(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 677 609 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **95105006.1**

(51) Int. Cl.[6] : **D06F 39/08**

(22) Date of filing : **04.04.95**

(30) Priority : **15.04.94 IT TO940295**

(43) Date of publication of application :
18.10.95 Bulletin 95/42

(84) Designated Contracting States :
DE ES FR GB IT

(71) Applicant : **MERLONI ELETTRODOMESTICI S.p.A.**
Viale Aristide Merloni, 45
I-60044 Fabriano (AN) (IT)

(72) Inventor : **Lattanzi, Giuseppe**
Via Marischio 20/F
I-60044 Fabriano (AN) (IT)
Inventor : **Mariotti, Constantino**
Via Ermanno Caserta 4
I-06028 Sigillo (PG) (IT)

(54) Method for the detergent recirculation in a washing machine.

(57) A method for re-circulating detergents in a laundry washing machine (1) comprising a washing tub (2), a basket (3) which rotates in said tub around a substantially horizontal axis, a drainage duct (4) of the washing liquid, having a mouth (4a) in proximity to the bottom of said tub (2), during the functioning of the machine which provides for at least one washing phase with the presence of liquid and detergents inside said tub (2), in said phase the basket (3) is placed in rotation at a determined washing speed (55 rpm). The main characteristic of the described method consists in that, with the aim of recovering the detergents gathered in said drainage duct (4), during said washing phase the passage to at least one brief spinning phase is provided, i.e. a rotating phase of the basket at a substantially higher speed (400 rpm) respect said determined washing speed (55 rpm), during said brief spinning phase part of the liquid is made to pass through an auxiliary duct (6) by way of its first extremity (8), in communication with said drainage duct (4), to its second extremity (6a), in communication with the inside of said tub (2) and arranged above the level (7) of the liquid in the tub (2) during the wash.

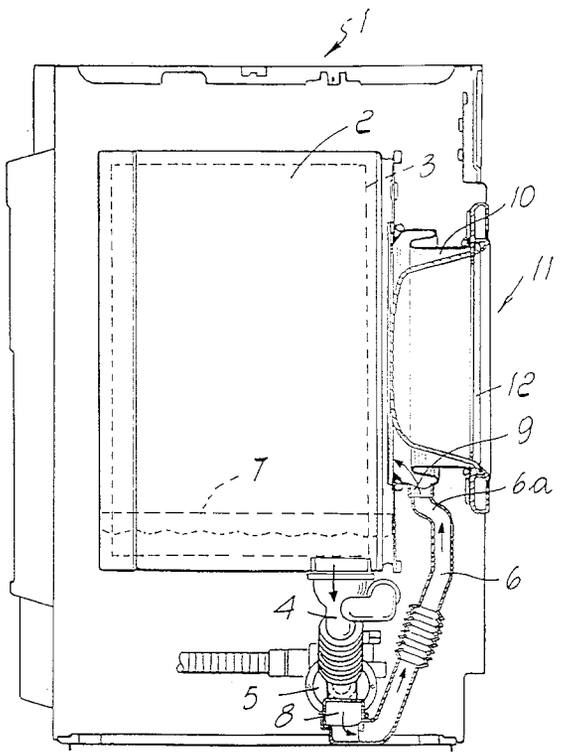

Fig. 4

EP 0 677 609 A2

The present invention has as its subject a detergent re-circulation method in a laundry washing machine, and a laundry washing machine implementing such method.

As is known, a problem particularly felt in the field of laundry washing machines is that of obtaining a satisfactory exploitation of the detergents during the wash. In fact, part of the detergents, be it powder or liquid, introduced to the washing tub deposits in the drainage duct, the mouth of which is defined in the bottom of the tub, and remains practically unused.

For overcoming this problem laundry washing machines have been realised that, before introducing the detergents to the washing tub, charge a quantity of water of such to fill the drainage duct, so as to impede the depositing of the detergents in such duct.

In other types of machines, an organ is provided, that blocks such duct during the introduction of detergents to the tub and during the wash.

In other types of machines, during the wash a natural or forced flow of water is generated, by way of appropriate ducts, that causes a re-circulation in the tub of the water and detergents contained in the drainage duct.

Such types of machine have several drawbacks.

More in particular, in the machines which carry out a pre-charge of water, a poor level of efficiency is reached in preventing the downflow of a large part of the detergents in the drainage duct.

In the machines equipped valve organs arranged in correspondence with the mouth of the drainage duct difficulties are met in realising a good seal in the closure of the mouth of the drainage duct.

Moreover, in these machines additional components are necessary for the activation of the valve organ in function of the various washing phases, with consequent increases in production costs.

High production costs are also the result in machines that carry out a forced re-circulation of the water and the detergents contained in the drainage duct, due to the fact that the use of an additional pump is then necessary, and ducts and components for its mounting and operation. In this case, moreover, the presence of a greater number of components increases the maintenance costs of the machine, in that the possibilities of breakdowns is increased.

Several drawbacks are also met in the machines that are realised for obtaining a natural re-circulation of the washing liquid contained in the drainage duct. In these machines, in fact, an auxiliary duct is provided that has a mouth connected with the interior of the washing tub and being arranged at a higher level than the static level of the water in the tub, and with an outlet in the drainage duct so as to exploit, for the re-circulation, the water head that is created when the basket is made to rotate.

In machines that have a very low static water level in the tub the difficulty is met of re-circulating the water along the auxiliary duct. In fact, as the mouth of the auxiliary duct is arranged in proximity with the bottom of the tub, a dragging of the detergents along the auxiliary duct may take place with the consequence of conveying other detergents in the drainage duct thus reducing the efficiency of removing the detergents from the said drainage duct.

Furthermore, for small quantities of laundry, the level reached by the washing liquid during the wash may result in being lower than the auxiliary duct, with the consequence of not obtaining the desired re-circulation.

The main aim of the present invention is that of overcoming the aforementioned drawbacks realising a laundry washing machine with a method and device for re-circulating detergents that allows for a efficient exploitation of the detergents introduced to the washing tub.

Within the scope of such aim, a purpose of the invention is that of realising a machine that obtains an efficient re-circulation of the detergents practically without increasing the production costs of the machine, in particular without the necessity of additional pumps for its functioning.

This purpose, and these and other aims that shall appear clear in the following, are reached by a detergents re-circulation method, and a laundry washing machine, incorporating the characteristics of the enclosed claims.

Further characteristics and advantages of the invention shall result in being clear from the description of a preferred, but not exclusive, embodiment of the laundry washing machine with device and method of re-circulating detergents according to the invention, illustrated as an explanatory and non-limiting example, wherein:

- figure 1 is a partially sectioned schematic side elevation of a laundry washing machine according to the invention, in a first functional condition;
- figure 2 is a schematic enlarged front elevation of the re-circulation device of the laundry washing machine illustrated in figure 1;
- figure 3 schematically represents in the form of a diagram the state of the rotational speed of the basket during a functional phase of the machine according to the invention;
- figure 4 is a partially sectioned schematic side elevation of a laundry washing machine according to the invention, in a second functional condition.

With reference to figures 1, 2 and 4, the laundry washing machine with re-circulation device of the detergents according to the invention, indicated as a whole with reference number 1, comprises in the known way, a washing tub 2 within which a washing basket 3 is housed, of a horizontal axis, which is actionable with a rotary motion around such axis.

In proximity of the bottom of the tub 2, the mouth of the drainage duct 4 is defined, that enters the intake zone of a pump 5, of the known type, which is actuated when the washing cycle provides for a partial or complete emptying of the tub.

According to the invention an auxiliary duct 6 is also provided, the first extremity 6a of which communicates with the interior of the tub 2 and arranged above the level 7 reached by the water during the wash due to the effect of the rotation of the basket 3.

The second extremity of the auxiliary duct 6 on the other hand joins the drainage duct 4, upstream from the pump 5: advantageously on the drainage duct 4 a union sump 8 is provided, which further lowers the level of drainage duct 4, and the second extremity of the auxiliary duct joins in proximity of the bottom of said union sump 8.

Appropriately, the first extremity 6a of the auxiliary duct 6 is water tightly connected to a passage 9, defined in a lower zone of the seal 10 that connects the tub to the loading opening 11 of the machine, in which a loading door 12 is arranged in the known way.

The machine also provides for a programming device, or timer, that supervises the operations of the various washing cycles that can be selected by the user of the machine; such device has not been represented in the figures for reasons of simplicity, inasmuch that it is known.

The functioning of the laundry washing machine with device for the re-circulation of detergents according to the invention is the following.

The user, after having loaded the laundry to be washed in the basket 3, through the door 12, selects the desired washing cycle and starts the machine.

At an appropriate moment of such cycle, the programming device of the machine controls the introduction of the water to the tub 2, at the beginning of a washing phase in the strict sense; in practice, during such phase, the washing water coming from the mains is made to pass through an appropriate dispensing device, in itself known and therefore not represented in the figures, so as to transport the detergents to the washing tub 2; the water in the tub is heated by way of appropriate resistences, upon a command of the programmer of the machine, to a suitable temperature to fit the needs, for instance 60°.

During the washing phase, the basket 3 is made to rotate at a determined speed, for instance in the order of 55 rpm, under control of the programming device; the mechanical rotational action of the basket (which produces the movement of the laundry), together with the chemical action (determined by the presence of detergents) and thermal action (water temperature) allows for obtaining the washing of the laundry.

As according to the known art, in this phase, part of the detergents introduced to the tub, not dissolved, tend to fall into the duct (4) of the drainage pump, with the risk of remaining unused.

According to the invention, such detergents are collected in the union sump 8: from such sump 8, a substantial part of the collected detergents is re-circulated during the rotation of the basket at 55 rpm, i.e. at the normal speed provided for the washing phase in the strict sense of the word.

In particular, the rotation of the basket 3, provided with the presence of laundry contained within, projects part of the washing liquid contained in the tub 2 against the internal wall of the tub and towards the loading door 12, that as seen from figure 1, extends in the direction of the tub 2 and towards the interior of the basket.

The liquid that is projected against the loading door 12, descends along its surface, gathers in the lower zone of the seal 10, where the mouth 6a of the auxiliary duct 6 is defined: in this way, due to the difference of levels which is created between the liquid contained in the auxiliary duct 6 and the liquid in the tub 2, a flow from the auxiliary duct 6 towards the union sump and from this to the tub is generated. Such flow causes, during the washing phase at 55 rpm, a gradual return to the tub 2 of part of the detergents that had deposited in the drainage duct 4 and in the union sump 8.

Such functional situation is in fact illustrated in figure 1, where the arrows inside ducts 4 and 6 indicate the flow that causes the return of a consistent part of the detergents from the sump 8 to the interior of the washing tub 2.

Advantageously, the quantity of washing liquid projected towards the loading door 12 can be increased by using a basket provided in the the known way with spoons or sacks 19 on its interior surface obtained on the projecting ridges 20 for the movement of the laundry (figure 2), that collect the liquid from the bottom of the tub and project it from above on the laundry below.

This re-circulation of the liquid is not however sufficient in bringing all the detergents accumulated in the zone of the drainage duct 4 back to the tub: therefore the present invention is based on the acknowledgement of the fact that with a brief spinning phase, inserted in the washing phase, due to the rather high rotational speed of the basket, it is possible to place in circulation all the detergents.

According to the invention, the programming device of the machine is realised in a way that provides for, during the washing phase at 55 rpm provided by the selected cycle, at least one brief spinning phase, i.e. the passage to a phase of basket rotation being of a considerably higher speed compared to the normal speed (55 rpm) provided for that particular washing phase: the programming device of the machine therefore provides for controlling in an automatic way, at an appropriate moment, such brief spinning phase.

During such brief intermediate spinning phase,

due to the greater rotational speed of the basket, for instance in the range of 100 and 400 rpm, the washing liquid is violently pushed towards the drainage duct 4; with this aim, advantageously but not exclusively, the drainage sump 4 has at its entrance point with the tub 2, a projection 4a (figure 2) from the side in which the washing liquid, due to the effect of the rotation of the basket, is pushed; due to the effect of such projection 4a the entrance of the washing liquid in the drainage duct 4 results in being efficient.

From the drainage duct 4 the liquid reaches the sump 8 and from here rises the duct 6: in this way a flow of liquid is obtained that passes the duct in the opposite sense to that indicated in figure 1; such flow finishes as a jet of liquid that exits in an abundant manner from the extremity 6a of the duct 6 and therefore enters towards the interior of the tub 2 or, if preferred, towards the interior of the basket 3. In this way, therefore, also the residue detergents remaining on the bottom of the sump 8 are certainly and completely replaced in circulation.

Such functional condition of the machine according to the invention is illustrated in figure 4; as is seen, in such figure the direction of the arrows that indicate the flow of the re-circulation is the complete opposite to that indicated in figure 1: in other words, therefore, the same re-circulation duct 6 is passed (according to the rotation speed of the basket) in the opposite direction by the washing liquid, with the aim of obtaining an efficient re-circulation of the detergents.

Preferably during the main washing phase at 55 rpm three intermediate spinning phases are provided; each of which comes before a graded ramp of the washing speed (the said 55 rpm) to the spinning speed; in a preferred solution the graded ramp comprises two intermediate speed levels, for instance of 55 and 90 rpm, and has an overall duration of 12 seconds; the final spinning phase takes place for instance at the speed of 400 rpm and lasts for approximately 5 seconds: in figure 3 a simplified diagram is represented, of the state of the speed during one of the intermediate spinning speeds provided according to the invention.

Each intermediate spinning phase is preferably followed by a low speed washing phase for several minutes, in the order of 35 rpm, with the aim of dissolving the froth that may have been produced during the spinning phase.

It has been observed that the effects of introducing such intermediate spinning phases have been considerable: without any substantial changes to the geometry of the machine, the percentage of unused detergents has fallen from a level of approximately 10% to almost zero.

It has in practice been witnessed how the laundry washing machine according to the invention fully undertakes the established task in that, obtaining during the wash a return of the detergents previously deposited in the drainage duct, it allows to efficiently exploit practically all the detergents used.

Claims

1. Method for re-circulating detergents in a laundry washing machine (1) comprising a washing tub (2), a basket (3) which rotates in said tub around a substantially horizontal axis, a drainage duct (4) of the washing liquid, having a mouth (4a) in proximity to the bottom of said tub (2), during the operation of the machine at least one washing phase being provided with the presence of liquid and detergents inside said tub (2), in said phase the basket (3) being placed in rotation at a determined washing speed (55 rpm), characterised in that, with the aim of recovering the detergents gathered in said drainage duct (4), during said washing phase the passage to at least one brief spinning phase is provided, i.e. a rotating phase of the basket at a substantially higher speed (400 rpm) respect said determined washing speed (55 rpm), during said brief spinning phase part of the liquid being made to pass through an auxiliary duct (6), from its first extremity (8), in communication with said drainage duct (4), to its second extremity (6a), in communication with the inside of said tub (2) and arranged above the level (7) of the liquid in the tub (2) during the wash.

2. Method, according to claim 1, characterised in that during said brief spinning phase part of the liquid contained in said auxiliary duct (6) exits in an abundant manner, as a jet, from said second extremity (6a) and enters the interior of the tub (2) and/or the interior of said basket (3).

3. Method, according to claim 1, characterised in that during said washing phase at said determined washing speed (55 rpm) the basket (3) is able to convey part of the washing liquid in said second extremity (6a) of the auxiliary duct (6), so as that said liquid can return towards the washing tub (2) through the auxiliary duct (6) and drainage duct (4), due to the difference of the level between said first extremity of the auxiliary duct (6) and the drainage duct (4).

4. Method, according to claim 1, characterised in that said spinning speed has a duration being comprised between 10 to 25 seconds.

5. Method, according to claim 1, characterised in that said spinning phase comprises a normal graded ramp from the washing speed (55 rpm) to the spinning speed (400 rpm), said graded ramp in particular comprising two intermediate levels

of speed between the washing speed (55 rpm) and the spinning speed (400 rpm).

6. Method, according to claim 1, characterised in that said spinning phase takes place at a speed comprised from approximately 100 and 400 rpm.

7. Method, according to claim 5, characterised in that said graded ramp has a duration being on the whole greater (for instance 12 seconds) than the actual spinning speed phase (for instance 5 seconds).

8. Method, according to claim 1, characterised in that said spinning phase is followed by a low speed washing phase (35 rpm) for dissolving the eventual froth produced by said spinning speed, said low speed washing phase having in particular a duration of some minutes.

9. Method, according to one or more of the previous claims, characterised in that during the washing phase two or three brief spinning phases are provided.

10. Laundry washing machine (1), comprising a washing tub (2) housing a washing basket (3) arranged having a horizontal axis and that can be actuated with a rotary motion around said axis, in proximity to the bottom of said tub (2) being provided a mouth (4a) of a drainage duct (4) of the washing liquid, said machine also having means (6-8) for avoiding the gathering of detergents in proximity of the drainage duct (4) by making the detergent-liquid mixture accumulated re-circulate, characterised in that it provides an auxiliary duct (6) having a first extremity (6a) communicating with the interior of said tub (2) and arranged above the level (7) of the water in the tub during the wash and a second extremity (8) communicating with said drainage duct (4) to convey, during the wash, part of the liquid present in the drainage duct (4), by sending it back to said tub (2) by way of said auxiliary duct (6), said laundry washing machine providing control means for producing, during at least one washing phase, the passage to at least one brief spinning phase, i.e. at a rotating speed of the basket (3) being substantially higher than that normally provided for said washing phase.

11. Washing machine, according to claim 10, characterised in that said auxiliary duct (6) is arranged in such a way that during said spinning phase part of the liquid contained within is discharged through said first extremity (6a) in an abundant manner, such as a jet, towards the interior of said tub (2) and/or said basket (3).

12. Laundry washing machine, according to claim 10, characterised in that said auxiliary duct (6) has a first extremity (6a) arranged higher if compared to the drainage duct (4) and in such a point to enable the gathering, during the normal speed washing phases, of washing liquid projected to the interior of the washing tub (2) from the basket (3) in movement, in a way that the washing liquid gathered is conveyed, through the auxiliary duct (6), to the terminal zone of the drainage duct (4), said washing liquid returning to the washing tub (2) through the drainage duct (4) due to the differences of the levels between said first extremity and the drainage duct (4).

13. Laundry washing machine, according to claim 10, characterised in that automatic control means are able to produce, after said brief spinning phase, a low speed washing phase (35 rpm) for dissolving the eventual froth produced by said spinning phase.

14. Laundry washing machine, according to one or more of the previous claims, characterised in that the drainage duct (4) has, at the point of its mouth, a projection (4a) from the side in which the washing liquid, due to the effect of the rotation of the basket (3), is pushed, in a way that, due to such projection (4a), the entrance of the liquid in the drainage duct (4) results in being favoured.

15. Laundry washing machine (1), comprising a washing tub (2), a basket (3) housed in said tub, a drainage duct (4) of the washing liquid, having a mouth (4a) in proximity to the bottom of said tub (2), characterised in that an auxiliary duct (6) is provided, with an extremity (6a) communicating with the interior of said tub (2) and arranged above the level (7) of the liquid within the tub (2) during the wash, and with another extremity (8) communicating with said drainage duct (4) where, with the aim of obtaining an efficient recovering of the detergents, at a first rotational speed of the basket (3) through said auxiliary duct (6) a flow of said liquid is able to pass in a first direction, while at a second rotational speed of the basket (3), through said auxiliary duct (6) a flow of said liquid is able to pass in a second direction, being different from said first direction.

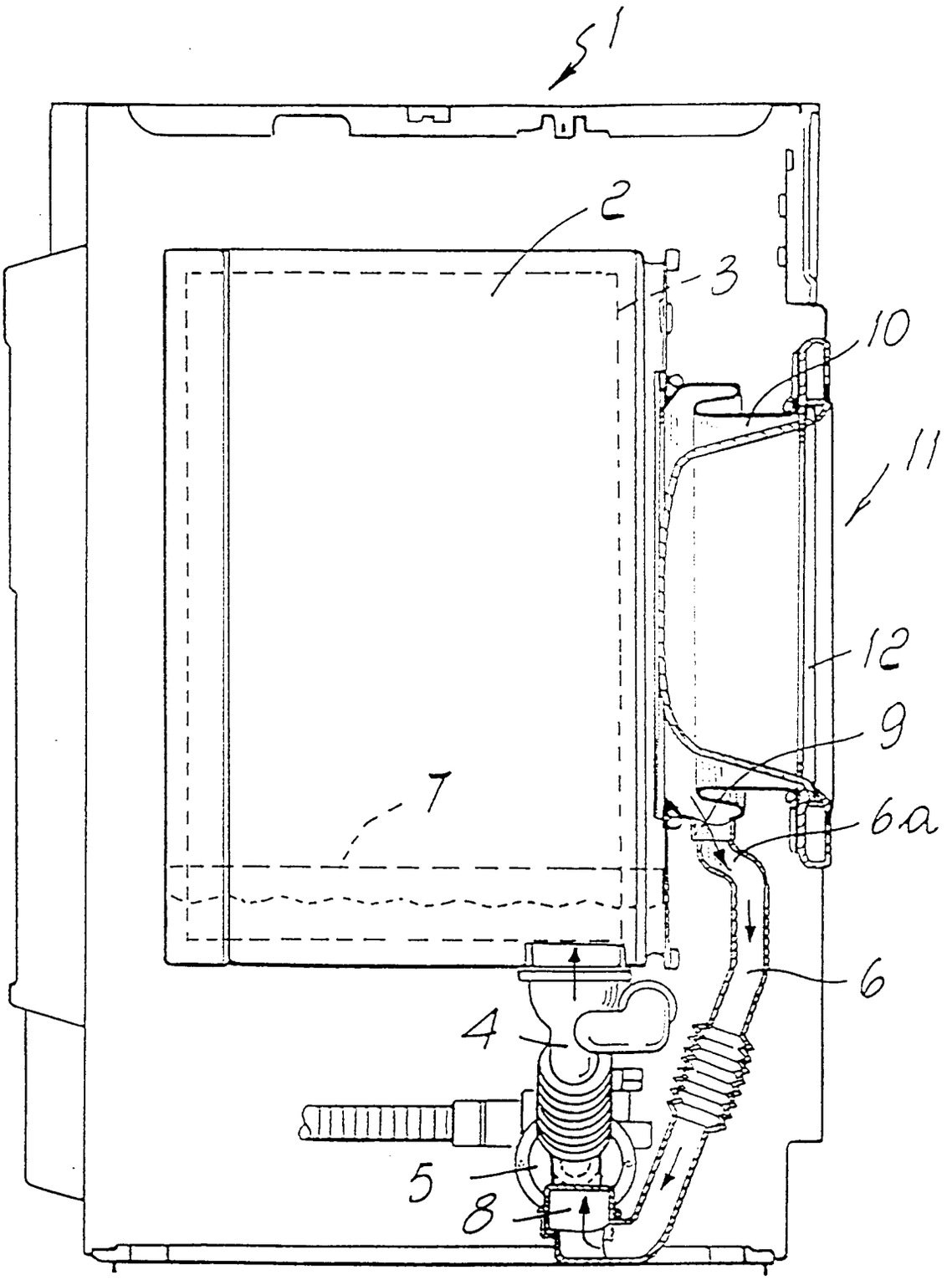

Fig. 1

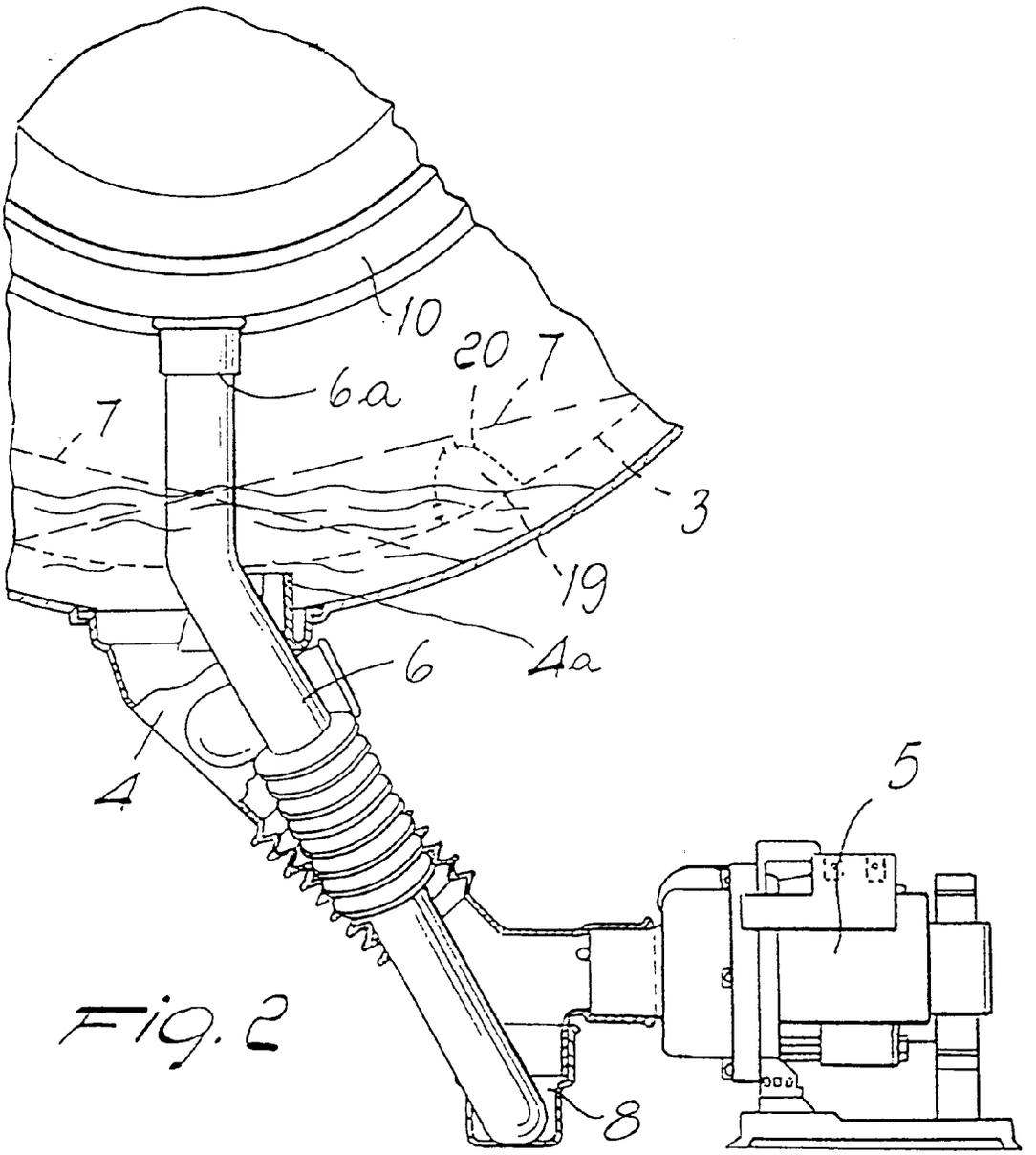

Fig. 2

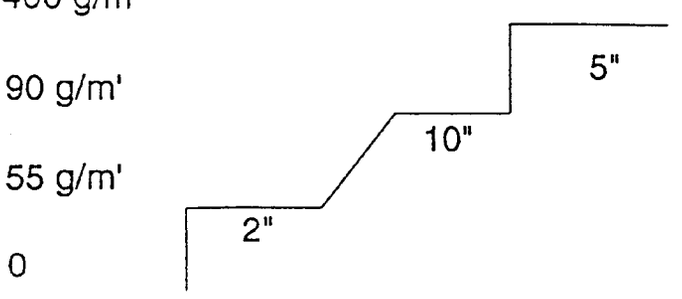

Fig. 3

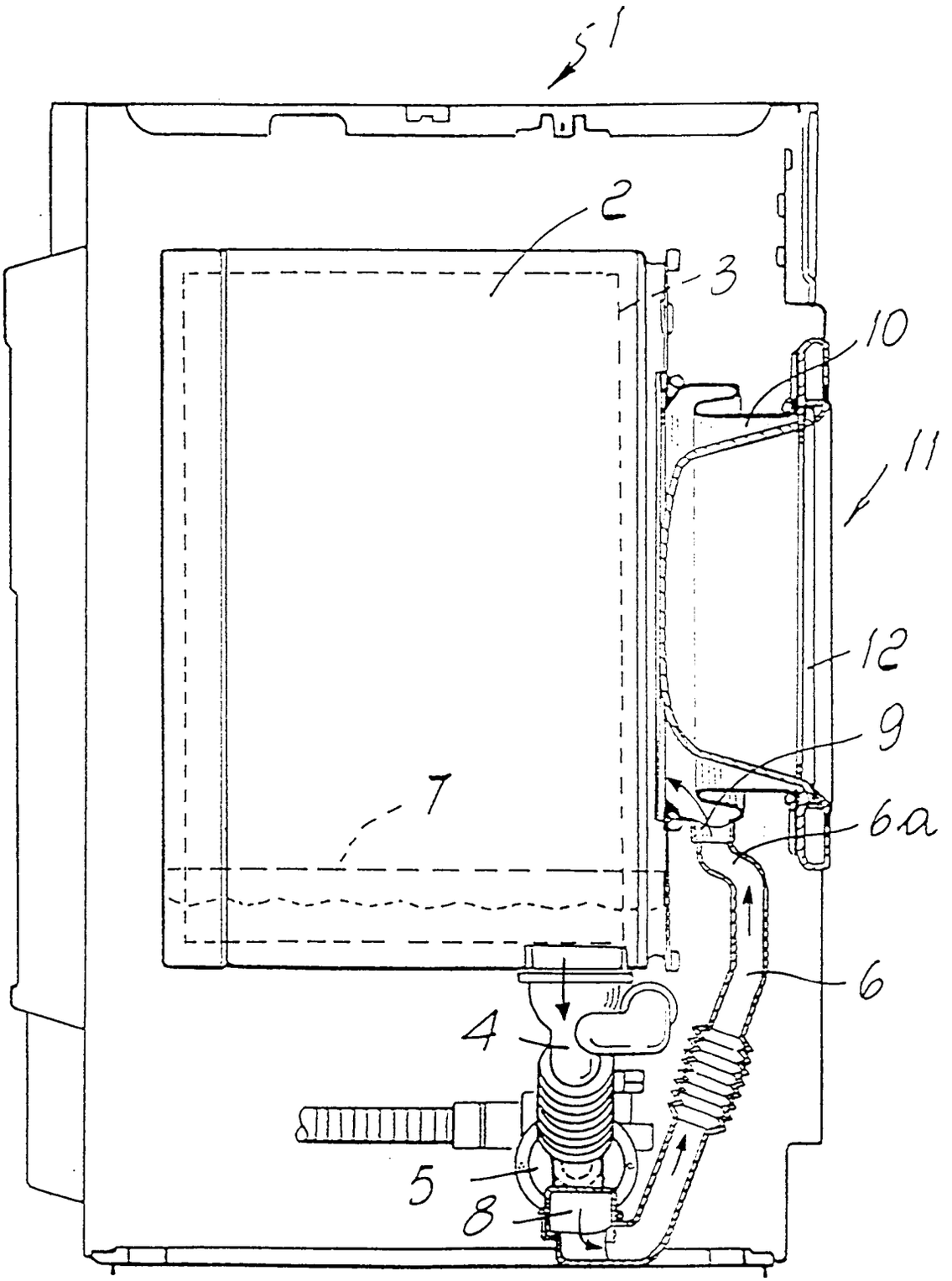

Fig. 4