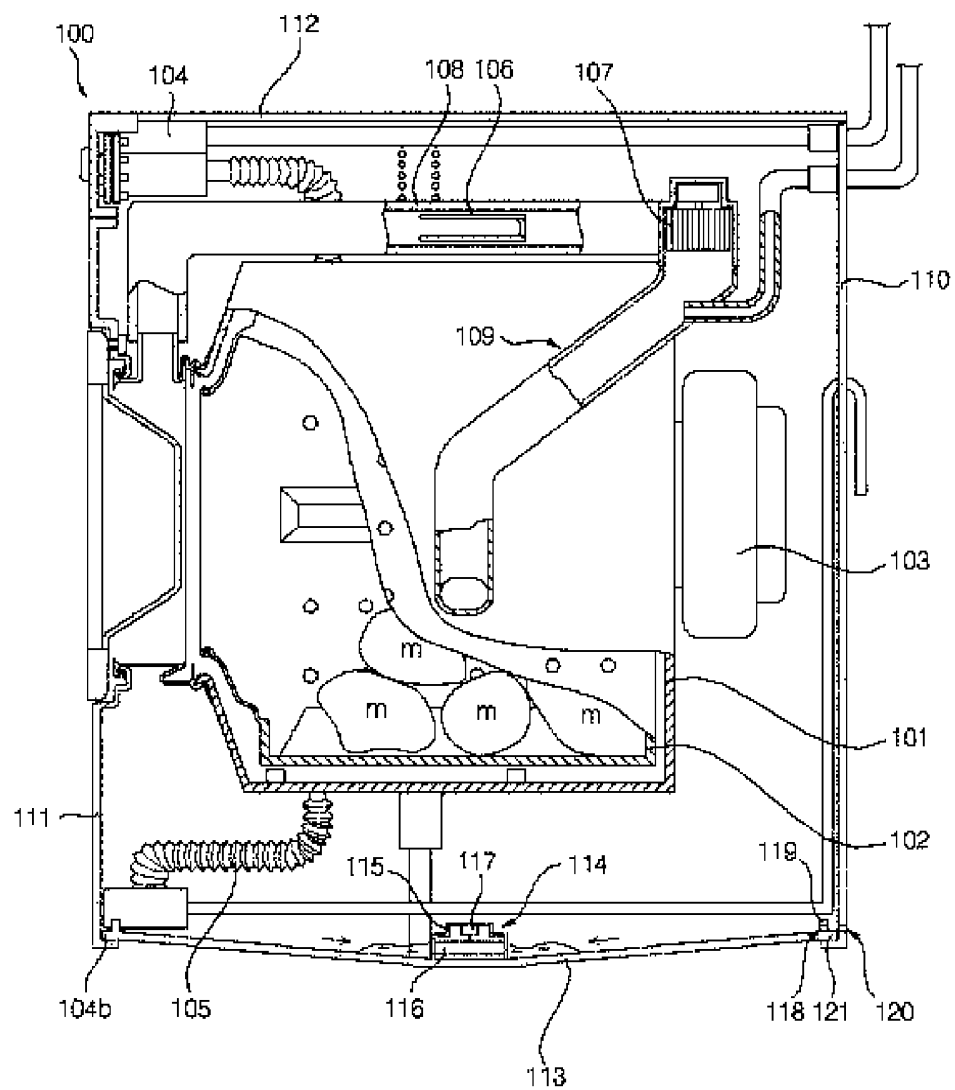
[Fig. 2]



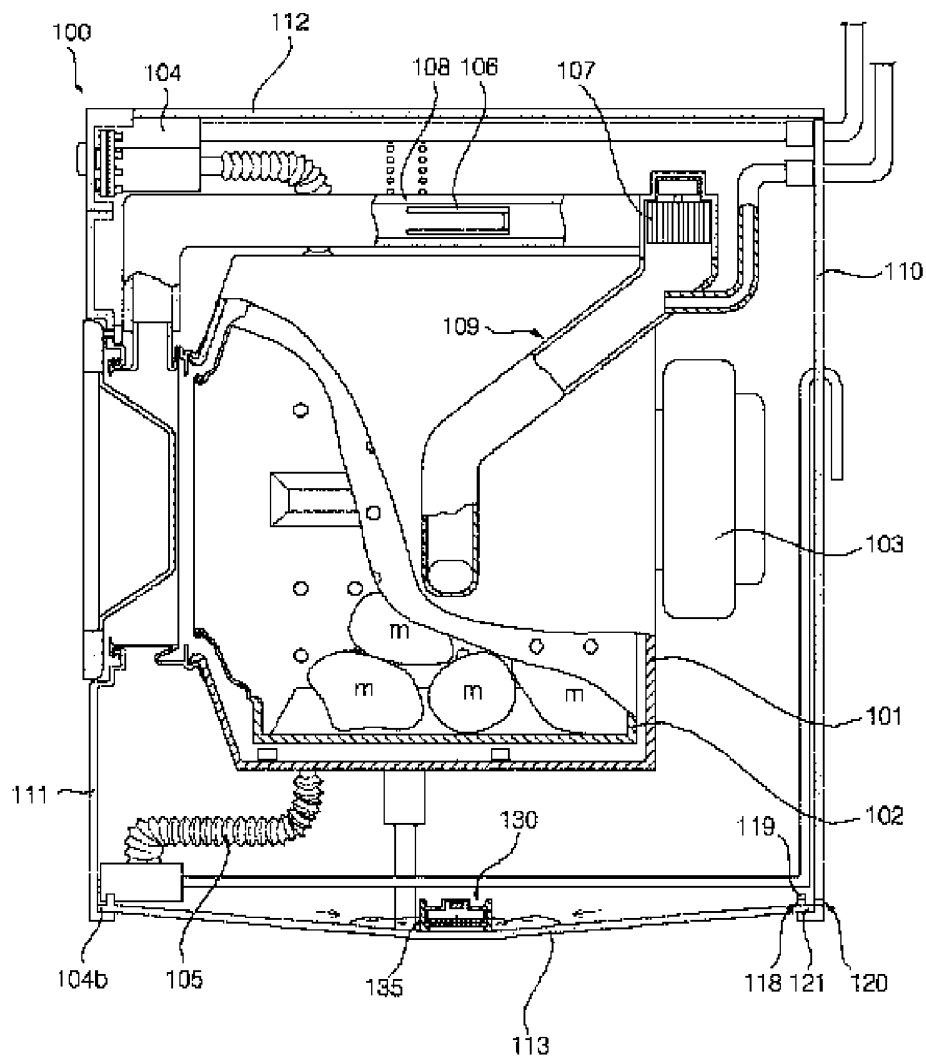
[Fig. 3]



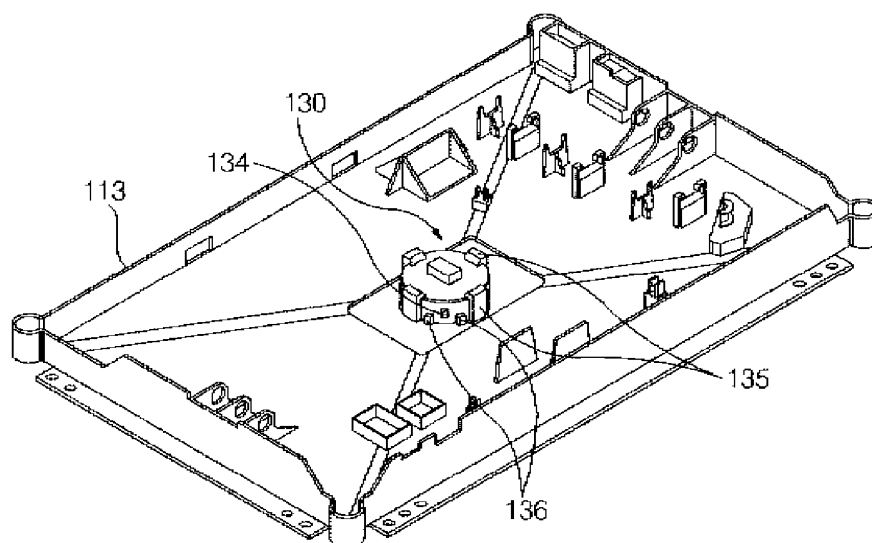
[Fig. 4]



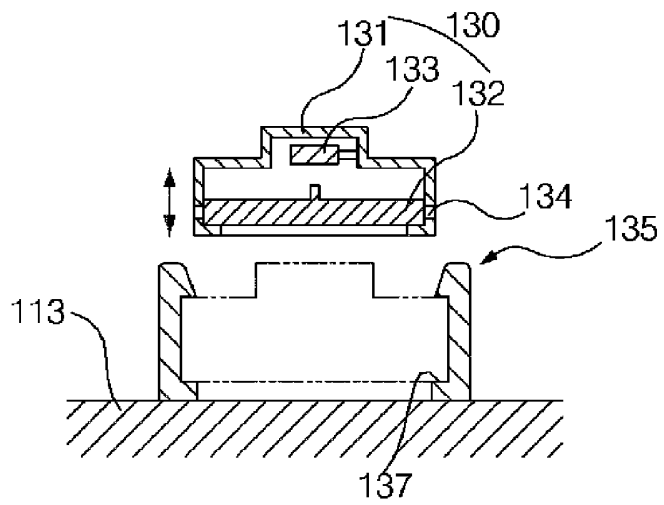
[Fig. 5]



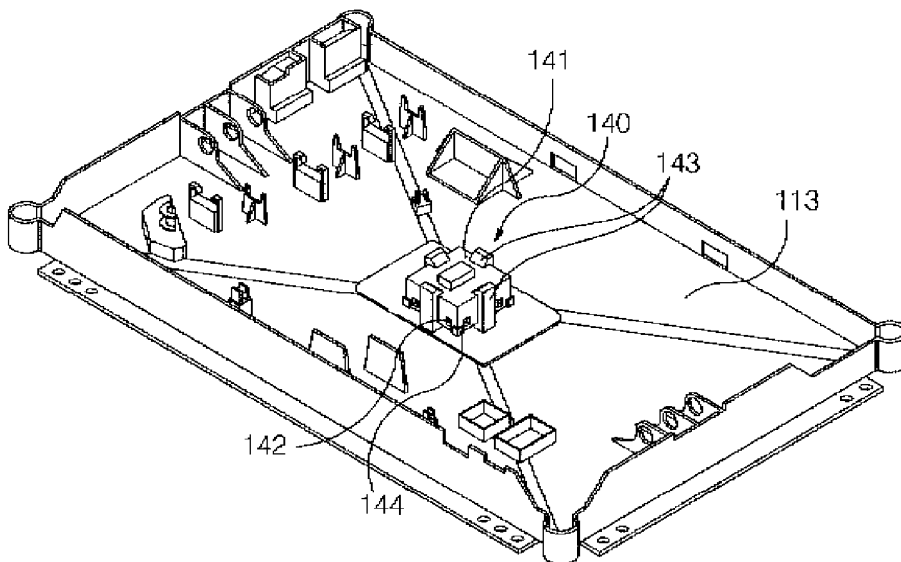
[Fig. 6]



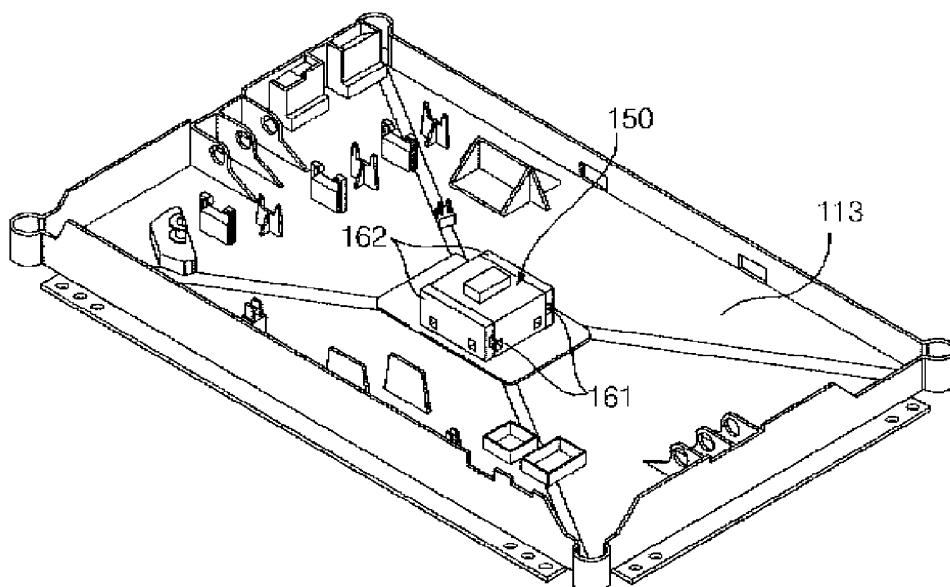
[Fig. 7]



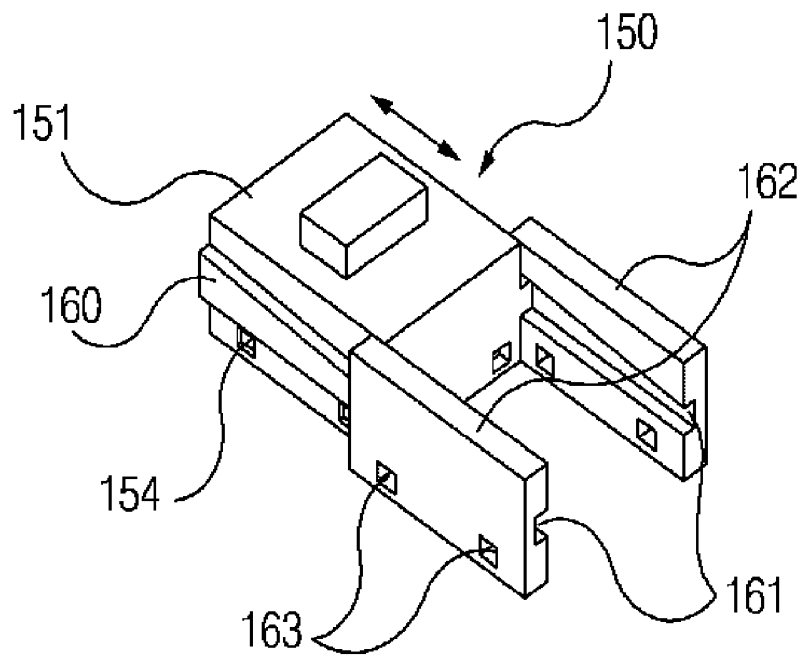
[Fig. 8]



[Fig. 9]



[Fig. 10]



[Fig. 11]

