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(54) WASHING MACHINE WITH A BUBBLE GENERATING UNIT

WASCHMASCHINE MIT EINER BLASENERZEUGUNGSVORRICHTUNG

MACHINE À LAVER AVEC UNE UNITÉ DE GÉNÉRATION DE BULLES

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(73) Proprietor: **BSH Hausgeräte GmbH**
81739 München (DE)

(72) Inventor: **GRACIA BOBED, Ismael**
E-50194 Zaragoza (ES)

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Description

[0001] The present invention relates to a washing machine with a tub, and a bubble generating unit for introducing air into the tub and generating bubbles in a washing liquid within said tub, and the bubble generating unit has a heating element for heating the air before introducing into the tub.

[0002] Such washing machine is disclosed in each of the publications U. S. Patent 2,535,901 and BE 493 012 A. Documents US 2008/0250823 A1 and U. S. Patent 5,653,129 each disclose a similar washing machine, wherein the bubble generating unit is without a heating element.

[0003] A laundry washer with a rotating drum that has a bubble generator for washing the laundry with bubbles is known from the document US 2008/250823 A1. The laundry washer includes a tub to contain the washing liquid, a bubble generator, and a supplier of bubbles to the tub. The bubble generator includes a bubble generating pump that permits the washing liquid to flow there-through and an ejector unit formed integrally with one side of same for mixing air with the washing liquid. The bubble generation is produced by injecting ambient temperature air into the generator, and the bubbles subsequently supplied to the tub are cooled, which affects the temperature of the washing liquid.

[0004] An object of the present invention is to provide a laundry washing machine that easily solves the mentioned problem in the state of the art.

[0005] This problem is solved in accordance with the invention by means of a washing machine as claimed in the independent claim attached. Preferred embodiments of the invention are subjects of the dependent claims attached, the subsequent description and the figures of the attached drawing.

[0006] Therefore, this problem is solved in accordance with the invention by means of a washing machine with a tub, and a bubble generating unit for introducing air into the tub and generating bubbles in a washing liquid within said tub, and the bubble generating unit has a heating element for heating the air before introducing into the tub, wherein further a rotatable drum is housed in the tub, and the bubble generating unit has a bubble distributing element arranged between the tub and the drum, and the heating element has a tubular element in thermal contact with the bubble distributing element.

[0007] In this manner, the temperature of the washing liquid will not drastically change a wash cycle that requires a certain temperature. For example, if air bubbles at ambient temperature are introduced into a wash cycle at a high temperature of 90 °C, this would extend the cycle time. By introducing hot air, the cycle time will not be increased and might even be shortened since introducing high-temperature air favors rapid heating of the water, accelerating the washing process and thus shortening of the cycle time.

[0008] According to the invention, a rotatable drum is

housed in the tub, and the bubble generating unit is provided with a bubble distributing element arranged between the tub and the drum housed inside the tub. In this way, the bubbles are generated directly inside the tub.

[0009] According to the invention, the heating element has a tubular element in thermal contact with the bubble distributing element. This type of heating element is standard for washing machines, and the use thereof in thermal contact with the bubble distributing element makes the bubble generating unit inexpensive because it can be manufactured in a manner similar to standard heating elements.

[0010] In accordance with a preferred embodiment of the invention, the heating element is provided for heating a mixture of the air and the washing liquid. Thereby an improved efficiency of heating can be achieved.

[0011] In accordance with other preferred embodiments of the invention, the bubble generating unit has an air duct through which the air is introduced into the wash tub, and a heating element is arranged in the air duct, inside same or in thermal contact with the exterior of same. In this manner, the heating element rapidly heats the air that circulates through the interior of the duct.

[0012] In accordance with a further preferred embodiment, the heating element is arranged between the tub and a rotatable drum housed inside the tub. A heating element of this type heats the washing liquid in the wash cycles and at the same time heats the air duct for introducing the air used for generating bubbles.

[0013] In accordance with yet a further preferred embodiment of the invention, the bubble distributing element is also provided as part of the air duct and with a plurality of air outflow orifices. Still more preferred, the bubble distributing element is a body of a porous material. The surface of the air duct is utilized to distribute bubbles through its surface, preferably through its entire surface.

[0014] In accordance with still another preferred embodiment of the invention, each air outflow orifice has a diameter of 0.05 mm to 2 mm, preferably to 0.1 mm to 1.5 mm, more preferably of 0.5 mm.

[0015] In a still more preferred embodiment of the invention the tubular element has at least one U-shaped portion, and the bubble distributing element comprises an air duct arranged between arms of the U-shaped portion. Such a tubular element encircles and encloses the bubble distributing element and improves the temperature transmission. The bubble distributing element is formed from a metallic tube with high temperature transmission.

[0016] In accordance with again a preferred embodiment of the invention, the bubble generating unit is provided with an air compressor that propels the air into the tub, especially by means of the bubble distributing element, and especially through the outflow orifices. If these are very small, the air pressure can be higher while at the same time preventing these orifices from becoming plugged.

[0017] Other advantages are apparent from the following description of a preferred embodiment of the invention shown in the figures of the attached drawing. Shown in:

- Figure 1 is a cross-sectional elevation view of a washing machine;
- Figure 2 is a perspective, isometric, schematic view of a washing machine;
- Figure 3 is a frontal section schematic view of a washing machine; and,
- Figure 4 is a top view of a heating element with a bubble distributing element.

[0018] Figure 1 shows a cross-sectional elevation view of washing machine 10. The washing machine 10 has laundry loading door 11 for placing the clothing to be washed in drum 30 through drum mouth 31. The drum is rotated by a motor (not shown) around shaft 33 that is held by rear part 39 of the drum within wash tub 20.

[0019] The washing machine 110 has filling system 60 connected by means of solenoid valve 63 to an external water supply. The water enters tub 20 through detergent compartment 50 having come from the solenoid valve through compartment tube 61, and after having collected the detergent enters therein through filling pipe 62. The tub 20 is filled with washing liquid W that enters drum 30 through drum orifices 37 of the side band of the drum 30. To maintain the leak-tightness of the tub 20, it is provided with an elastic bellows that connects tub portal 21 with a washing machine chassis. Door 11 closes and is held in against the elastic bellows to ensure that no washing liquid will escape from tub mouth 21. To drain washing liquid W from the tub 20, tub outlet 27 is provided for drainage of the liquid W that is brought through emptying pipe 29 toward drainage pump 90 that propels it through drainage pipe 71 to exit the machine 10.

[0020] For generating bubbles within the drum 30, bubble generating unit 40 is provided and introduces air into the lowest part of tub 20 between the lower wall of same and drum 30. Air duct 81 extends through the interior of the tub 20 with bubble distributing element 45 that has a plurality of air outflow orifices 46 over its entire surface. Each air outflow orifice 46 has a diameter of 0.05 mm to 2 mm, preferably to 0.1 mm to 1.5 mm, more preferably of 0.5 mm. Bubble distributing element 45 is arranged in contact with heating element 41, and the assembly is held to the interior wall of the tub by means of support 49. The assembly of heating element 41 and bubble distributing element 45 is introduced into the tub 20 through an opening that is closed by cap 48 of the assembly.

[0021] Figure 2 shows a perspective view of machine 10, this time with loading door 11 open and where in addition to the elements from figure 1 is shown air compressor 80 of bubble generating unit 40 that introduces compressed air into wash tub 20 by means of air duct 81. Shown here in dotted lines is heating element 41 with a tubular element 43 within which is enclosed bubble

distributing element 45 from air duct 81.

[0022] Figure 3 shows a schematic view of a frontal section of washing machine 10. Shown here in particular is the space between tub 20 and drum 30 wherein are arranged the lower portion of the tub 20, heating element 41, and bubble distributing element 45. During the wash cycle, this lowest part of the tub 20 is filled with washing liquid W.

[0023] Figure 4 shows in detail the bubble generating unit 40 assembly comprising air compressor 80 that propels pressurized air through the tubular air duct 81. The heating element 41 has a tubular shape with three U-shaped portions 43 and four arms 44. The two longer arms 44 are fixed to cap 48 with which the tub opening is closed to introduce heating element 41 therein, which protrudes together with its electrical connection connectors 47. The air duct 81 passes through a sealed through hole in cap 48, and extends as bubble distributor element 45 to the side of the heating element 41 to be fixed between arms 44 of the heating element 41. Bubble distributor element 45 has air outflow orifices 46 originating from air compressor 80. The compressor 80 can be joined to the external part of the tub 20 near the opening through which the heating element 41 is introduced, or fixed to another separate part of the tub 20 and with a flexible air duct 81.

LIST OF REFERENCE NUMERALS

- [0024]**
- 10 Washing machine
 - 11 Loading door
 - 20 Tub
 - 21 Tub portal
 - 27 Tub outlet
 - 29 Emptying pipe
 - 30 Drum
 - 31 Drum mouth
 - 33 Shaft
 - 37 Drum orifices
 - 39 Rear of the drum
 - 40 Bubble generating unit
 - 41 Heating element
 - 43 U-shaped portion
 - 44 Arm
 - 45 Bubble distributing element
 - 46 Air outflow orifices
 - 47 Connector
 - 48 Cap
 - 49 Support
 - 50 Detergent compartment
 - 60 Filling system
 - 61 Compartment tube
 - 62 Filling pipe
 - 63 Solenoid valve
 - 71 Outlet pipe
 - 80 Air compressor

81 Air duct
90 Drainage pump
W Washing liquid

Claims

1. A washing machine (10) with a tub (20), and a bubble generating unit (40) for introducing air into the tub (20) and generating bubbles in a washing liquid (W) within said tub (20), the bubble generating unit (40) has a heating element (41) for heating the air before introducing into the tub (20),

characterized in that:

a rotatable drum (30) is housed in the tub (20), and the bubble generating unit (40) has a bubble distributing element (45) arranged between the tub (20) and the drum (30), and the heating element (41) has a tubular element (43) in thermal contact with the bubble distributing element (45).

2. Washing machine (10) according to claim 1, **characterized in that** the heating element (41) is provided for heating a mixture of the air and the washing liquid (W).
3. Washing machine according to one of claims 1 and 2, **characterized in that** the bubble generating unit (40) has an air duct (81) thermally connected to the heating element (41).
4. Washing machine according to claim 3, **characterized in that** the heating element (41) is arranged between the tub (20) and a rotatable drum (30) housed inside the tub (20).
5. Washing machine according to one of claims 1 and 2, **characterized in that** the heating element (41) is arranged inside an air duct (81).
6. The washing machine according to one of the preceding claims, **characterized in that** the bubble distributing element (40) is part of the air duct (81) with a plurality of air outflow orifices (46).
7. The washing machine (10) according to claim 6, **characterized in that** the bubble distributing element (40) is a body (40) of a porous material.
8. The washing machine (10) according to one of claims 6 and 7, **characterized in that** each air outflow orifice (46) has a diameter of 0.05 mm to 2 mm, preferably 0.1 mm to 1.5 mm, more preferably to 0.5 mm.

9. Washing machine according to one of the preceding claims, **characterized in that** a part of the tubular element (43) has at least one U-shaped portion (43) and the bubble distributing element (45) comprises an air duct (81) arranged between the arms (44) of the U-shaped portion (43).

10. The washing machine according to one of the preceding claims, **characterized in that** the bubble generating unit (40) has an air compressor (80).

Patentansprüche

1. Waschmaschine (10) mit einem Laugenbehälter (20) und einer Blasen erzeugungsvorrichtung (40) zum Einleiten von Luft in den Laugenbehälter (20) und Erzeugen von Blasen in einer Waschflüssigkeit (W) innerhalb dieses Laugenbehälters (20), wobei die Blasen erzeugungsvorrichtung (40) ein Heizelement (41) zum Erwärmen der Luft vor dem Einleiten in den Laugenbehälter (20) aufweist, **dadurch gekennzeichnet, dass:**
- eine drehbare Trommel (30) in dem Laugenbehälter (20) untergebracht ist und die Blasen erzeugungsvorrichtung (40) ein Blasenverteilungselement (45) aufweist, das zwischen dem Laugenbehälter (20) und der Trommel (30) angeordnet ist, und das Heizelement (41) ein rohrförmiges Element (43) aufweist, das sich in thermischem Kontakt mit dem Blasenverteilungselement (45) befindet.
2. Waschmaschine (10) nach Anspruch 1, **dadurch gekennzeichnet, dass** das Heizelement (41) zum Erwärmen eines Gemisches der Luft und der Waschflüssigkeit (W) vorgesehen ist.
3. Waschmaschine nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** die Blasen erzeugungsvorrichtung (40) einen Luftkanal (81) aufweist, der mit dem Heizelement (41) thermisch verbunden ist.
4. Waschmaschine nach Anspruch 3, **dadurch gekennzeichnet, dass** das Heizelement (41) zwischen dem Laugenbehälter (20) und einer innerhalb des Laugenbehälters (20) untergebrachten drehbaren Trommel (30) angeordnet ist.
5. Waschmaschine nach einem der Ansprüche 1 und 2, **dadurch gekennzeichnet, dass** das Heizelement (41) innerhalb eines Luftkanals (81) angeordnet ist.
6. Waschmaschine nach einem der vorhergehenden

Ansprüche, **dadurch gekennzeichnet, dass** das Blasenverteilungselement (40) Teil des Luftkanals (81) mit mehreren Luftausströmöffnungen (46) ist.

7. Waschmaschine (10) nach Anspruch 6, **dadurch gekennzeichnet, dass** das Blasenverteilungselement (40) ein Körper (40) aus einem porösen Material ist.
8. Waschmaschine (10) nach einem der Ansprüche 6 und 7, **dadurch gekennzeichnet, dass** jede Luftausströmöffnung (46) einen Durchmesser von 0,05 mm bis 2 mm, vorzugsweise von 0,1 mm bis 1,5 mm, stärker bevorzugt bis 0,5 mm aufweist.
9. Waschmaschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ein Teil des rohrförmigen Elements (43) wenigstens einen U-förmigen Abschnitt (43) aufweist und das Blasenverteilungselement (45) einen Luftkanal (81) umfasst, der zwischen den Armen (44) des U-förmigen Abschnitts (43) angeordnet ist.
10. Waschmaschine nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Blasenverteilungselement (40) einen Luftkompressor (80) aufweist.

Revendications

1. Lave-linge (10) avec une cuve (20), et une unité génératrice de bulles (40) afin d'introduire de l'air dans la cuve (20) et de générer des bulles dans un liquide de lavage (W) à l'intérieur de ladite cuve (20), l'unité génératrice de bulles (40) possédant un élément chauffant (41) pour chauffer l'air avant de l'introduire dans la cuve (20),
caractérisé en ce que :

un tambour rotatif (30) est logé dans la cuve (20) et l'unité génératrice de bulles (40) possède un élément distributeur de bulles (45) disposé entre la cuve (20) et le tambour (30), l'élément chauffant (41) possédant un élément tubulaire (43) en contact thermique avec l'élément distributeur de bulles (45).
2. Lave-linge (10) selon la revendication 1, **caractérisé en ce que** l'élément chauffant (41) est fourni afin de chauffer un mélange d'air et de liquide de lavage (W).
3. Lave-linge selon l'une des revendications 1 et 2, **caractérisé en ce que** l'unité génératrice de bulles (40) possède un conduit d'air (81) connecté thermiquement à l'élément chauffant (41).

4. Lave-linge selon la revendication 3, **caractérisé en ce que** l'élément chauffant (41) est disposé entre la cuve (20) et un tambour rotatif (30) logé à l'intérieur de la cuve (20).
5. Lave-linge selon l'une des revendications 1 et 2, **caractérisé en ce que** l'élément chauffant (41) est disposé à l'intérieur d'un conduit d'air (81).
6. Lave-linge selon l'une des revendications précédentes, **caractérisé en ce que** l'élément distributeur de bulles (40) fait partie du conduit d'air (81) avec une pluralité d'orifices d'écoulement d'air (46).
7. Lave-linge (10) selon la revendication 6, **caractérisé en ce que** l'élément distributeur de bulles (40) est un corps (40) en un matériau poreux.
8. Lave-linge (10) selon l'une des revendications 6 et 7, **caractérisé en ce que** chaque orifice d'écoulement d'air (46) possède un diamètre de 0,05 mm à 2 mm, de préférence de 0,1 mm à 1,5 mm, de manière particulièrement préférée à 0,5 mm.
9. Lave-linge selon l'une des revendications précédentes, **caractérisé en ce que** une partie de l'élément tubulaire (43) possède au moins une partie en forme de U (43) et l'élément distributeur de bulles (45) comprend un conduit d'air (81) disposé entre les bras (44) de la partie en forme de U (43).
10. Lave-linge selon l'une des revendications précédentes, **caractérisé en ce que** l'unité génératrice de bulles (40) possède un compresseur d'air (80).

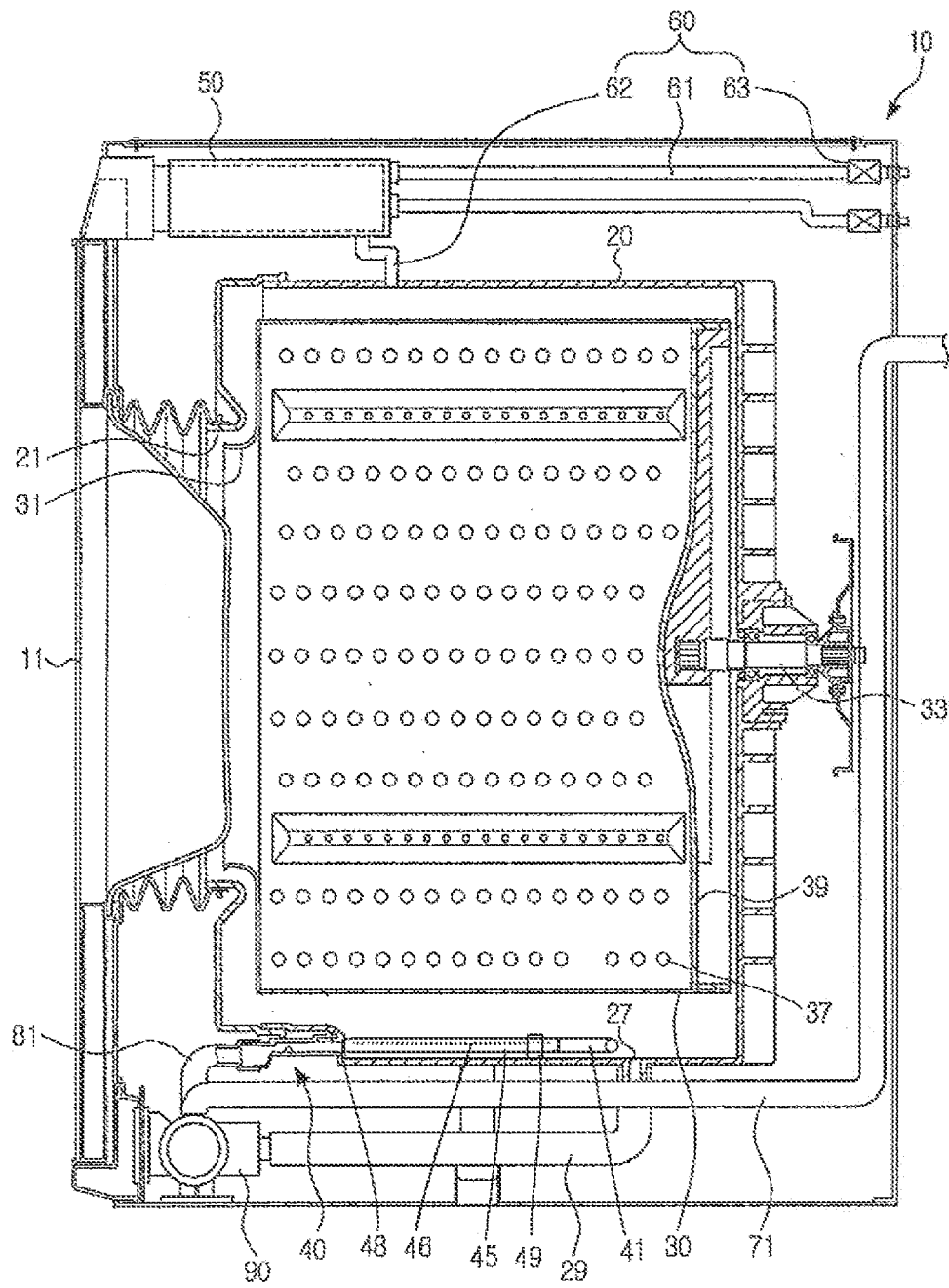


Fig.1

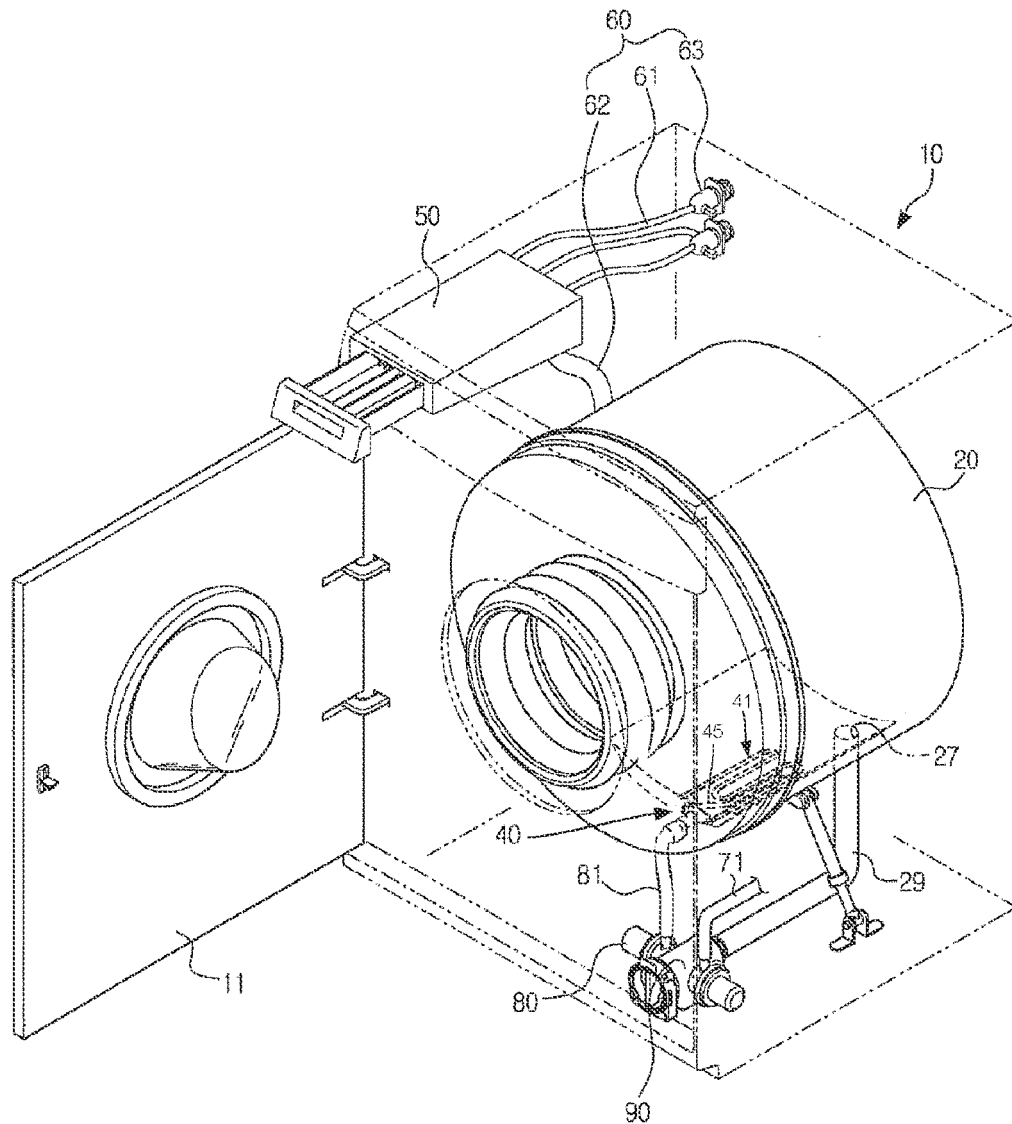


Fig.2

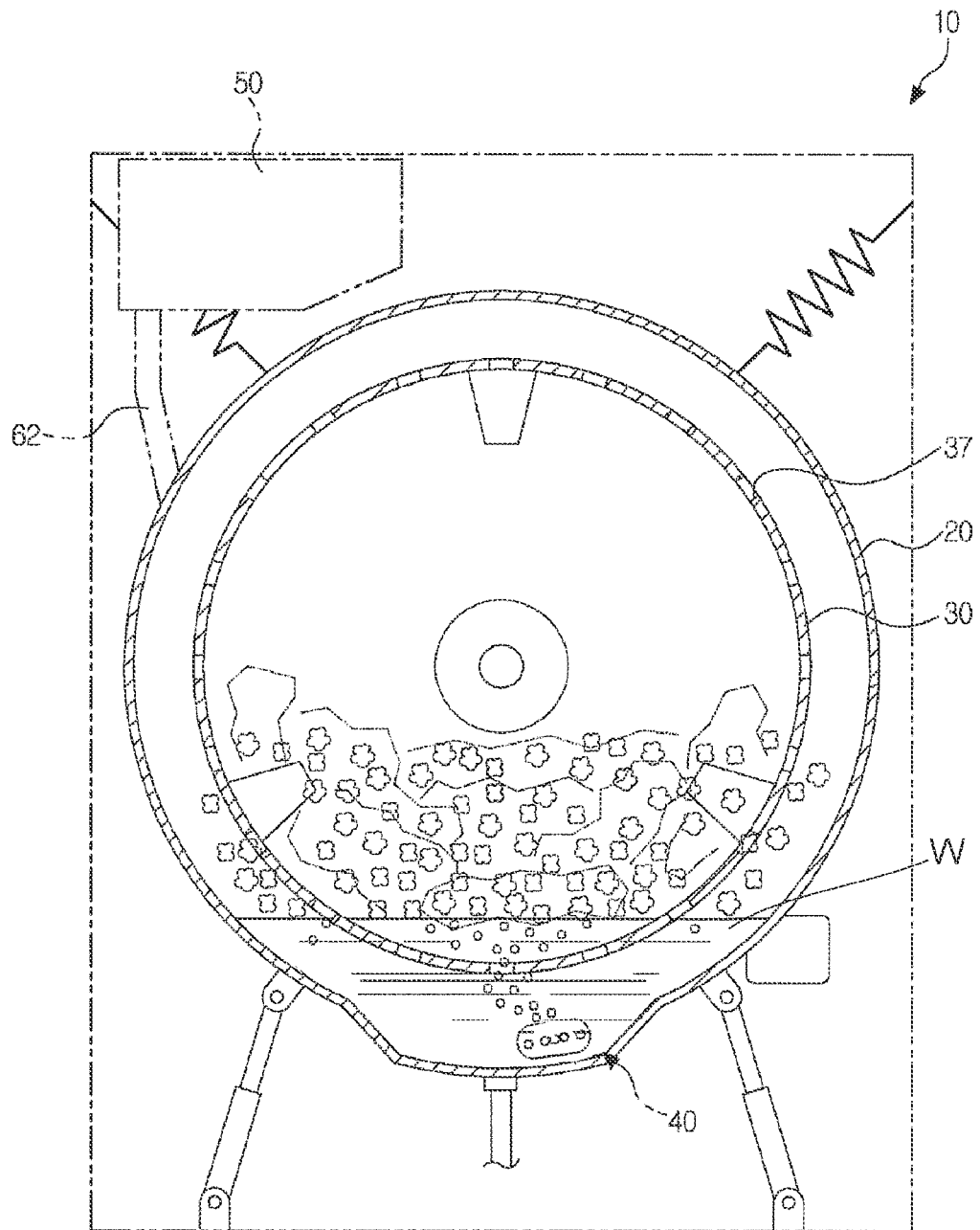


Fig.3

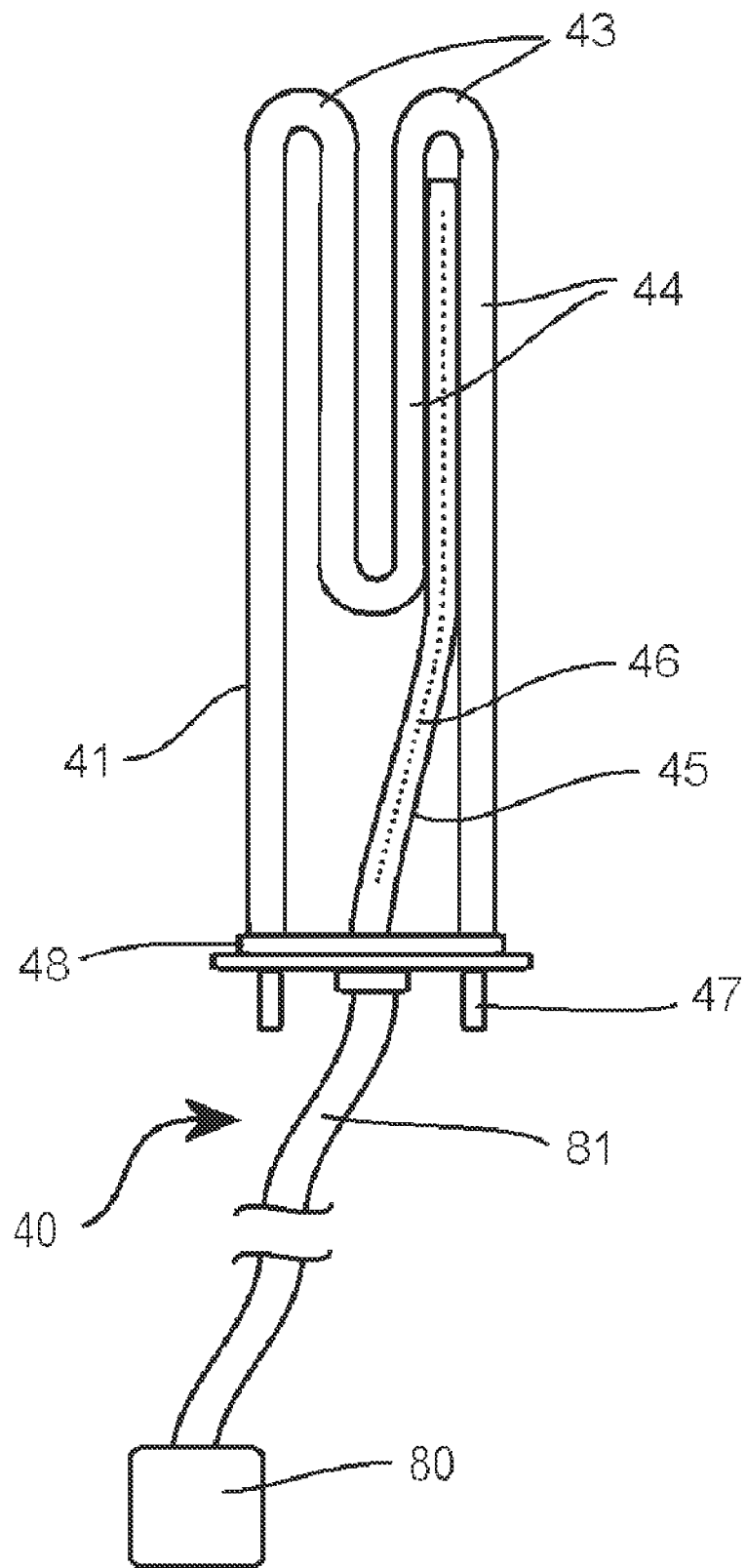


Fig.4

REFERENCES CITED IN THE DESCRIPTION

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