

DESCRIPTION

WASHING MACHINE

5 TECHNICAL FIELD

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

BACKGROUND ART

10 [0002] A description is provided of a conventional washing machine which is a top-loading washing machine having a lead wire fixed under a water tub.

[0003] The conventional top-loading washing machine includes a housing, the water tub elastically supported inside the housing, a washing and spin-drying tub rotatable inside the water tub, and a motor that is disposed under the water tub to rotate the washing and spin-drying tub. The conventional top-loading washing machine further includes a motor
15 holder that is fixed to a lower part of the water tub and holds the motor, a control device that controls the motor, and the lead wire connecting the motor and the control device. The lead wire, which is connected to the motor, is secured to the motor holder by a lead wire fastening unit on the motor holder (refer to, for example, PTL 1).

Citation List

20 Patent Literature

[0004] PTL 1: Unexamined Japanese Patent Publication No. H09-276587

SUMMARY OF THE INVENTION

25 [0005] The present disclosure provides a washing machine that restrains breaks in a lead wire, reduces material cost for a motor holder and enables highly flexible attachment of a lead wire fastening unit.

[0006] A washing machine according to the present disclosure includes a housing, a water tub supported to be swingable inside the housing, a washing and spin-drying tub rotatable inside the water tub, the washing and spin-drying tub being used to wash and
30 spin-dry laundry, a motor that rotates the washing and spin-drying tub, and a motor holder securing the motor externally to a bottom of the water tub. The washing machine according to the present disclosure further includes a control device that is disposed in a rear of the housing and controls the motor, a lead wire connecting the motor and the control device, and a water tub-side attaching unit that is external to the bottom of the

water tub and secures the lead wire.

[0007] The washing machine according to the present disclosure restrains breaks in the lead wire, reduces material cost for the motor holder and enables highly flexible attachment of the water tub-side attaching unit, which is a lead wire fastening unit.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 illustrates a longitudinal section of a washing machine according to a first exemplary embodiment.

FIG. 2 illustrates a lower part of a rear of the washing machine according to the first exemplary embodiment with a rear cover removed.

FIG. 3 is a sectional view taken along line 3-3 in FIG. 2.

FIG. 4A is a front view of a water tub-side attaching unit of the washing machine according to the first exemplary embodiment.

FIG. 4B is a side view of the water tub-side attaching unit of the washing machine according to the first exemplary embodiment.

FIG. 4C is a perspective view of the water tub-side attaching unit of the washing machine according to the first exemplary embodiment.

FIG. 5 is a perspective view illustrating the water tub-side attaching unit attached to a water tub of the washing machine according to the first exemplary embodiment and a part surrounding the water tub-side attaching unit.

DESCRIPTION OF EMBODIMENTS

[0009] A detailed description is hereinafter provided of exemplary embodiments with reference to the drawings. The accompanying drawings and the following description are not restrictive of the present disclosure.

[0010] FIRST EXEMPLARY EMBODIMENT

Basic configuration of washing machine

FIG. 1 illustrates a longitudinal section of a washing machine according to a first exemplary embodiment.

[0011] Washing machine 100 includes housing 101 that serves as an outer frame, upper frame body 102, and lower frame body 103. Upper frame body 102 is fixed to a top of housing 101 and has, substantially in a center, an opening serving as laundry loading port 105. Lower frame body 103 is made with a resin and is fixed to a bottom of housing 101.

[0012] Lid 104 is pivotally supported at an upper rear part of upper frame body 102 to be

openable and closeable and covers laundry loading port 105. Operation display unit 106 is behind lid 104 and includes a display and an operation part. A user operates the operation part, checks information displayed on the display, and sets operational conditions of the washing machine.

5 **[0013]** Inside housing 101, water tub 107 having the shape of a bottomed cylinder is elastically supported by a suspension (not illustrated).

[0014] Drainpipe 115 extends as a connection through a bottom of water tub 107. When a drain valve (not illustrated) is opened, water in water tub 107 is drained out of water tub 107 through drainpipe 115, thus being discharged out of washing machine 100.

10 **[0015]** Inside water tub 107, washing and spin-drying tub 109 is rotatably held. Washing and spin-drying tub 109 has, in a wall, a large number of drain holes 112 through which washing water enters and leaves washing and spin-drying tub 109. Balancer 111 is provided over washing and spin-drying tub 109 to restrain rattling of washing and spin-drying tub 109 during spin-drying. Washing and spin-drying tub 109 is provided with
15 rotatable pulsator 110 at a bottom. By rotating, pulsator 110 agitates laundry within washing and spin-drying tub 109.

[0016] Motor holder 120 is a plate-shaped metal component disposed externally of a central portion of the bottom of water tub 107. Motor holder 120 secures transmission mechanism 126 attached externally to the bottom of water tub 107 and motor 121 that
20 drives transmission mechanism 126 via belt 122. Belt 122 bridges motor-side pulley 123 provided at motor 121 and mechanism-side pulley 124 provided at transmission mechanism 126 and transmits rotary driving force from motor 121 to transmission mechanism 126.

[0017] Transmission mechanism 126 includes rotating shaft 125, a reduction gear (not
25 illustrated), a clutch (not illustrated) that switches connections for rotating shaft 125, and a brake (not illustrated). Rotating shaft 125 is connected to pulsator 110 and washing and spin-drying tub 109. Transmission mechanism 126 causes pulsator 110 to rotate singly and causes pulsator 110 and washing and spin-drying tub 109 to rotate concurrently by switching the clutch.

30 **[0018]** A rear of housing 101 partly includes an opening, and disposed in the opening is controller box 113 that internally includes an unshown control board, which is a control device. The control board controls motor 121, transmission mechanism 126, and others to execute a washing operation including a series of steps. Rear cover 114 includes rear cover bulge 114a near a back of controller box 113, covering the opening of housing 101.

[0019] Lead wire

FIG. 2 illustrates a lower part of a rear of washing machine 100 according to the first exemplary embodiment with rear cover 114 removed. FIG. 3 is a sectional view taken along line 3-3 in FIG. 2.

5 **[0020]** As illustrated in FIGS. 2 and 3, lead wire 127 is routed from motor 121 to a rear of lower frame body 103 and is inserted into controller box 113 through box opening 113a in a bottom of controller box 113 that internally includes the control board, which serves as the control device. Lead wire 127 electrically connects the control board, which serves as the control device, and motor 121 for supplying electricity and transmitting electrical
10 signals.

[0021] Lead wire 127 is fastened near the control board, which is the control device, to lower frame body-side attaching unit 140. Lower frame body-side attaching unit 140 is disposed at lower frame body 103 and is under controller box 113. Lead wire 127 is fastened near motor 121 to water tub-side attaching unit 130. Water tub-side attaching
15 unit 130 is fixed externally to the bottom of water tub 107. In order to reduce stress concentration which will be described later, water tub-side attaching unit 130 is substantially parallel to lower frame body-side attaching unit 140 near lower frame body-side attaching unit 140.

[0022] Lead wire 127 is held fast while having, between water tub-side attaching unit
20 130 and lower frame body-side attaching unit 140, lead wire slack 127a that is a loose part. As will be described later, water tub 107 vibrates and thus causes a considerably varying distance between water tub-side attaching unit 130 and lower frame body-side attaching unit 140. By having lead wire slack 127a, lead wire 127 is restrained from breaking.

[0023] Water tub-side attaching unit

25 FIG. 4A is a front view of the water tub-side attaching unit of the washing machine according to the first exemplary embodiment. FIG. 4B is a side view of the water tub-side attaching unit of the washing machine according to the first exemplary embodiment. FIG. 4C is a perspective view of the water tub-side attaching unit of the washing machine according to the first exemplary embodiment. FIG. 5 is a perspective
30 view illustrating the water tub-side attaching unit attached to the water tub of the washing machine according to the first exemplary embodiment and a part surrounding the water tub-side attaching unit.

[0024] As illustrated in FIGS. 3, 4A to 4C, and 5, water tub-side attaching unit 130 is plate-shaped, is made with a fire-resistive material such as a metal, and is separate from

motor holder 120. Because of being separate from motor holder 120, water tub-side attaching unit 130 is enabled to flexibly secure lead wire 127 with respect to water tub 107.

[0025] As FIGS. 3, 4A to 4C, and 5 illustrate, water tub-side attaching unit 130 includes fastening side 131 and shield side 132 that extends upright from fastening side 131 as a result of bending. Fastening side 131 has locating holes 136, screw holes 135, and cable tie holes 133.

[0026] Water tub 107 includes locating bosses 137 that are external to the bottom to face locating holes 136, respectively. With locating bosses 137 engaged respectively in locating holes 136, water tub-side attaching unit 130 has shield side 132 in a direction of a center of water tub 107. Water tub-side attaching unit 130 in position is fixed externally to the bottom of water tub 107 at screw holes 135 with screws 134. Water tub-side attaching unit 130 can be readily detached from water tub 107 by removing screws 134.

[0027] Fastening side 131 has two cable tie holes 133, namely, motor-side cable tie hole 133a and control device-side cable tie hole 133b. Lead wire 127 is bound with two cable ties 150, namely, motor-side cable tie 150a and control device-side cable tie 150b that have substantially the same spacing as two cable tie holes 133. Motor-side cable tie 150a and control device-side cable tie 150b are inserted respectively into motor-side cable tie hole 133a and control device-side cable tie hole 133b and are locked behind fastening side 131, thus binding lead wire 127.

[0028] Shield side 132 screens lead wire 127, which is fastened to water tub-side attaching unit 130, from the center of water tub 107. Shield side 132 is closer to control device-side cable tie hole 133b, faces the center of water tub 107 when viewed from water tub-side attaching unit 130, and screens lead wire 127 from drainpipe 115, which is closer to water tub-side attaching unit 130 than the center of water tub 107 is.

[0029] A description is hereinafter provided of how washing machine 100 configured thus is operated.

[0030] Vibration of water tub during washing operation

The user opens lid 104, loads laundry into washing and spin-drying tub 109 through laundry loading port 105, and operates operation display unit 106 to turn on power. Next, the user operates operation display unit 106 to make a selection from various courses and start a washing operation. Each of the various courses includes various steps such as a washing step, a rinsing step, and a spin-drying step. The washing operation ends as the series of steps is completed in the selected course.

[0031] During the washing operation, water tub 107, which is supported to be swingable

by the suspension, vibrates with motion of washing and spin-drying tub 109 and motion of pulsator 110. Lead wire 127 swings significantly with the vibration of water tub 107 at water tub-side attaching unit 130, which secures lead wire 127, and substantially does not vibrate at housing 101, which fixes lead wire 127. Therefore, lead wire 127 is subject to concentrated stress at control device-side cable tie 150b of water tub-side attaching unit 130 and motor-side cable tie 160a (refer to FIG. 2) of lower frame body-side attaching unit 140 that fasten lead wire 127, and thus might have breaks that cause lead wire 127 to have a higher temperature. Water tub-side attaching unit 130 according to the present exemplary embodiment is made with the fire-resistive material, and lower frame body-side attaching unit 140 is made with a fire-resistive material. Therefore, water tub-side attaching unit 130 and lower frame body-side attaching unit 140 are capable of inhibiting spread of heat from lead wire 127. Consequently, water tub-side attaching unit 130 is capable of reducing or preventing effect that the increased heat on fastening side 131 might have on water tub 107.

[0032] Water tub-side attaching unit 130 according to the present exemplary embodiment is disposed near controller box 113 and along an outer periphery of water tub 107 for restraining the above-mentioned breaks that might be caused by the concentrated stress. Water tub-side attaching unit 130 according to the present exemplary embodiment is separate from motor holder 120 and is fixed directly to water tub 107 near lower frame body-side attaching unit 140. Because of this, motor holder 120 does not need to be extended closer to the outer periphery of water tub 107 and thus can be smaller.

[0033] In manufacture of multiple models of washing machines that have varying sizes of water tubs 107, each water tub-side attaching unit 130 can be disposed close to the rear of washing machine 100 and along the outer periphery of water tub 107 by being attached to a different position. Therefore, by each having water tub-side attaching unit 130 and motor holder 120 separately, the multiple models of washing machines that have the varying sizes of water tubs 107 are enabled to have the common components.

[0034] Water tub-side attaching unit 130 has shield side 132 near drainpipe 115, which is a component made with a resin. Such a shield provided closer to control device-side cable tie 150b, which may become hot, for drainpipe 115 is capable of checking spread of fire to drainpipe 115. Lead wire 127, which is routed from motor 121, curves sharply near motor-side cable tie hole 133a and is fastened to motor-side cable tie hole 133a with cable tie 150. Since it is only near control device-side cable tie 150b that shield side 132 is provided, lead wire 127 curving sharply from motor 121 does not come into contact with shield side

132. This staves off a break in lead wire 127 as a result of contact between lead wire 127 and shield side 132 during vibration in the washing operation.

[0035] Effects and others

As described above, washing machine 100 according to the present exemplary
5 embodiment includes housing 101, upper frame body 102, lower frame body 103, water
tub 107 supported to be swingable inside housing 101, washing and spin-drying tub 109
rotatable inside water tub 107, and motor 121 that rotates washing and spin-drying tub 109.
Washing machine 100 further includes the control board that is disposed in the rear of
housing 101 and controls motor 121, lead wire 127 connecting motor 121 and the control
10 board, and water tub-side attaching unit 130 that is external to the bottom of water tub 107
and secures lead wire 127.

[0036] This configuration enables water tub-side attaching unit 130 to be near the outer
periphery of water tub 107 and also enables motor holder 120 to be smaller. Therefore, the
breaks in lead wire 127 can be restrained, and material cost for motor holder 120 can be
15 reduced.

[0037] As in the present exemplary embodiment, water tub-side attaching unit 130 may
be made with the fire-resistive material and may include shield side 132 that screens lead
wire 127 secured to water tub-side attaching unit 130 from the center of water tub 107
with water tub-side attaching unit 130 attached to water tub 107.

20 **[0038]** Where lead wire 127 is fastened, the fire-resistive material is thus capable of
screening lead wire 127 from the resin component that is closer to the center of water tub
107, such as drainpipe 115. Therefore, even if there is a break in lead wire 127 where lead
wire 127 is fastened, resulting in a higher temperature of lead wire 127, the effect on the
resin component such as drainpipe 115 can be reduced or prevented.

25 **[0039]** As in the present exemplary embodiment, shield side 132 may screen, from the
center of water tub 107, the position where lead wire 127 is fastened by control device-
side cable tie 150b that is closer to the control device.

[0040] This configuration precludes contact between shield side 132 and a bend of lead
wire 127 that is closer to motor-side cable tie hole 133a. Therefore, the break in lead wire
30 127 due to shield side 132 can be staved off.

[0041] OTHER EXEMPLARY EMBODIMENTS

The first exemplary embodiment described above is illustrative of the technique
disclosed in the present application. However, the above technique is not restrictive of the
present disclosure.

[0042] Exemplary embodiments below are given as other illustrations.

[0043] Washing machine 100 given as one example of a washing machine has been a top-loading washing machine in the first exemplary embodiment. The washing machine is not limited to any top-loading washing machine provided that the washing machine includes a control device and a water tub that is supported to be swingable inside a housing. The washing machine may be a twin tub washing machine.

[0044] In the first exemplary embodiment, one example of the fire-resistive material described has been the metal. The fire-resistive material is not limited to metals. The fire-resistive material to use may be a ceramic or a fire-resistive resin.

INDUSTRIAL APPLICABILITY

[0045] The present disclosure is applicable to washing machines each having a motor and a control device electrically connected by a lead wire. Specifically, the present disclosure is applicable to top-loading washing machines and twin tub washing machines, among others.

REFERENCE MARKS IN THE DRAWINGS

[0046] 100: washing machine

101: housing

102: upper frame body

103: lower frame body

104: lid

105: laundry loading port

106: operation display unit

107: water tub

109: washing and spin-drying tub

110: pulsator

111: balancer

112: drain hole

113: controller box

113a: box opening

114: rear cover

114a: rear cover bulge

115: drainpipe

	120: motor holder
	121: motor
	122: belt
	123: motor-side pulley
5	124: mechanism-side pulley
	125: rotating shaft
	126: transmission mechanism
	127: lead wire
	130: water tub-side attaching unit
10	131: fastening side
	132: shield side
	133: cable tie hole
	133a: motor-side cable tie hole
	133b: control device-side cable tie hole
15	134: screw
	135: screw hole
	136: locating hole
	137: locating boss
	140: lower frame body-side attaching unit
20	150: cable tie
	150a, 160a: motor-side cable tie
	150b: control device-side cable tie

CLAIMS

1. A washing machine comprising:
- 5 a housing;
- a water tub supported to be swingable inside the housing;
- a washing and spin-drying tub rotatable inside the water tub, the washing and spin-drying tub being used to wash and spin-dry laundry;
- a motor that rotates the washing and spin-drying tub;
- a motor holder securing the motor externally to a bottom of the water tub;
- 10 a control device disposed in a rear of the housing and controlling the motor;
- a lead wire connecting the motor and the control device; and
- a water tub-side attaching unit external to the bottom of the water tub, the water tub-side attaching unit securing the lead wire.
- 15 2. The washing machine according to claim 1, wherein the water tub-side attaching unit is made with a fire-resistive material and includes a shield side, and
- the shield side screens a part of the lead wire, the part being secured to the water tub-side attaching unit and located closer to a center of the water tub with respect to the water tub-side attaching unit attached to the water tub.
- 20 3. The washing machine according to claim 2, wherein the shield side screens, from the center of the water tub, a secured position of the lead wire that is closer to the control device.
- 25