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- **Bombardieri, Giovanni**
24021 Albino (BG) (IT)
- **La Bella, Savio**
60044 Fabriano (AN) (IT)
- **Cesari, Luca**
62024 Matelica (MC) (IT)

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(71) Applicant: **Indesit Company S.p.A.**
60044 Fabriano (AN) (IT)

(74) Representative: **Paolizzi, Marco**
C/o Bugnion S.p.A.
Via A. Valentini, 11/15
47900 Rimini (IT)

(72) Inventors:
• **Mariotti, Costantino**
06028 Sigillo (PG) (IT)

(54) **Washing appliance**

(57) A washing appliance that uses a washing liquid comprises: a washing tank (2) suitable for containing the washing liquid used for the washing treatment; a pipe (3) for draining out the washing liquid and in fluid communication with the washing tank (2); a drainage pump (6) operatively connected to the drainage pipe (3); means (4) for detecting a free surface level of a column of the washing liquid, said column being located immediately upstream of the drainage pump (6) relative to the direction in which the washing liquid flows out of the washing tank (2) during its drainage. The washing appliance 1 comprises means (5), operatively connected to the detecting means (4), for controlling the drainage pump (6), said means (4) detecting a first condition where the water level is less than or equal to a first predetermined level. At least during a predetermined part of the washing cycle, if the drainage pump (6) is in operation, the control means (5) inhibit the operation of the drainage pump (6) upon occurrence of the first condition sensed by the detecting means (4).

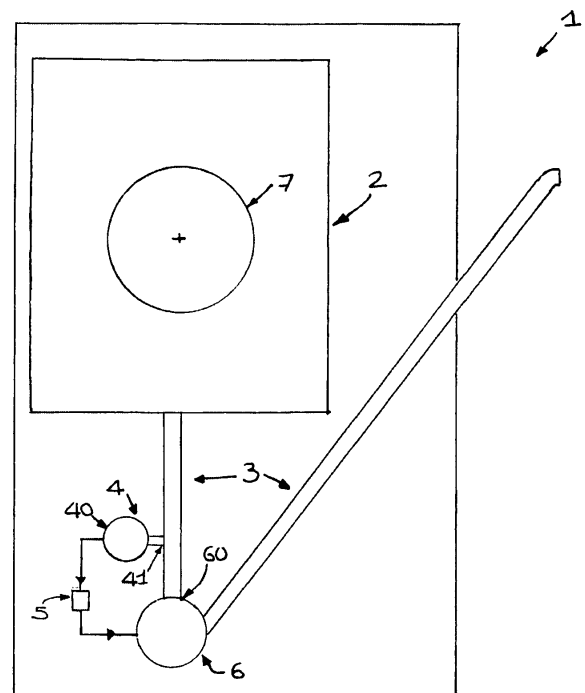


Fig. 1

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Description

[0001] This invention relates to a washing appliance, in particular a washing appliance equipped with a system designed to prevent noise from being produced by the drainage pump under certain working conditions.

[0002] Washing appliances comprise electrical appliances such as, for example:

- laundry washers for washing clothes, bed sheets, etc.;
- dishwashers for washing dishes, cutlery, pans, etc.

[0003] In particular, washing appliances called "laundry washers" are suitable for carrying out at least a washing treatment on textile articles made of any fibre or in any colour and include machines known as "washing machines" and machines known as "washer dryers", if in addition to washing they also carry out at least a treatment for drying textile articles.

[0004] There are washing machines comprising a washing tank with a drum in which the laundry to be washed is placed. A pipe for draining the washing tank extends from the washing tank. The drainage pipe is connected to a drainage pump through which the washing water from the washing tank is pumped. After the main washing treatment and after each rinse, the washing water used is drained out of the tank. To enable the washing water to be drained out of the washing machine, an electronic circuit board activates the drainage pump for a preset length of time.

[0005] This causes some disadvantages, however.

[0006] When the suction inlet of the drainage pump is no longer fully occupied by water, the pump begins sucking in air together with the remaining water, producing an unpleasant noise.

[0007] To this must be added the noise produced by the small quantity of washing water that remains trapped in the drainage pump delivery pipe and which moves up and down the pipe under the action of the pump itself.

[0008] This invention has for an aim to overcome the above mentioned disadvantages by providing a washing appliance which prevents the drainage pump from producing unpleasant noise under certain working conditions.

[0009] Another aim of the invention is to provide a washing tank that optimizes the operation of some of the components of the washing appliance.

[0010] A further aim of the invention is to provide a washing appliance that reduces power consumption.

[0011] A yet further aim of the invention is to provide a washing appliance that allows the above aims to be achieved with only minor modifications to the basic structure of prior art washers.

[0012] These aims and others, which are more apparent in the description which follows, are achieved, in accordance with the present invention, by a washing appliance with the structural and functional features described

in the independent claims herein. Alternative embodiments of the appliance are described in the dependent claims.

[0013] The invention will now be described in more detail with reference to the accompanying drawing, which illustrates a non-limiting preferred embodiment of it.

[0014] Figure 1 is a schematic view of a washer according to this invention.

[0015] With reference to Figure 1, the numeral 1 denotes a washing appliance that uses a washing liquid. The washing liquid usually consists of a mixture of water and cleaning agents such as detergents and other washing aids (bleach, fabric softener, etc).

[0016] The washing appliance 1 may be one of several different kinds of machine but in the preferred embodiment it is a laundry washer or a dishwasher. The washing appliance 1 is designed preferably for household use.

[0017] The washing appliance 1 comprises a washing tank 2 suitable for containing the washing liquid used for the washing treatment. Inside the washing tank 2, the washing appliance 1 also comprises means 7 for containing the articles to be washed, said containing means 7 defining at least a space for accommodating the articles to be washed. In Figure 1, for example, which schematically illustrates a laundry washer without limiting the scope of the invention, the containing means 7 comprise a rotary drum in which the laundry to be washed is placed. Similarly, in the case of a dishwasher, the containing means 7 comprise one or more racks which can usually be pulled out by means of suitable carriages.

[0018] The washing appliance 1 also comprises:

- a pipe 3 for draining out the washing liquid and in fluid communication with the washing tank 2;
- a drainage pump 6 operatively connected to the drainage pipe 3;
- means 4 for detecting a free surface level of a column of the washing liquid. The column is located immediately upstream of the drainage pump 6 relative to the direction in which the washing liquid flows out of the washing tank 2 during its drainage. The column is preferably inside the drainage pipe 3 and may also extend inside the washing tank 2.

[0019] The drainage pipe 3 advantageously extends from the bottom portion of the washing tank 2; during drainage, the washing liquid flows out through the drainage pipe 3 under the action of the drainage pump 6.

[0020] The drainage pump 6 normally used is a centrifugal pump. The drainage pump 6 is suitably mounted on the drainage pipe 3 and is designed in such a way that the washing liquid flows through it during its operation. Usually, the drainage pipe 3 extends both upstream and downstream of the drainage pump 6.

[0021] The washing appliance 1 comprises means 5, operatively connected to the detecting means 4, for controlling the drainage pump 6. The detecting means 4 detect a first condition where the water level is less than or

equal to a first predetermined level.

[0022] At least during a predetermined part of the washing cycle, if the drainage pump 6 is in operation, the control means 5 inhibit the operation of the drainage pump 6 upon occurrence of the first condition sensed by the detecting means 4. Appropriately, the detecting means 4 apply a first condition detected signal to the control means 5, either directly or indirectly. Advantageously, the detecting means 4 sense the level of the free surface of the column and compare it with a predetermined reference level. The predetermined reference level is below the level of the free surface of the column and, in particular, is located below the first predetermined level.

[0023] In the preferred embodiment, during the entire washing cycle, if the drainage pump 6 is in operation, the control means 5 inhibit the operation of the drainage pump 6 upon occurrence of the first condition.

[0024] In this case, the predetermined part of the washing cycle in which the detecting means 4 inhibit the operation of the drainage pump 6 upon occurrence of the first condition coincides with the entire duration of the washing cycle. By washing cycle is meant the pre-wash step, if any, the rinse step, if any, and the main wash step in their entirety.

[0025] Alternatively, in another embodiment, the predetermined part of the washing cycle in which the control means 5 inhibit the operation of the drainage pump 6 might not include the final step of draining the washing liquid, this step being usually associated with the final rinse. That is because, in the final drainage step, to enable as much washing liquid as possible to be drained out, it may be necessary to set the timer of the drainage pump 6 so that the pump operates for a slightly extended length of time.

[0026] In the first condition, the washing liquid constitutes a liquid barrier to the air inside the drainage pipe 3. The barrier is at least partly upstream of the drainage pump 6 relative to the direction in which the washing liquid flows out of the washing tank 2 during its drainage. The barrier obstructs at least a full section of the drainage pipe 3 upstream of the drainage pump 6 and thereby prevents the drainage pump 6 from sucking in air, in addition to the washing liquid, from the washing tank 2.

[0027] Also in this regard, the washing appliance 1 comprises an interface connecting a suction zone 60 of the pump 6 to the drainage pipe 3, said interface being fully immersed in the washing liquid when the first predetermined level occurs.

[0028] The first predetermined level of the free surface is between 0 and 30 mm above a minimum level necessary for the interface to be fully immersed in the washing liquid. Preferably, the first predetermined level is preset at a level of the free surface of around 20 mm above the minimum level necessary for the interface to be fully immersed in the washing liquid. This provides a good safety margin and minimizes the risk of the drainage pump 6 sucking in air together with the washing liquid.

[0029] During a predetermined part of the washing cycle, the control means 5 start the drainage pump 6 upon occurrence of a predetermined second condition after the first condition, the occurrence of the second condition being sensed by the detecting means 4; the detecting means 4 appropriately applying a second condition detected signal to the control means 5, either directly or indirectly. Just before the predetermined second condition occurs, the level of the washing liquid column upstream of the drainage pump 6 is on the rise. In the predetermined second condition, the level of the free surface is greater than or equal to a second predetermined level, which is greater than the first predetermined level and smaller than any other level such that the space that accommodates the articles to be washed would be at least partly immersed in the washing liquid to be drained out. The occurrence of the second condition is typical of a laundry washer but is not usual in dishwashers. That is because in laundry washers, during the step in which the drainage pump is in operation or after the occurrence of the first condition, there may be a spin-drying step during which more washing liquid may accumulate at the bottom of the washing tank 2, which must be disposed of and which must not come into contact with the articles in the drum again. It is also important that the drum be free to rotate without coming into contact with the washing liquid to be drained out from the washing tank 2: given the high rotation speeds of the drum, this is particularly true during spin-drying also to prevent noise from being produced.

[0030] The second predetermined level is between 1 and 20 mm below the level in which the washing liquid reaches the space of the containing means 7 where the articles to be washed are placed. Preferably, the second predetermined level is preset at a level of the free surface of around 15 mm below the level in which the washing liquid reaches the space of the containing means 7 where the articles to be washed are placed. This prevents the washing liquid at the bottom of the washing tank from coming into contact with the articles to be washed in the containing means 7. When the washing liquid is being fed into the washing tank 2 through the inlet valve, the control means 5 are inhibited. Thus, the drainage pump 6 is not activated at the wrong time for example when the washing liquid must not be drained out.

[0031] Advantageously, the detecting means 4 comprise a pressure sensor 40.

[0032] Advantageously, the pressure sensor 40 can continuously measure the level of the free surface of the washing liquid with respect to the reference level located below the free surface. The pressure sensor 40 comprises what in the trade is commonly known as "linear pressure switch".

[0033] The pressure sensor 40 also makes it possible to control the washing liquid level during the step of feeding the washing liquid into the washing tank 2 and/or provides prior warning of the risk of the washing liquid overflowing from the washing tank 2. The use of a pressure sensor 40 that continuously measures the level of the

free surface is highly advantageous and makes it unnecessary to fit an additional bistable pressure switch. Bistable pressure switches are normally used in traditional washing machines to control the level of washing liquid during the feeding of washing liquid into the washing tank 2.

[0034] The pressure sensor 40 that continuously measures the level of the free surface comprises a measuring point 41 located upstream of the drainage pump 6 relative to the direction in which the washing liquid flows out of the washing tank 2 during its drainage. When the first predetermined level occurs, the measuring point 41 is fully immersed in the washing liquid column. Advantageously, the above mentioned predetermined reference level is at the same level as the measuring point 41.

[0035] As illustrated by way of non limiting example in Figure 1, the measuring point 41 is made on the drainage pipe 3.

[0036] The pressure sensor 40 that continuously measures the level of the free surface associates a specific command with the detection of each of at least four predetermined levels that occur during the normal and correct operation of the washing appliance: the occurrence of the first and second predetermined level during a predetermined part of the washing cycle is associated, respectively, with the starting and stopping of the drainage pump 6; the occurrence of a third and fourth predetermined level during a predetermined part of the washing cycle respectively enables and inhibits the feeding of the washing liquid into the washing tank 2. The occurrence of the third predetermined level while the washing liquid is being drained out does not start washing liquid feed. Similarly, the occurrence of the second predetermined level while the washing liquid is being fed into the washing tank 2 out does not start the drainage pump 6. By way of non-limiting example, the first, second, third and fourth levels might be associated with a height of the free surface of the washing liquid column of 15mm, 30mm, 60mm and 90mm from the measuring point 41, respectively. If necessary, the pressure sensor 40 might also be used to detect a fifth level indicating a fault or excessively high level of washing liquid in the washing tank 2. The fifth level is normally associated with counteractions such as immediate activation of the drainage pump 6 to prevent the water from overflowing from the washing tank.

[0037] The operation of the washing appliance 1 during use may be described very briefly by way of example as follows: after washing and/or a rinsing step, the drainage pump 6 is started in order to drain out the washing liquid. Upon occurrence of the first condition, the detecting means 4 stop the drainage pump 6. In the case of a laundry washer, this step is usually followed by a spin-drying step during which a certain amount of washing liquid is released by the washed laundry and settles at the bottom of the washing tank 2: as a result, the washing liquid level in the washing tank 2 rises. When the detecting means 4 sense that the washing liquid in the washing tank 2 has

reached a predetermined level associated with a second condition, the drainage pump is started again to drain out the washing liquid that has accumulated.

[0038] The invention brings important advantages.

5 [0039] First of all, it minimizes the noise produced by the drainage pump under certain working conditions.

[0040] Secondly, it allows the drainage pump to be used only when its use is necessary. Thus, besides reducing power consumption, it reduces pump wear and hence extends pump life.

10 [0041] The invention can be modified and adapted in several ways without thereby departing from the scope of the inventive concept.

[0042] Moreover, all details of the invention may be substituted by other technically equivalent elements.

15 [0043] In practice, the embodiments of the invention may be made from any material, and in any size, depending on requirements.

Claims

1. A washing appliance that uses a washing liquid, comprising:

- a washing tank (2) suitable for containing the washing liquid used for a washing treatment;
- a pipe (3) for draining out the washing liquid and in fluid communication with the washing tank (2);
- a drainage pump (6) operatively connected to the drainage pipe (3);
- means (4) for detecting a free surface level of a column of the washing liquid, said column being located immediately upstream of the drainage pump (6) relative to the direction in which the washing liquid flows out of the washing tank (2) during its drainage;

the washing appliance being **characterized in that** it comprises means (5), operatively connected to the detecting means (4), for controlling the drainage pump (6), said detecting means (4) detecting a first condition where the water level is less than or equal to a first predetermined level; and

characterized in that at least during a predetermined part of the washing cycle, if the drainage pump (6) is in operation, the control means (5) inhibit the operation of the drainage pump (6) upon occurrence of the first condition sensed by the detecting means (4).

2. The washing appliance according to claim 1, **characterized in that** during the entire washing cycle, if the drainage pump (6) is in operation, the control means (5) inhibit the operation of the drainage pump (6) upon occurrence of the first condition sensed by the detecting means (4).

3. The washing appliance according to claim 1 or 2, **characterized in that** in the first condition, the washing liquid constitutes a liquid barrier to the air inside the drainage pipe (3), the barrier being at least partly upstream of the drainage pump (6) relative to the direction in which the washing liquid flows out of the washing tank (2) during its drainage.
4. The washing appliance according to any of the foregoing claims, **characterized in that** it comprises an interface connecting a suction zone (60) of the pump (6) to the drainage pipe (3), said interface being fully immersed in the washing liquid when the first predetermined level of the free surface of the washing liquid column occurs.
5. The washing appliance according to claim 4, **characterized in that** the first predetermined level of the free surface is between 0 e 20 mm above a minimum level necessary for the interface to be fully immersed in the washing liquid.
6. The washing appliance according to any of the foregoing claims, **characterized in that**, inside the washing tank (2), it comprises means (7) for containing the articles to be washed, said containing means (7) defining at least a space for accommodating the articles to be washed, and **characterized in that** during a predetermined part of the washing cycle, the control means (5) start the drainage pump (6) upon occurrence of a predetermined second condition after the first condition, the occurrence of the second condition being sensed by the detecting means (4); just before the predetermined second condition occurs, the level of the washing liquid column upstream of the drainage pump (6) being on the rise, in the second condition, the level of the free surface being greater than or equal to a second predetermined level, said second predetermined level being greater than the first predetermined level and smaller than any other level such that the space that accommodates the articles to be washed would be at least partly immersed in the washing liquid to be drained out.
7. The washing appliance according to claim 6, **characterised in that** the second predetermined level of the free surface is between 1 and 20 mm below the level in which the washing liquid reaches the space of the containing means (7) where the articles to be washed are placed.
8. The washing appliance according to any of the foregoing claims, **characterised in that** the detecting means (4) comprise a pressure sensor (40).
9. The washing appliance according to claim 8, **characterized in that** the pressure sensor (40) can continuously measure the level of the free surface of the washing liquid with respect to a predetermined reference level located below the free surface.
10. The washing appliance according to claim 8 or 9, **characterized in that** the pressure sensor (40) also makes it possible to control the washing liquid level during the step of feeding the washing liquid into the washing tank (2) and/or provides prior warning of the risk of the washing liquid overflowing from the washing tank (2).
11. The washing appliance according to any of the foregoing claims from 8 to 10, **characterized in that** the pressure sensor (40) comprises a measuring point (41) located upstream of the drainage pump (6) relative to the direction in which the washing liquid flows out of the washing tank (2) during its drainage, the measuring point (41) being fully immersed in the washing liquid column in the first condition.
12. The washing appliance according to claim 11, **characterised in that** the measuring point (41) is made on the drainage pipe (3).

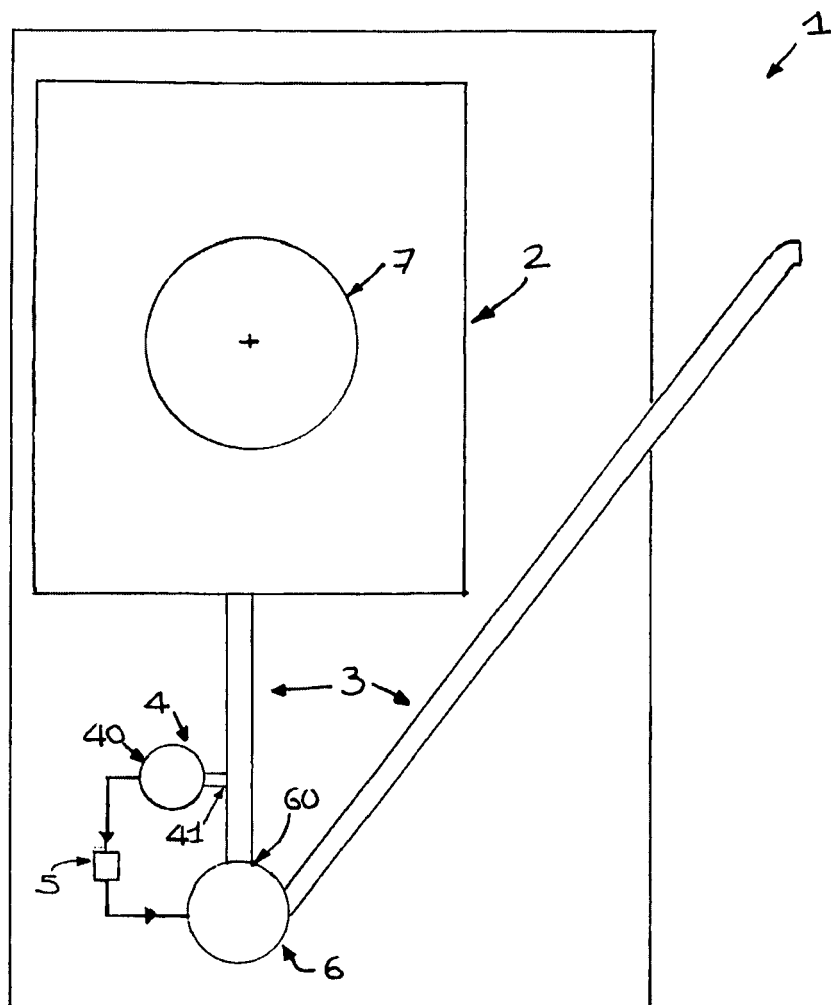


Fig. 1