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(54) Improvement in the ballasting method for a clothes washing machine.

(57) Method for ballasting the washing tub of clothes washing machines, in particular of the domestic type, comprising a washing tub (1) consisting of a rigid structure formed by the cylindrical peripheral mantle (2) and the circular back wall (3), as well as one or more reservoirs (4, 5) that are rigidly connected to said washing tub and are adapted to be filled with liquid ballast means, wherein said liquid ballast means is the wash liquor being let off the tub at the end of the washing phase.

Said wash liquor is let off the tub and collected into said ballast reservoirs before the actual spin-extraction phase is started. It is then preferably let definitively off said ballast reservoirs at the end of the washing process. Said tub and said reservoirs may be moulded as an integral construction of plastic material.

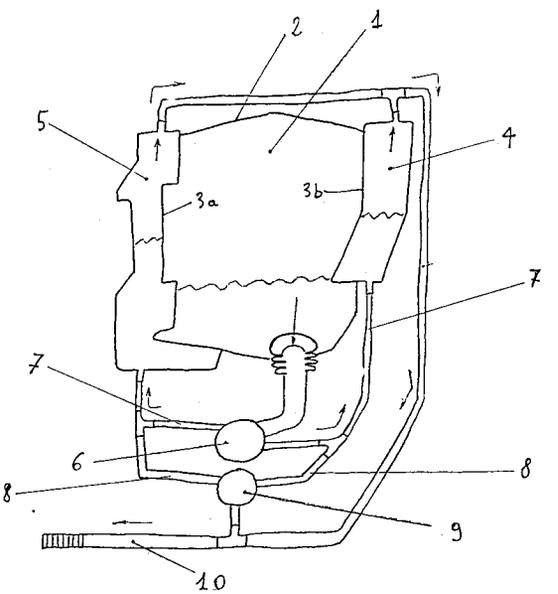

FIG. 1

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The present invention relates to an improvement in the ballasting method for washing tubs, as particularly employed in clothes washing machines for household use.

Washing tubs of various materials for clothes washing machines are known, which essentially consist of a rigid structure forming the cylindrical peripheral mantle and the circular back wall, and a front wall that is circular in its shape, and is sometimes separate from said structure, capable of being joined to said rigid structure by means of *per sè* known fastening means.

Some heavy elements are generally associated to said tubs to act as ballasting means for these same tubs, ie. in order to increase their inertia and, as a consequence, limit the vibrations that are transmitted to the tub during spin-extraction operation, ie. when the revolving drum containing the wash load to be spin-extracted is allowed to rotate at a speed which is considerably higher than the speed at which it normally rotates during washing operation.

These vibrations are generated owing to an uneven distribution of the washload along the cylindrical peripheral wall of the revolving drum. This gives rise to such vibrations which, failing an effective damping action, are likely to bring about a number of problems.

This is a well-known fact to anyone skilled in the art and, therefore, will not be discussed here any further.

Among the various solutions that have been suggested in this connection, a particularly interesting one is described in the Italian patent specification no. 824.386 having as a title "Rotary-motion machine, in particular washing machine, provided with ballasting means".

The features claimed in said patent specification include at least a container applied to the washing tub and capable of being filled with ballasting means during the installation, said ballasting means consisting preferably of water.

The main advantage of such a solution lies in the fact that a washing machine being provided with such a feature not only has a considerably lower weight and, as a consequence, is much lighter to handle during transport and installation, but, of course, is also much more economical owing to both the reduction in transport and handling costs and the saving in the costs that would be prompted by the application of a traditional ballast made of heavy materials such as concrete or cast-iron.

Furthermore, the afore cited Italian patent specification describes an improvement consisting in providing said container of the ballasting water with appropriate electrical or similar heating elements in view of the ability of using said ballasting water as hot water in subsequent washing processes.

In such a case, said container is arranged to be in connection with the water supply conduit and the washing tub.

However, all of the described solutions, albeit fully feasible and practicably implementable, have hitherto failed to find any practical application, mainly owing to technical difficulties that have been found in trying to achieve reservoirs rigidly connected to the washing tub and acting as containers for the ballasting water, as well as to a lack of mercantile interest in actually having particularly lightweight machines in both transport and installation.

However, the continuously expanding base of the international trade and the resulting levelling-off and standardisation of product typologies are making it increasingly interesting to direct product marketing towards areas that, while being characterized by a high standard of purchasing power, were previously *de facto* precluded due to both the high transport costs and the existing differences in consumers' habits and requirements.

This of course applies also to one among the most typical items that are finding application in the homes, ie. the washing machine. This product is in fact inflicted a double penalty by its weight: first of all with reference to the costs of its transport, especially if one considers that a quite appreciable part of the total weight of a washing machine is due to the weight of ballast means whose provision is actually necessary only in view of particular phases of the washing process (spin-extraction), while it is on the contrary almost fully useless in all other phases of the same process; and then with reference to the fact that, especially in many lower-cost residential buildings, people are not allowed to burden the floor with a weight exceeding a well-defined average pressure. In a number of countries, this is a restraint that does not allow for the installation of washing machines having traditional design features and weight.

The proposed solution of using reservoirs as temporary water containers in view of creating a vibration-damping ballast means for the washing tub, becomes of course particularly interesting in this connection. However, it brings about some inherent drawbacks that must be avoided, along with some opportunities that can on the contrary be advantageously seized.

As a matter of fact, the construction of additional reservoirs to be rigidly connected to the washing tub would not fail to imply a sensible increase in costs if it has to be carried out with traditional means and according to traditional concepts.

Furthermore, it is well-known from the state of the art that it is very advantageous to have reser-

voirs arranged for recovering both the wash and the rinse water so that it may be appropriately re-used in subsequent washing processes, thereby achieving a considerable reduction in the overall water consumption of the washing machine and contributing to the safeguard of an increasingly valued natural resource.

It would therefore be desirable, and it is actually the purpose of the present invention, to provide a washing tank with a number of reservoirs associated therewith, said reservoirs being arranged to be used both as a containers to hold the ballasting liquid and as reservoirs to collect the liquor being recovered from some phases of the washing process in view of a re-use in subsequent washing processes.

The invention will be further described by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical view of a portion of the water-carrying circuit of a clothes washing machine made according to the present invention;
- Figure 2 is a schematical view of a different embodiment of the water-carrying circuit of the washing machine according to Fig. 1.

With reference to the Figures, it can be noticed that they show a washing tub 1 made preferably of plastic material, and arranged to be installed in a *per sè* known manner in the washing machine, said washing tub consisting substantially of a rigid structure formed by a cylindrical peripheral mantle 2 and two walls 3a and 3b.

It can further be noticed that associated to said washing tub there is a plurality of rigid reservoirs or containers 4 and 5 that are rigidly joined to the tub itself. Of course, said containers can take the most appropriate shape and position in accordance with particular constraints that may arise in terms of available space, design requirements and/or capacity or volume requirements for the same containers.

During the washing phase of the process, the washing liquor is let into the washing tub in a traditional way, while said containers 4 and 5 remain empty. As a matter of fact, the washload-holding drum is rotating at a quite low speed during this phase, so that no actual need arises to provide for damping the vibrations of the washing tub.

At the end of the washing phase of the process, the washing liquid is let off the washing tub. However, instead of being discharged outside as it occurs customarily, it is filled into said containers through appropriate pumps 6, or similar provisions, as well as through one or more conduits 7.

The capacity of said containers is sized in such a way as to both enable them to store such an amount of liquor as is actually required to cope with the water supply demand for a new washing process to be performed subsequently, as it will be further described hereinafter, and to provide the ballast mass required to dampen the stronger vibrations of the washing tubs at the fast rotating speed of the drum during the following spin-extraction phase of the process.

As a matter of fact, the phase following the actual washing cycles, ie. spin-extraction, has to be performed at a high revolving speed of the rotating drum and, as a consequence, mandates for an adequately ballasted tub. In this case, the provision of a ballasted tub to cope with spin-extraction conditions is ensured by the preceding phase in which said containers 4, 5 are filled with the liquor discharged from the washing phase.

In order to avoid the circumstance that said liquor from the washing phase, and therefore containing the dirt removed from the clothes and all other substances used for the washing process, may remain for a long time stored in said containers and, as a consequence, may give rise to undesirable processes of fermentation and/or decay or bacterial growth, it is advantageous to have said containers emptied at the end of each complete cycle.

In such a way, the empty reservoirs will never be all owed to become the seat of undesired processes or events, while, on the other hand, after the spin-extraction phase of a washing process and before the spin-extraction phase of a subsequent washing process there is no actual need for a ballasted tub, so that there is no actual need to have said containers filled up during such a period.

Said outlet phase provided to empty the containers 4, 5 may be achieved through the use of conduits that, for more simplicity, may partly be the same as the afore cited filling conduits 7 and partly be formed by appropriate, dedicated conduits 8 specially provided for that emptying function.

With special reference to Figure 1, in order to prevent said containers from draining empty spontaneously by gravity after having been filled in the afore described way, an appropriate flow-control element 9, such as for instance an electromagnetic valve, may be installed in a common location along said dedicated conduits 8.

What has been just said in connection with the washing liquor that, instead of being discharged outside into the environment, is collected in the afore cited containers in order to provide the required ballasting action, may of course be extended to also Include the water from the rinsing cycles and the subsequent spin-extraction phases. All it takes to do it is to provide for an appropriate programme which is arranged to control the various

functional components involved, including the pump 6 and the valve 9, in due sequence and synchrony.

This is readily obtainable by anyone skilled in the art and, therefore, it will not be described any further.

An advantageous improvement of the invention consists in providing a programme for controlling the sequence of the various functional components in such a way that the water filled in for the last rinsing phase, or even the last two rinsing phases, is then collected and stored into said containers, instead of being discharged outside, at the end of the corresponding cycle. The relatively clean water recovered in such a way can then be re-used as washing liquor in the washing phase of a subsequent washing process.

The above described embodiment can be obtained through the implementation of an arrangement of conduits and pumps, as well as a control system for said pumps, which is fully within the capacity of anyone skilled in the art and is therefore not shown in the Figures.

With reference to Figure 2, in which it is shown that the drain pipe 10 is raised to a level above the highest level of the liquor in the tub in view of preventing said liquor from flowing out therethrough during the various intermediate phases of the process, the need arises to install a pump 11 instead of the electromagnetic valve 9 in order to enable said liquor to be pumped outside through said pipe 10.

In such a case, appropriate provisions shall be taken to avoid that, after having been filled by the pump 6, the containers 4, 5 start emptying partially by gravity as soon as said pump stops, thereby filling the underlying water-carrying circuit with recovered liquor.

To this purpose, a further valve 12 may be provided in the conduit 7 so as it is controlled to open during the phases in which the liquor is being filled in the containers, it is further controlled to close at the end of said phases and for the entire duration of the subsequent spin-extraction phases, and it is finally controlled to also open during the phase in which the liquor collected in said containers is discharged outside.

It is now fully apparent that the present invention differs from the disclosures in the afore cited prior-art patents due in particular to following features:

a) the containers are filled after, and not before, the washing phase of the process;

b) the containers are filled with the washing liquor discharged from the tub and not, as previously disclosed, with fresh water to be preheated before being delivered into the tub;

c) said containers are used also as storage reservoirs for recovering the rinsing water in view of reusing it as washing liquor in the washing phase of a subsequent washing process;

d) the washing tub and the ballast containers associated there to are made as a single-piece construction, preferably as a single-piece plastic moulding.

It will be appreciated that each washing tub 1 may be given also different shapes and configurations, in deviation from the ones shown here by way of example, without departing from the scopes of the present invention. The fabrication of such a tub assembly can in any case be performed automatically, and it is obtained in a simple, realiable and economical way.

Claims

1. Method for ballasting the washing tub (1) of a clothes washing machine, in particular of the household type, comprising one or more containers (4, 5) that are rigidly connected with said tub and are capable of being filled with ballasting liquor, **characterized in that** said ballasting liquor is derived from the wash or rinse liquor that is discharged from the wasging tub (1) at the end of the corresponding washing phase.

2. Tub ballasting method according to claim 1, **characterized in that** said wash or rinse liquor is discharged from the washing tub and is collected into said ballast containers before the corresponding spin-extraction phases are started.

3. Tub ballasting method according to claim 2, **characterized in that** the recovery of said liquor discharged from said washing tub occurs through a first pump (6) and appropriate conduits (7) from said pump to said containers (4, 5).

4. Tub ballasting method according to claim 3, **characterized in that** said conduits (7) are connected to further conduits (8) comprising an electromagnetic valve (9) or, alternatively, a second pump (11) for the final ejection of said liquor from said containers.

5. Tub ballasting method according to any of the preceding claims, **characterized in that** said ballasting liquor contained in said containers (4, 5) is discharged from said containers in a subsequent moment, after the end of the corresponding spin-extraction phases.

6. Tub ballasting method according to any of the preceding claims, **characterized in that** the liquor from the last rinse phases, after having been filled into said containers (4, 5), is kept stored therein at the end of the washing process in view of its re-utilization in a subsequent washing process.

7. Clothes washing machine **characterized in that** it makes use of the method according to any of the preceding claims.

8. Clothes washing machine according to claim 7, **characterized in that** said containers (4, 5) are made of plastic material and are moulded integrally with said washing tub.

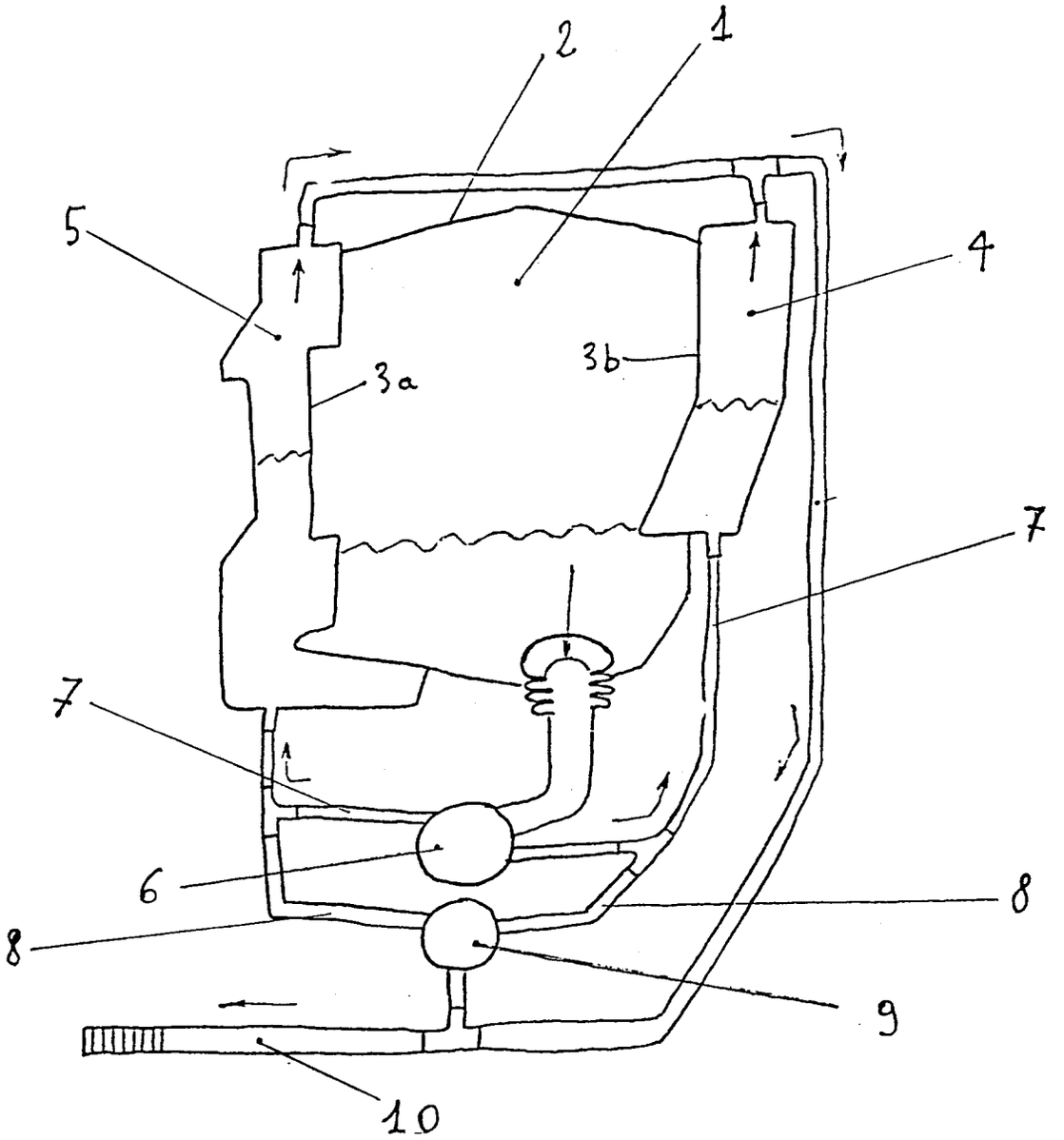

FIG. 1

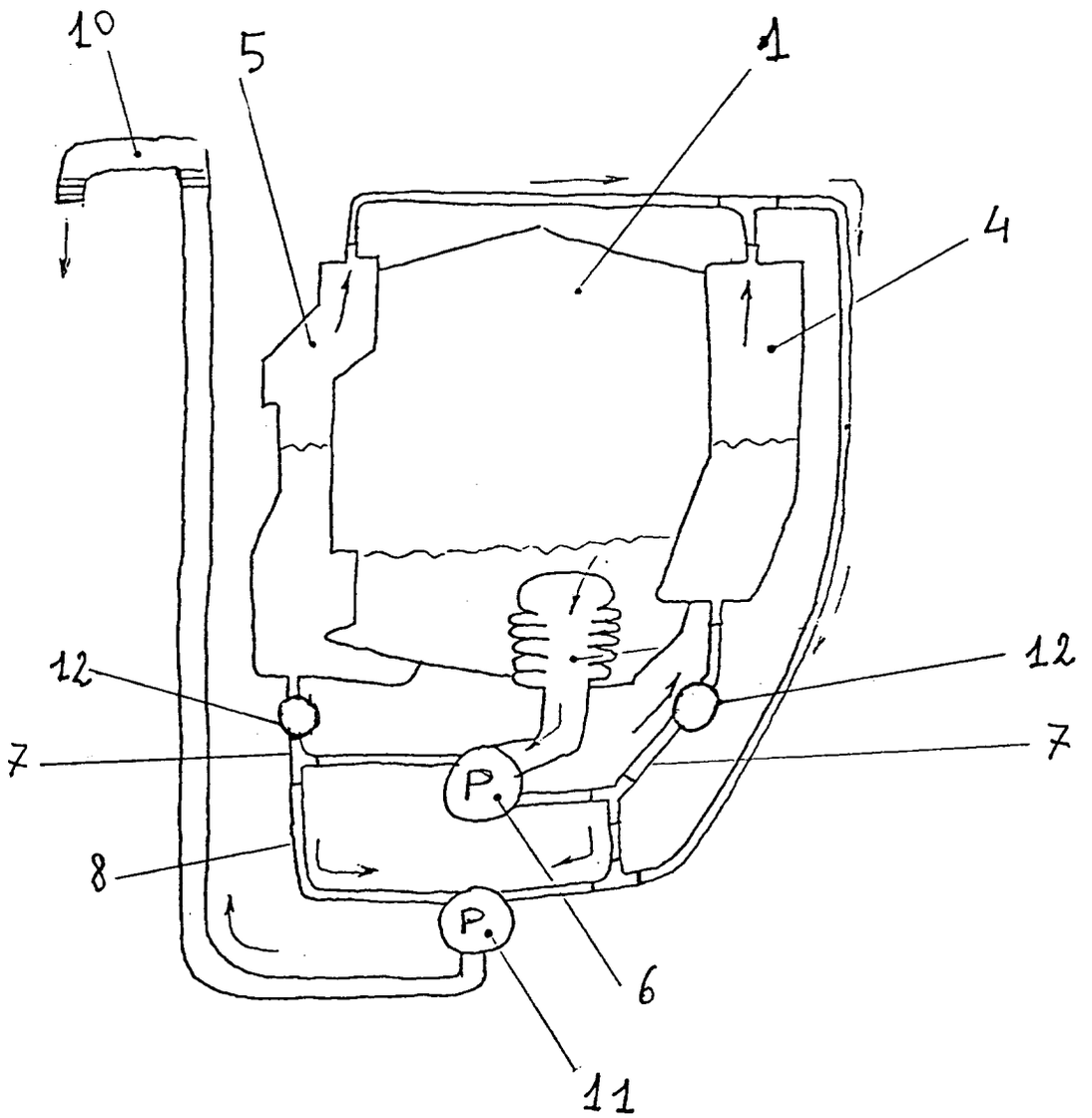

FIG. 2

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EUROPEAN SEARCH REPORT

Application Number

EP 93 10 0006

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X A	DE-A-3 734 234 (S. LASKOWSKI) * column 1, line 12 - line 41; figure 1 *	1,2,5,7 3,4,8	D06F37/22 D06F37/26 D06F39/00
X A	DE-A-2 754 254 (A.SANNER) * claims 1,4; figures 1,4,5 *	1-4 5,7	
A	EP-A-0 326 502 (G. MARTINEZ) * claims; figures *	1,2,8	
A	DE-A-1 902 325 (INDUSTRIE A. ZANUSSI S.P.A.) * claims; figures *	1,2,8	
A	DE-A-2 910 140 (WFK-TESTGEWEBE GMBH) * claims; figures *	3,4,6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 MARCH 1993	COURRIER G.L.A.

CATEGORY OF CITED DOCUMENTS

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