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(54) A WASHING MACHINE COMPRISING AN AIR TRAP

WASCHMASCHINE MIT LUFTFALLE

LAVE-LINGE COMPRENANT UN SIPHON

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Description

[0001] The present invention relates to a washing machine wherein the water level measurement is made reliable.

[0002] In washing machines, the level of the water received in the machine is determined by measuring the pressure of the air compressed inside the air trap, which is connected to the tub, as the manometric height of the water, rising in the tub, increases, and by comparing this pressure with the reference pressure value of the tub when it is empty.

[0003] On the other hand, in horizontal-axis washing machines, in order that the spin-drying step can be efficiently performed, the laundry is required to be distributed to the drum wall equally in every direction. In the situation that the laundry cannot be distributed equally, the vibration in the washing machine increases at high speeds in the spin-drying step and this causes the dynamic and structural system of the machine to be damaged. Therefore, in horizontal-axis washing machines, unbalanced load detection methods are present. By means of these methods, the amount of unbalanced load, situated inside the machine in the spin-drying step of the machine, is determined and depending on the determined value, various distribution algorithms are applied for the distribution of the laundry on the drum wall if required and/or the spin-drying process is stopped.

[0004] In the state of the art, in order to minimize the usage of additional elements for unbalanced load detection, embodiments, aimed at achieving the same result by a single element instead of multiple elements used for water level detection and for unbalanced load detection, have been developed.

[0005] A state of the art embodiment is explained in the German Patent Application No DE19616635. In this application, a system which measures the fluctuations, occurring due to the imbalance, with regard to the pressure data, is described.

[0006] In the state of the art European Patent Application No EP0967318, a system which, by the pressure difference, measures the oscillations, that is, the imbalance, occurring in the tub, is explained. In an embodiment explained in the said application, the tube coming from the air trap and the tube coming from the vibration sensor are joined together by a T element and are connected to the pressure sensor by a single tube. In another embodiment, the tube coming from the air trap and the tube coming from the vibration sensor are connected to the pressure sensor separately. In this embodiment, a valve, which enables the tube coming from the air trap to be cut off when desired, is situated on the tube coming from the air trap.

[0007] In another state of the art document, the European Patent Application No EP0750065, a method, which relates to the interpretation of the data, received by the pressure sensor from the air trap, to be used for unbalanced load detection, is explained Document DE-B3-10 2005 028 253 discloses a washing machine according to the preamble of claim 1.

[0008] However, in these state of the art embodiments, while the measurement of the water level and of the unbalanced load is desired to be performed by means of a single pressure sensor, it cannot be prevented that these measurements affect each other in different steps of the washing process and that the measurement efficiency decreases in at least one of the measurements.

[0009] The aim of the present invention is the realization of a washing machine wherein the measurement of the water level and of the unbalanced load amount is performed with low cost and high accuracy.

[0010] The washing machine realized in order to attain the aim of the present invention is explicated in the claims.

[0011] The washing machine comprises a main pipe which provides air to be transmitted to the pressure sensor, a three-way valve which is mounted to the inlet of the main pipe and which controls the air input to the main pipe and the air output therefrom, an air trap pipe, the inlet of which is connected to the air trap and the outlet of which is connected to the valve, and which provides the connection between the air trap and the main pipe, and a vibration pipe, the inlet of which is connected to the vibration transmitter and the outlet of which is connected to the valve and thus, which provides the connection between the vibration transmitter and the main pipe.

[0012] By means of the valve being three-way and of its placement, air transmission can be provided to the pressure sensor preferentially. Thus, by a single pressure sensor, also the pressure balancing between the pipes is possible for performing a robust detection while both the water level and the unbalanced load are detected.

[0013] In the preferred embodiment of the present invention, the washing machine comprises a counterweight which is disposed onto the tub. In this embodiment, the vibration transmitter is disposed onto the counterweight. The washing machine applies a washing algorithm which preferably comprises water intake, washing, discharge and spin-drying steps.

[0014] In the preferred embodiment of the present invention, a three-way and three-position valve is used. The valve is kept in the position which will allow air flow only from the air trap pipe to the main pipe throughout the water intake and washing steps. Thus, in the water intake and washing steps, the water level measurement is performed with high accuracy.

[0015] At the end of the washing step, the valve is brought to the position wherein it will allow air flow between the vibration pipe and the air trap pipe and will close the inlet of the main pipe; and thus, pressure balancing between the pipes is provided.

[0016] In the discharge step, the outlet of the vibration pipe is closed and thus, the air flow is allowed only between the air trap pipe and the main pipe, again. Thus, both the pressure inside the vibration transmitter is prevented from

decreasing during the discharge step and the level of water inside the tub is provided to be determined accurately during the discharge step.

[0017] Finally, since the unbalanced load detection becomes important in the spin-drying step, the valve is brought to the position wherein air will flow into the main pipe only through the vibration pipe, and the unbalanced load measurement is provided to be performed accurately.

[0018] In another embodiment of the present invention, the valve has three ways and two positions. Thus, cost advantage is provided. In this embodiment, in the water intake, washing, discharge and spin-drying steps, the valve is kept in the positions which are explained in the previous embodiment. At the end of the washing step and before the discharge step, the valve is brought to the position wherein the vibration pipe outlet and the main pipe inlet will be open and the air trap pipe outlet will be closed.

[0019] In a version of this embodiment, in order that pressure equalization is provided at the end of the washing step and before the discharge step, the main pipe comprises a chamber. Thus, since the volume at the main pipe side is greater than the volume at the vibration pipe side, air flow is provided into the vibration pipe and thus, pressure balancing is possible.

[0020] In the preferred embodiment of the present invention, the vibration transmitter comprises a box. The box has a first compartment, and a second compartment which is filled with air inside and whereto the vibration pipe is connected. The vibration transmitter, furthermore, comprises a flexible barrier which separates the first compartment and the second compartment, and a weight which, by being located in the first compartment, applies pressure to the flexible barrier according to the vibration of the tub and compresses the air located in the second compartment.

[0021] In different embodiments of the present invention, the weight is produced from a solid or liquid material.

[0022] In an embodiment of the present invention, the vibration transmitter comprises a first transmitter which is disposed at the front side of the tub, a second transmitter which is disposed at the rear side of the tub, a vibration pipe valve which controls the air input and output from the first transmitter and the second transmitter to the vibration pipe, a first pipe which connects the first transmitter and the vibration pipe valve to each other, and a second pipe which connects the second transmitter and the vibration pipe valve to each other. Thus, as well as the determination of the unbalanced load amount, also the determination of the data that the unbalanced load is at the front or at the back is possible.

[0023] The model embodiments relating to the washing machine realized in order to attain the aim of the present invention are illustrated in the attached figures, where:

[0024] Figure 1 - is the front schematic view of a washing machine.

[0025] Figure 2 - is the front schematic view of another embodiment of the present invention.

[0026] Figure 3 - is the schematic view of the vibration transmitter used in an embodiment of the present invention.

[0027] Figure 4 - is the schematic view of the vibration transmitter used in another embodiment of the present invention.

[0028] Figure 5 - is the top schematic view of an embodiment of the present invention.

[0029] The elements illustrated in the figures are numbered as follows:

1. Washing machine
2. Drum
3. Tub
4. Air trap
5. Vibration transmitter
6. Pressure sensor
7. Main pipe
8. Valve
9. Air trap pipe
10. Vibration pipe
11. Chamber
12. Counterweight
13. Box
14. First compartment
15. Second compartment
16. Flexible barrier
17. Weight
18. First transmitter
19. Second transmitter
20. First pipe
21. Second pipe
22. Vibration pipe valve

[0030] The washing machine (1) comprises a drum (2) wherein the laundry is disposed, a tub (3) wherein the drum (2) moves, an air trap (4) wherein the air is compressed as the amount of water taken into the tub (3) increases, a vibration transmitter (5) which is disposed onto the tub (3) and wherein the air is compressed depending on the vibration of the tub (3), and a pressure sensor (6) which determines the amount of water inside the tub (3) by reading the pressure that is created by the air compressed in the air trap (4) and which determines the unbalanced load amount by reading the pressure that is created by the air compressed in the vibration transmitter (5).

[0031] The washing machine (1), furthermore, comprises

- a main pipe (7) which provides air to be transmitted to the pressure sensor (6),
- a three-way valve (8) which is mounted to the inlet of the main pipe (7) and which controls the air input to the main pipe (7) and the air output therefrom,
- an air trap pipe (9), the inlet of which is connected to the air trap (4) and the outlet of which is connected to the valve (8), and which provides the connection between the air trap (4) and the main pipe (7),
- a vibration pipe (10), the inlet of which is connected to the vibration transmitter (5) and the outlet of which is connected to the valve (8), and which provides the connection between the vibration transmitter (5) and the main pipe (7)

[0032] (Figure 1).

[0033] By means of the valve (8) being three-way and of its explained connections, in different washing steps, air transmission from the air trap pipe (9) and the vibration pipe (10) to the main pipe (7) and hence to the pressure sensor (6) can be controlled preferentially, and thus, during the performing of the unbalanced load detection and of the water level detection by means of a single pressure sensor (6), the two measurement processes are prevented from adversely affecting each other.

[0034] In the preferred embodiment of the present invention, the washing machine (1) comprises a counterweight (12) which is disposed onto the tub (3) in order to prevent the tub (3) from being displaced excessively, and the vibration transmitter (5) is disposed onto the said counterweight (12) (Figure 1). Thus, as well as the vibration transmitter (5) detects the vibration of the tub (3) with high accuracy, ease of assembly is provided.

[0035] The washing machine (1) of the present invention applies a washing algorithm which preferably comprises water intake, washing, discharge and spin-drying steps.

[0036] In the preferred embodiment of the present invention, the valve (8) is a three-way and three-position valve. Thus, both the water level measurement and the unbalanced load measurement are provided to be performed with high accuracy.

[0037] In this embodiment, throughout the water intake and washing steps, the valve (8) is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet. Thus, the air flow is allowed only from the air trap (4) to the main pipe (7), and throughout the water intake and washing steps, the water level measurement is provided to be performed robustly.

[0038] At the end of the washing step and before the discharge step, the valve (8) is kept in the position wherein it will open the vibration pipe (10) outlet and the air trap pipe (9) outlet, and will close the main pipe (7) inlet. Thus, the pressure in each three of the main pipe (7), the air trap pipe (9) and the vibration pipe (10) is equalized with the pressure inside the tub (3). In the discharge step, the valve (8) is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet. Thus, the pressure inside the vibration transmitter (5) is prevented from decreasing during the discharge step, and the level of water inside the tub (3) is provided to be measured throughout the discharge step.

[0039] During the spin-drying step, the valve (8) is kept in the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet. Thus, during the spin-drying step, the unbalanced load detection is provided to be performed with high accuracy without being affected by the pressure change occurring as a result of the vibrations in the air trap (4).

[0040] The position of the valve (8) in different washing steps in this embodiment is summarized in the following table.

[0041]

Table 1

	Vibration pipe (10) outlet	Main pipe (7) inlet	Air trap pipe (9) outlet
Water intake and washing steps	Closed	Open	Open
At the end of the washing step, before the discharge step	Open	Closed	Open
Discharge step	Closed	Open	Open

(continued)

	Vibration pipe (10) outlet	Main pipe (7) inlet	Air trap pipe (9) outlet
Spin-drying step	Open	Open	Closed

[0042] In another embodiment of the present invention, the valve (8) has three ways and two positions. Thus, cost advantage is provided.

[0043] In this embodiment, in the water intake, washing, discharge and spin-drying steps, the valve (8) is kept in the positions which are explained in the previous embodiment with three ways and three positions. At the end of the washing step and before the discharge step, the valve (8) is brought to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet.

[0044] The position of the valve (8) in different washing steps in this embodiment is summarized in the following table.

[0045]

Table 2

	Vibration pipe (10) outlet	Main pipe (7) inlet	Air trap pipe (9) outlet
Water intake and washing steps	Closed	Open	Open
At the end of the washing step, before the	Open	Open	Closed
discharge step			
Discharge step	Closed	Open	Open
Spin-drying step	Open	Open	Closed

[0046] As stated above, in this embodiment, at the end of the washing step and before the discharge step, the valve (8) is brought to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet. Since the valve (8) has two positions, it is not possible for the valve (8) to close the main pipe (7) inlet and to open the air trap pipe (9) inlet for pressure equalization at the end of the washing step and before the discharge step. However, in this situation, since the volume at the vibration pipe (10) side will be greater than the volume at the main pipe (7) side, problems will be confronted during the air intake to the main pipe (7) and during the equalization of the pressure therein with the other portions.

[0047] In a version of this embodiment, in order that pressure equalization is provided at the end of the washing step and before the discharge step, the washing machine (1) comprises a chamber (11) located on the main pipe (7). Thus, at the end of the washing step and before the discharge step, the pressure equalization is provided to be performed since the total volume of the main pipe (7) and the chamber (11) will be close to the volume at the vibration pipe (10) side when the valve (8) is brought to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet.

[0048] In another version of this embodiment, after the valve (8) is brought to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet in order that the pressure equalization can be provided at the end of the washing step and before the discharge step, the valve (8) is provided to be brought to the position wherein it will close the vibration pipe (10) outlet, and will open the main pipe (7) inlet and the air trap pipe (9) outlet, and air intake to the main pipe (7) is provided. Then, the pressure equalization is completed by bringing the valve (8) to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet again.

[0049] In the preferred version of this embodiment, the three-way valve (8) comprises a shutter each, which is disposed at the air trap pipe (9) outlet and at the vibration pipe (10) outlet, and a T connector which connects these shutters to the main pipe (7). Thus, the present embodiment is provided to be realized with low cost.

[0050] In an embodiment of the present invention, before the washing step, the valve (8) is kept in the position wherein it will open the vibration pipe (10) outlet, the air trap pipe (9) outlet and the main pipe (7) inlet. Thus, the pressure inside the pressure sensor (6) is balanced with the pressure in all pipes (7, 9, 10). In this embodiment, throughout at least a part of the water intake step, the valve (8) is kept in this position and thus, the value of the static pressure inside the pressure sensor (6) is provided to increase. Thus, the value of the static pressure inside the pressure sensor (6) is brought by being increased and the negative oscillations in the read pressure values are provided to be detected accurately.

[0051] Depending on the displacement occurring in the tub (3), the vibration transmitter (5) compresses the air located in the vibration transmitter (5). In the preferred embodiment of the present invention, the vibration transmitter (5) comprises

- a box (13) having a first compartment (14), and a second compartment (15) which is filled with air inside and whereto the vibration pipe (10) is connected,
- a flexible barrier (16) which separates the first compartment (14) and the second compartment (15) from each other,
- a weight (17) which is located in the first compartment (14) and which, depending on the vibration of the tub (3), applies pressure to the flexible barrier (16) and which compresses the air located in the second compartment (15)

[0052] (Figure 3 and Figure 4).

[0053] The weight (17) moves together with the tub (3) and thus, makes a vibration movement on the flexible barrier (16) at the same frequency of the tub (3) vibration, which depends on the load in the drum (2).As a result of this movement, the air located in the second compartment (15) is compressed and moves towards the vibration pipe (10). Thus, in the situation wherein the valve (8) allows air flow from the vibration pipe (10) to the main pipe (7) and hence to the pressure sensor (6), the pressure change, which is created by the air compressed as a result of the vibration of the weight (17), is measured by the pressure sensor (6). Thus, the amount of the tub (3) vibration at that time, in other words, the unbalanced load amount is determined.

[0054] In an embodiment of the present invention, the weight (17) is produced from a solid material, for example, from wood or metal (Figure 3). In another embodiment of the present invention, the weight (17) is a fluid, for example, oil which fills the first compartment (14) (Figure 4).

[0055] In an embodiment of the present invention, the vibration transmitter (5) comprises

- a first transmitter (18) which is disposed at the front side in order to detect the vibration at the front side of the tub (3),
- a second transmitter (19) which is disposed at the rear side in order to detect the vibration at the rear side of the tub (3),
- a vibration pipe valve (22) which controls the air flow from the first transmitter (18) and the second transmitter (19) to the vibration pipe (10),
- a first pipe (20) which provides the connection between the first transmitter (18) and the vibration pipe valve (22), and
- a second pipe (21) which provides the connection between the second transmitter (19) and the vibration pipe valve (22)

[0056] (Figure 5).

[0057] Thus, as well as the determination of the unbalanced load amount, also the determination of the data that the load is at the front or at the back is possible. In this embodiment, during the spin-drying step, while the valve (8) is in the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet, the vibration pipe valve (22) is first brought to the position wherein it will open the first pipe (20) outlet and will close the second pipe (21) outlet, and the data of the vibration at the front side of the tub (3) is received from the first transmitter (18). Then, the vibration pipe valve (22) is brought to the position wherein it will close the first pipe (20) outlet and will open the second pipe (21) outlet and thus, this time, the data of the vibration at the rear side of the tub (3) is received from the second transmitter (19). By considering the difference between these two data, it is decided that the unbalanced load is at the front or at the back.

[0058] In the washing machine (1) of the present invention, the data relating both to the unbalanced load and to the water level is provided to be measured with high accuracy by using a single pressure sensor (6).

[0059] It is to be understood that the present invention is not limited to the embodiments disclosed above and a person skilled in the art can easily introduce different embodiments. These should be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A washing machine (1) **comprising** a drum (2) wherein the laundry is disposed, a tub (3) wherein the drum (2) moves, an air trap (4) wherein the air is compressed as the amount of water taken into the tub (3) increases, a vibration transmitter (5) which is disposed onto the tub (3) and wherein the air is compressed depending on the vibration of the tub (3), and a pressure sensor (6) which determines the amount of water inside the tub (3) by reading the pressure that is created by the air compressed in the air trap (4) and which determines the unbalanced load amount by reading the pressure that is created by the air compressed in the vibration transmitter (5), **characterized by**

   - a main pipe (7) which provides air to be transmitted to the pressure sensor (6),
   - a three-way valve (8) which is mounted to the inlet of the main pipe (7) and which controls the air input to the main pipe (7) and the air output therefrom,
   - an air trap pipe (9), the inlet of which is connected to the air trap (4) and the outlet of which is connected to the valve (8), and which provides the connection between the air trap (4) and the main pipe (7),

- a vibration pipe (10), the inlet of which is connected to the vibration transmitter (5) and the outlet of which is connected to the valve (8), and which provides the connection between the vibration transmitter (5) and the main pipe (7).

2. A washing machine (1) as in Claim 1, **characterized by** a counterweight (12) which is disposed onto the tub (3) in order to prevent the tub (3) from being displaced excessively, and by the vibration transmitter (5) which is disposed onto the counterweight (12).

3. A washing machine (1) as in Claim 1 or 2, wherein a washing algorithm, comprising water intake, washing, discharge and spin-drying steps, is applied.

4. A washing machine (1) as in any one of the above Claims, **characterized by** the three-way and three-position valve (8).

5. A washing machine (1) as in Claim 4, **characterized by** the valve (8) which, throughout the water intake and washing steps, is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet.

6. A washing machine (1) as in Claim 4 or 5, **characterized by** the valve (8) which, at the end of the washing step and before the discharge step, is brought to the position wherein it will open the vibration pipe (10) outlet and the air trap pipe (9) outlet, and will close the main pipe (7) inlet.

7. A washing machine (1) as in any one of the Claims 4 to 6, **characterized by** the valve (8) which, in the discharge step, is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet.

8. A washing machine (1) as in any one of the Claims 4 to 7, **characterized by** the valve (8) which, during the spin-drying step, is kept in the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet.

9. A washing machine (1) as in any one of the Claims 1 to 3, **characterized by** the three-way and two-position valve (8).

10. A washing machine (1) as in Claim 9, **characterized by** the valve (8) which, throughout the water intake and washing steps, is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet.

11. A washing machine (1) as in Claim 9 or 10, **characterized by** the valve (8) which, at the end of the washing step and before the discharge step, is brought to the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet.

12. A washing machine (1) as in any one of the Claims 9 to 11, **characterized by** the valve (8) which, in the discharge step, is kept in the position wherein it will close the vibration pipe (10) outlet, and will open the air trap pipe (9) outlet and the main pipe (7) inlet.

13. A washing machine (1) as in any one of the Claims 9 to 12, **characterized by** the valve (8) which, during the spin-drying step, is kept in the position wherein it will open the vibration pipe (10) outlet and the main pipe (7) inlet, and will close the air trap pipe (9) outlet.

14. A washing machine as in any one of the above Claims, **characterized by** the vibration transmitter (5) that comprises

- a box (13) having a first compartment (14), and a second compartment (15) which is filled with air inside and whereto the vibration pipe (10) is connected,
- a flexible barrier (16) which separates the first compartment (14) and the second compartment (15) from each other,
- a weight (17) which is located in the first compartment (14) and which, depending on the vibration of the tub (3), applies pressure to the flexible barrier (16) and which compresses the air located in the second compartment (15).

15. A washing machine (1) as in any one of the above Claims, **characterized by** the vibration transmitter (5) that comprises

- a first transmitter (18) which is disposed at the front side in order to detect the vibration at the front side of the tub (3),
- a second transmitter (19) which is disposed at the rear side in order to detect the vibration at the rear side of the tub (3),
- a vibration pipe valve (22) which controls the air flow from the first transmitter (18) and the second transmitter (19) to the vibration pipe (10),
- a first pipe (20) which provides the connection between the first transmitter (18) and the vibration pipe valve (22), and
- a second pipe (21) which provides the connection between the second transmitter (19) and the vibration pipe valve (22).

Patentansprüche

1. Waschmaschine (1), **umfassend** eine Trommel (2), in der die Wäsche angeordnet ist, einen Waschbehälter (3), in dem sich die Trommel (2) bewegt, eine Luftfalle (4), in der die Luft verdichtet wird, wenn die Menge des in den Waschbehälter (3) aufgenommenen Wassers zunimmt, einen Vibrationsgeber (5), der am Waschbehälter (3) angeordnet ist und in dem die Luft abhängig von der Vibration des Waschbehälters (3) verdichtet iwrd, und einen Drucksensor (6), der die Menge an Wasser im Waschbehälter (3) bestimmt, indem er den Druck misst, der von der Luft erzeugt wird, die in der Luftfalle (4) verdichtet ist, und der die Menge an unausgewogener Beladung bestimmt, indem er den Druck misst, der von der Luft erzeugt wird, die im Vibrationsgeber (5) verdichtet ist, **gekennzeichnet durch**

- ein Hauptrohr (7), das dafür sorgt, dass Luft an den Drucksensor (6) geleitet wird,
- ein Drehwegeventil (8), das am Einlass des Hauptrohres (7) angebracht ist und den Lufteinlass in das Hauptrohr (7) und den Luftauslass daraus steuert,
- ein Luftfallenrohr (9), dessen Einlass mit der Luftfalle (4) verbunden ist und dessen Auslass mit dem Ventil (8) verbunden ist, und das die Verbindung zwischen der Luftfalle (4) und dem Hauptrohr (7) bereitstellt,
- ein Vibrationsrohr (10), dessen Einlass mit dem Vibrationsgeber (5) verbunden ist und dessen Auslass mit dem Ventil (8) verbunden ist, und das die Verbindung zwischen dem Vibrationsgeber (5) und dem Hauptrohr (7) bereitstellt.

2. Waschmaschine (1) nach Anspruch 1, **gekennzeichnet durch** ein Gegengewicht (12), das am Waschbehälter (3) angeordnet ist, um zu verhindern, dass der Waschbehälter (3) übermäßig verschoben wird, und **durch** den Vibrationsgeber (5), der am Gegengewicht (12) angeordnet ist.

3. Waschmaschine (1) nach Anspruch 1 oder 2, wobei ein Waschalgorithmus angewandt wird, der Wasseraufnahme, Waschen, Ablassen und Schleudertrocknen umfasst.

4. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** das Dreiwege- und Dreipositionsventil (8).

5. Waschmaschine (1) nach Anspruch 4, **dadurch gekennzeichnet, dass** das Ventil (8) während des Wasseraufnahme- und des Waschschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) schließt und den Auslass des Luftfallenrohres (9) und den Einlass des Hauptrohres (7) öffnet.

6. Waschmaschine (1) nach Anspruch 4 oder 5, **dadurch gekennzeichnet, dass** das Ventil (8) am Ende des Waschschritts und vor dem Ablassschritt in diejenige Position gebracht wird, in der es den Auslass des Vibrationsrohres (10) und den Auslass des Luftfallenrohres (9) öffnet und den Einlass des Hauptrohres (7) schließt.

7. Waschmaschine (1) nach einem der Ansprüche 4 bis 6, **dadurch gekennzeichnet, dass** das Ventil (8) während des Ablassschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) schließt und den Auslass des Luftfallenrohres (9) und den Einlass des Hauptrohres (7) öffnet.

8. Waschmaschine (1) nach einem der Ansprüche 4 bis 7, **dadurch gekennzeichnet, dass** das Ventil (8) während

des Schleudertrocknungsschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) und den Einlass des Hauptrohres (7) öffnet und den Auslass des Luftfallenrohres (9) schließt.

9. Waschmaschine (1) nach einem der Ansprüche 1 bis 3, **gekennzeichnet durch** das Dreiwege- und Zweipositionsventil (8).

10. Waschmaschine (1) nach Anspruch 9, **dadurch gekennzeichnet, dass** das Ventil (8) während des Wasseraufnahme- und des Waschschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) schließt und den Auslass des Luftfallenrohres (9) und den Einlass des Hauptrohres (7) öffnet.

11. Waschmaschine (1) nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** das Ventil (8) am Ende des Waschschritts und vor dem Ablassschritt in diejenige Position gebracht wird, in der es den Auslass des Vibrationsrohres (10) und den Einlass des Hauptrohres (7) öffnet und den Auslass des Luftfallenrohres (9) schließt.

12. Waschmaschine (1) nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** das Ventil (8) während des Ablassschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) schließt und den Auslass des Luftfallenrohres (9) und den Einlass des Hauptrohres (7) öffnet.

13. Waschmaschine (1) nach einem der Ansprüche 9 bis 12, **dadurch gekennzeichnet, dass** das Ventil (8) während des Schleudertrocknungsschritts in derjenigen Position gelassen wird, in der es den Auslass des Vibrationsrohres (10) und den Einlass des Hauptrohres (7) öffnet und den Auslass des Luftfallenrohres (9) schließt.

14. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Vibrationsgeber (5) Folgendes umfasst:

- einen Kasten (13) mit einem ersten Fach (14) und einem zweiten Fach (15), das im Inneren mit Luft gefüllt ist und mit dem das Vibrationsrohr (10) verbunden ist,
- eine flexible Trennwand (16), die das erste Fach (14) und das zweite Fach (15) voneinander trennt,
- ein Gewicht (17), das im ersten Fach (14) angeordnet ist und das abhängig von der Vibration des Waschbehälters (3) Druck auf die flexible Trennwand (16) ausübt und die Luft im zweiten Fach (15) verdichtet.

15. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** der Vibrationsgeber (5) Folgendes umfasst:

- einen ersten Geber (18), der auf der Vorderseite angeordnet ist, um die Vibration auf der Vorderseite des Waschbehälters (3) zu erkennen,
- einen zweiten Geber (19), der auf der Rückseite angeordnet ist, um die Vibration auf der Rückseite des Waschbehälters (3) zu erkennen,
- ein Vibrationsrohrventil (22), das den Luftstrom vom ersten Geber (18) und zweiten Geber (19) zum Vibrationsrohr (10) steuert,
- ein erstes Rohr (20), das die Verbindung zwischen dem ersten Geber (18) und dem Vibrationsrohrventil (22) bereitstellt, und
- ein zweites Rohr (21), das die Verbindung zwischen dem zweiten Geber (19) und dem Vibrationsrohrventil (22) bereitstellt.

Revendications

1. Une machine à laver (1) **comprenant** un tambour (2) dans lequel le linge est placé, une cuve (3) dans laquelle le tambour (2) se déplace, un piège à air (4) dans lequel l'air est comprimé en tant que la quantité d'eau prise dans la cuve (3) augmente, un transmetteur de vibrations (5) qui est disposé sur la cuve (3) et où l'air est comprimé selon la vibration de la cuve (3), et un capteur de pression (6) qui détermine la quantité d'eau dans la cuve (3) en lisant la pression qui est générée par l'air comprimé dans le piège à air (4) et qui détermine la quantité de la charge déséquilibrée en lisant la pression qui est générée par l'air comprimé dans le transmetteur de vibrations (5), **caractérisée par**

- un tuyau principal (7) qui permet la transmission de l'air au capteur de pression (6),
- une vanne à trois voies (8) qui est montée à l'entrée du tuyau principal (7) et qui commande l'entrée de l'air

au tuyau principal (7) et la sortie de l'air de celui-ci,
- un tuyau de piège à air (9), dont l'entrée est reliée au piège à air (4) et dont la sortie est reliée à la vanne (8), et qui permet le raccordement entre le piège à air (4) et le tuyau principal (7),
- un tuyau de vibration (10), dont l'entrée est reliée au transmetteur de vibrations (5) et dont la sortie est reliée à la vanne (8), et qui permet le raccordement entre le transmetteur de vibrations (5) et le tuyau principal (7).

2. Une machine à laver (1) selon la Revendication 1, **caractérisée par** un contrepoids (12) qui est disposé sur la cuve (3) afin d'empêcher la cuve (3) de se déplacer de manière excessive, et **par** le transmetteur de vibrations (5) qui est disposé sur le contrepoids (12).

3. Une machine à laver (1) selon la Revendication 1 ou 2, où un algorithme de lavage qui comprend des étapes de prise d'eau, de lavage, d'évacuation et d'essorage est réalisé.

4. Une machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** la vanne à trois voies et trois positions (8).

5. Une machine à laver (1) selon la Revendication 4, **caractérisée par** la vanne (8) qui, tout au long des étapes de prise d'eau et de lavage, est maintenue dans la position où elle ferme la sortie du tuyau de vibration (10) et ouvre la sortie du tuyau de piège à air (9) et l'entrée du tuyau principal (7).

6. Une machine à laver (1) selon la Revendication 4 ou 5, **caractérisée par** la vanne (8) qui, à la fin de l'étape de lavage et avant l'étape d'évacuation, est amenée à la position où elle ouvre la sortie du tuyau de vibration (10) et la sortie du tuyau de piège à air (9) et ferme l'entrée du tuyau principal (7).

7. Une machine à laver (1) selon l'une quelconque des revendications de 4 à 6, **caractérisée par** la vanne (8) qui, dans l'étape d'évacuation, est maintenue dans la position où elle ferme la sortie du tuyau de vibration (10) et ouvre la sortie du tuyau de piège à air (9) et l'entrée du tuyau principal (7).

8. Une machine à laver (1) selon l'une quelconque des revendications de 4 à 7, **caractérisée par** la vanne (8) qui, pendant l'étape d'essorage, est maintenue dans la position où elle ouvre la sortie du tuyau de vibration (10) et l'entrée du tuyau principal (7) et ferme la sortie du tuyau de piège à air (9).

9. Une machine à laver (1) selon l'une quelconque des revendications de 1 à 3, **caractérisée par** la vanne à trois voies et deux positions (8).

10. Une machine à laver (1) selon la Revendication 9, **caractérisée par** la vanne (8) qui, tout au long des étapes de prise d'eau et de lavage, est maintenue dans la position où elle ferme la sortie du tuyau de vibration (10) et ouvre la sortie du tuyau de piège à air (9) et l'entrée du tuyau principal (7).

11. Une machine à laver (1) selon la Revendication 9 ou 10, **caractérisée par** la vanne (8) qui, à la fin de l'étape de lavage et avant l'étape d'évacuation, est amenée à la position où elle ouvre la sortie du tuyau de vibration (10) et l'entrée du tuyau principal (7) et ferme la sortie du tuyau de piège à air (9).

12. Une machine à laver (1) selon l'une quelconque des revendications de 9 à 11, **caractérisée par** la vanne (8) qui, dans l'étape d'évacuation, est maintenue dans la position où elle ferme la sortie du tuyau de vibration (10) et ouvre la sortie du tuyau de piège à air (9) et l'entrée du tuyau principal (7).

13. Une machine à laver (1) selon l'une quelconque des revendications de 9 à 12, **caractérisée par** la vanne (8) qui, pendant l'étape d'essorage, est maintenue dans la position où elle ouvre la sortie du tuyau de vibration (10) et l'entrée du tuyau principal (7) et ferme la sortie du tuyau de piège à air (9).

14. Une machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** le transmetteur de vibrations (5) qui comprend

- une boîte (13) ayant un premier compartiment (14), et un second compartiment (15), qui est remplie d'air et à laquelle le tuyau de vibration (10) est relié,
- une barrière flexible (16) qui sépare le premier compartiment (14) et le second compartiment (15) l'un de l'autre,
- un poids (17) qui est situé dans le premier compartiment (14) et qui, selon la vibration de la cuve (3), applique

une pression à la barrière flexible (16) et qui comprime l'air situé dans le second compartiment (15).

15. Une machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** le transmetteur de vibrations (5) qui comprend

- un premier transmetteur (18) qui est placé au côté avant afin de détecter la vibration au côté avant de la cuve (3),
- un second transmetteur (19) qui est placé au côté arrière afin de détecter la vibration au côté arrière de la cuve (3),
- une vanne de tuyau de vibration (22) qui commande l'écoulement d'air à partir du premier transmetteur (18) et second transmetteur (19) au tuyau de vibration (10),
- un premier tuyau (20) qui permet le raccordement entre le premier transmetteur (18) et la vanne de tuyau de vibration (22), et
- un second tuyau (21) qui permet le raccordement entre le second transmetteur (19) et la vanne de tuyau de vibration (22).

Figure 1

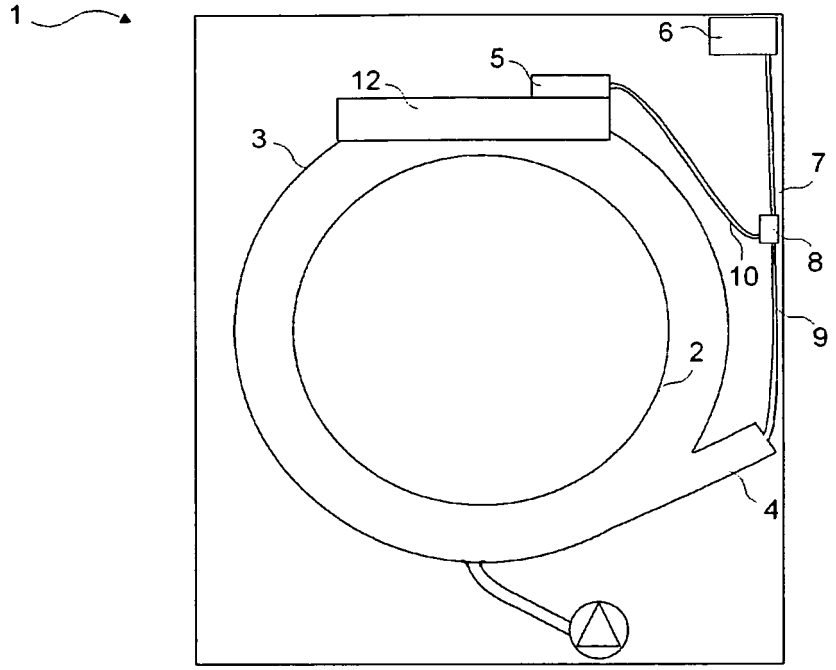


Figure 2

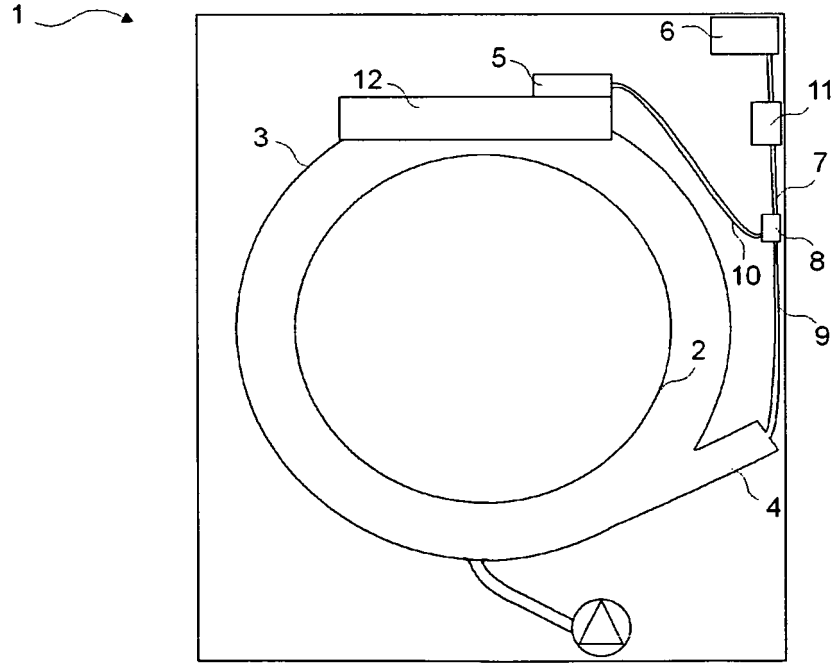


Figure 3

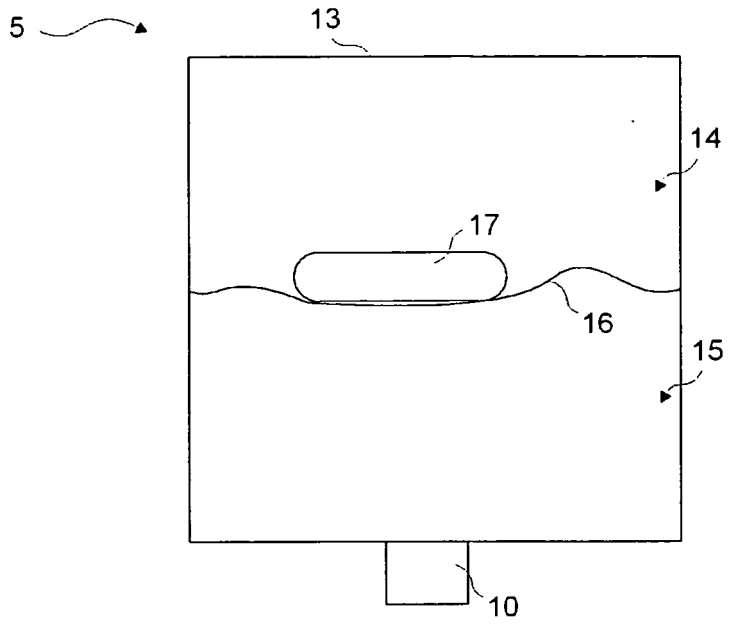


Figure 4

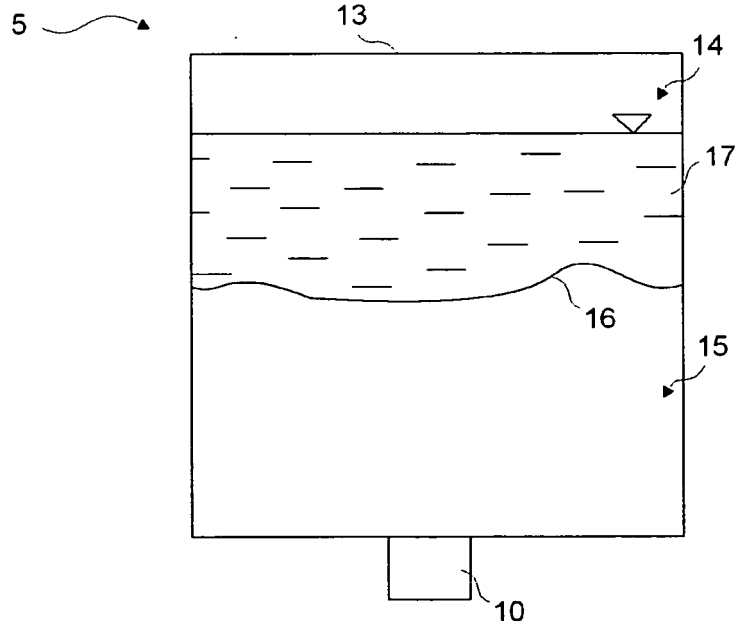
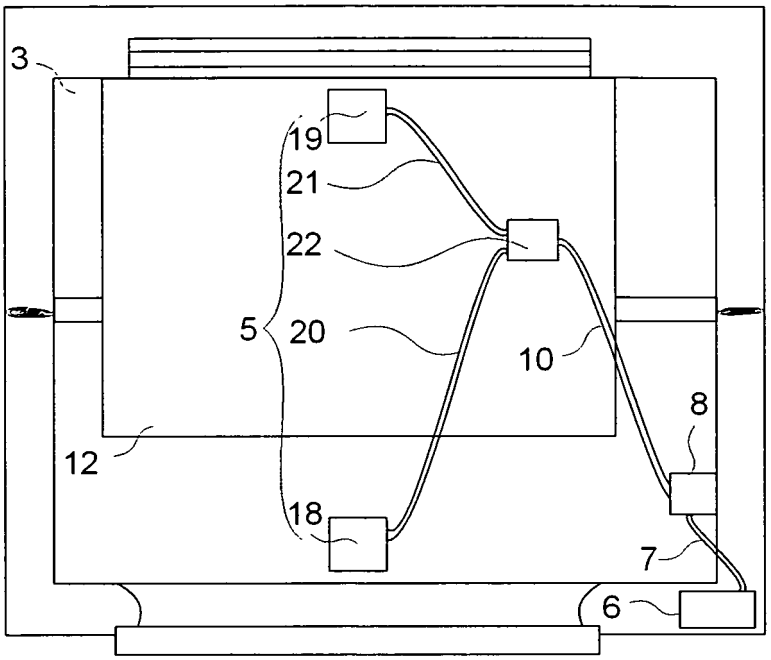


Figure 5



REFERENCES CITED IN THE DESCRIPTION

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