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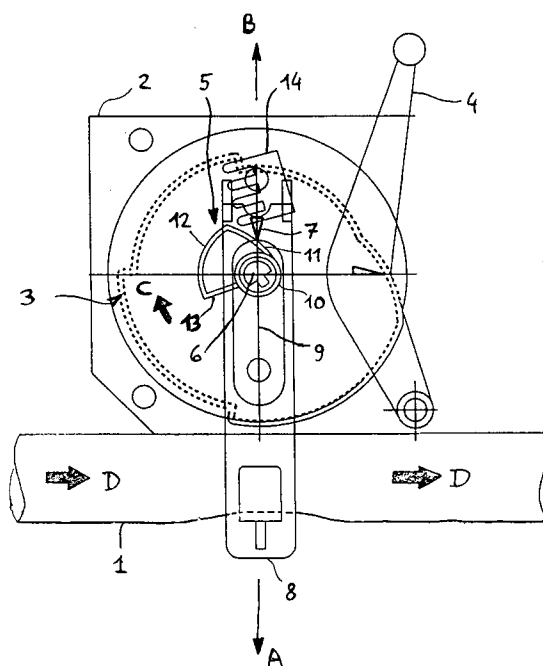
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I-33170 Pordenone (IT)(54) **Flow rate regulation arrangement for the wash liquor in clothes washing machines.**

(57) Flow rate regulation arrangement for the wash liquor in a clothes washing machine comprising an outer washing tub, a recirculation conduit (1) connected with both the lower and the upper portion of said washing tub, an electromechanical actuator means (2) and an electronic microprocessor means connected to an electric printed-circuit board and arranged to detect and identify the various positions taken by a rotary selector means for letting the various detergents and laundering product into said washing tub at the correct time during the washing process.

Said regulation arrangement comprising a cam (5) with a properly contoured outer profile, adapted to be operated by said actuator means (2) and capable of causing, through a cam follower (7) and an alternately displaceable lever (8), said recirculation conduit (1) to be more or less throttled under resulting variation, from a given maximum value to a given minimum one, in the flow rate of the wash liquor pumped through said conduit.

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The present invention relates to a quick-action arrangement of a simple type for regulating the flow rate of the wash liquor circulating through a clothes washing machine, in particular a clothes washing machine or a combined clothes washing and drying machine equipped with a provision to recirculate the wash liquor from the lower portion to the upper portion of the washing tub in view of spraying said liquor onto the clothes being contained in the drum rotating inside said washing tub.

Clothes washing machines of the above specified type are known from the prior art, which substantially comprise a conduit for recirculating the wash liquor, said conduit including a circulation pump and communicating with one of its ends with a liquor collecting vessel, which houses at least an electric heating element and is connected with the lower portion of the washing tub of said washing machines, as well as being connected with its other end with the upper portion of said washing tub and a liquor spraying device fastened thereto, said liquor spraying device being arranged to direct the washing liquor in form of spray jets on the clothes contained in the perforated drum rotating inside the washing tub.

When a washing process is going on as selected each time by the user for these machines to perform, the wash liquor contained in the washing tub, and used to wet the clothes to be washed, is repeatedly recirculated by the circulation pump through said recirculation conduit at a flow rate which is substantially constant. Said liquor, which is filled at different, pre-determined levels in the washing tub in accordance with the actual amount of clothes being loaded in the drum, is then sprayed onto the clothes in the drum, thereby causing then to be washed in an effective way.

It is an object of the present invention to provide an arrangement for regulating the flow rate of the wash liquor recirculated through said washing machines, by means of which it shall thus be possible to vary within pre-determined limits the flow rate of said washing liquor according to the amount of clothes contained in the drum and the filling level of the liquor in the washing tub, so as to bring about corresponding variations in the pressure of the washing liquor that is sprayed onto the clothes in the drum, in such a way that these variations are instrumental in ensuring each time the achievement of satisfactory pre-wash and wash results that are optimized in accordance with the actual type and amount of clothes to be washed.

This flow rate regulation arrangement is substantially based on the principle of varying the inflow cross-section of the recirculating conduit for the washing liquor, using to this purpose a system which differs from all known ones that are used to regulate the flow rate of liquid-carrying conduits,

such as for instance the ones consisting of pumps with electronic phase-shift control, fluid shut-off or throttling organs controlled by electromagnetic valves or electromechanical actuators of various types.

Such a flow-rate regulation arrangement is provided with the features that are as substantially described with particular reference to the appended claims.

For better understanding, the invention will however be further described in the following, by way of non-limiting example, with reference to the accompanying drawing, in which the sole Figure appearing is a schematical front view of the flow-rate regulation arrangement according to the invention.

In the afore cited Figure, the flow-rate regulation arrangement is shown schematically as being installed in a clothes washing machine, in particular a clothes washing machine or a combined clothes washing and drying machine, comprising a washing tub and a rotating drum housed inside said tub, as well as comprising a conduit (only a portion of which being shown in the Figure, as indicated by the reference numeral 1) for recirculating the washing liquor, which is provided with a recirculating pump and communicates with one of its ends with a washing-liquor collecting vessel housing at least an electric heating element and connected with the lower portion of said washing tub, said conduit being connected with its other end with the upper portion of said washing tub and a spraying device fastened thereto so as to direct the washing liquor circulated through said recirculating conduit in form of spray jets onto the clothes contained in the perforated drum rotating inside the washing tub, thereby wetting the clothes and, as a consequence, promoting the soil removal effect as the machine goes through the washing process according to the cycle selected by the user (the remaining ones among the various component parts of the machine mentioned above are not shown in the Figure).

Furthermore, the flow-rate regulation device according to the present invention is associated with an arrangement provided to control detergent dispensing, which is similar to the one described in the Italian patent application no. PN 91A000012, filed by the same applicant on February 27, 1991, and which essentially consists of a rotary selector means installed in a detergent dispenser and actuatable selectively by a linkage into different positions. The water is let into this dispenser and caused to flow through the various compartments that are provided there to contain the different detergents required for the washing process, so that it is able to flush off these detergents and carry them into the washing tub. In the process, the displacement of said rotary selector means into its

various operational positions is controlled by the electronic microprocessor of the washing machine, which also is arranged to automatically identify said operational positions of the selector means.

An electromechanical actuator means 2 of the type described in the afore cited patent application PN 91A000012, and rotatably actuatable by the electronic microprocessor means of the machine, can be viewed in the illustration shown in the Figure, said actuator means including the above mentioned control device and comprising a first profiled cam 3 adapted to cause the linkage 4 and, therefore, the rotary selector means (not shown) to be displaced into its various operational positions, as well as a second profiled cam 5 which is made coaxially in a single piece with said first cam, both cams being integral with the horizontal rotating shaft 6 of the actuator means 2.

The first cam 3 is made with dimensions that are larger than those of said other cam; furthermore, it has such an outer profile as to enable the rotary selector means to be displaced into four different operational positions to cater for the corresponding pre-wash, main wash, rinsing/fabric conditioning and rinsing/bleaching phases making up the washing cycles that are each time selected by the user to handle the different washloads.

Also the second cam 5 has, in turn, a properly contoured outer profile, on which is slidably resting a cam follower 7 that is fixed to an end of a rectilinear lever 8 provided with a central slot 9 for insertion onto the rotating shaft 6 of the actuator means 2, said lever being capable to slide alternately along a linear pattern in the two mutually opposing directions A and B, and said lever being further appropriately shaped at its other lower free end so as to close in around the recirculation conduit 1 of the washing machine.

Said second cam 5, in the case being considered here, is shaped with an outer profile comprising three arcuate portions 10, 11 and 12, as well as a rectilinear portion 13, all of them flowingly joined to each other. Of these portions, the arcuate portion 10 has a curvature radius which is smaller than the curvature radius of the remaining arcuate portions 11 and 12, which in turn have practically identical curvature radii.

It will of course be appreciated that the above mentioned cam may also be provided with outer profiles that are different from the above described one, without departing from the scopes of the present invention.

In this manner, as the actuator means 2 turns in the pre-determined direction of rotation, as indicated by the arrow C for this particular case, during the progress of the washing process selected by the user for the particular wash load, both profiled cams 3 and 5 are actuated to turn in the

same direction of rotation, so that while the cam 3 causes the rotary selector means to be displaced into its different operational positions through the linkage 4, the cam 5 acts to alternately displace, through said cam follower 7, the lever 8 in either one or the other one of its two rectilinear displacement directions A and B, thanks to said rotating shaft 6 of the actuator means 2 being slidably engaged in the slot 9 provided in said lever, according to the portion of cam surface on which said cam follower is resting each time.

In the first case, thus, the lever 8 is kept by gravity in its lowered position (as shown in the Figure), wherein the free end of said lever is not causing the recirculation conduit 1 of the washing machine to be squeezed to any extent, ie. a condition in which the washing liquor circulates through said conduit at its highest flow rate, in the flow direction indicated by the arrow D, toward the spraying device of the same washing machine.

Quite on the contrary, in the second case the lever 8 is lifted up to a position in which the free end thereof causes said recirculation conduit to be squeezed to such an extent as to bring about a reduction in the in-flow cross-section of the same conduit and, as a consequence, a corresponding reduction in the flow rate of the washing liquor circulating through said conduit. This in turn brings about a corresponding increase in the pressure of the washing liquor that is sprayed onto the clothes in the drum.

By appropriately dimensioning the travelling distance of the lever 8 in accordance with the outer profile of the cam 5, it is thus possible for said recirculation conduit 1 to be squeezed to different extents, thereby varying within pre-determined limits the flow rate and, as a consequence, the pressure of the washing liquor circulating through said recirculation conduit, ie. generating variable liquor recirculation flow rates and spraying pressures so as they are required to ensure greater effectiveness in washing the clothes during the various phases of each laundering process selected by the user to handle particular washloads.

In the particular instance being considered here, a normal flow rate of the washing liquor is achieved when the lever is fully displaced in the direction A, ie. in its fully lowered position, whereas the flow rate of the washing liquor is reduced by 50 percent when said lever is fully displaced in the direction B, ie. in its fully lifted position.

It shall also be noticed that both cams 3 and 5 are linked to each other with such an angular displacement as to cause the flow rate of said washing liquor in the recirculation conduit to be always varied within the pre-determined limits in the specially intended phases of each washing process selectable by the user.

In particular, in the case being specially considered here, such a variation of the flow rate is caused to occur during the pre-wash phases of the clothes washing process. However, it may of course, be caused to occur also during the main wash phases, or even during other possible phases of said process, provided that the outer profiles of both cams 3 and 5 are to this purpose shaped accordingly.

Finally, also this arrangement is provided with a rotary electrical contact 14 which is associated coaxially with said first cam 3, said contact being built onto an electrical printed-circuit board provided with a plurality of electrically conductive tracks (not shown), which are arranged concentrically and are separated from each other, and capable of being actuated rotatably, in step with the corresponding rotation of both cams 3 and 5, so as to cause different electrical contacts, which are each time identified by the electronic microprocessor means of the washing machine and are associated with said rotary contact and said conductive tracks, to close in due time and sequence so as to also enable the respective operational position of the regulation arrangement considered to be identified.

This electrical printed circuit is embodied and operates in the same manner as described in the afore cited Italian patent application no. PN 91A000012, to which reference is therefore made in view of a better understanding of the operation of the above illustrated arrangement.

The flow-rate regulation arrangement built according to the afore illustrated way is therefore effective in enabling the flow rate, and therefore the pressure with which the washing liquor is sprayed onto the clothes, to be advantageously regulated during the progress of any laundering process selected to wash woollens, cottons and/or synthetics, with a resulting improvement in the effectiveness with which soil is actually removed from the clothes being washed.

Claims

1. Flow-rate regulation arrangement for the wash liquor circulated in clothes washing machines, in particular clothes washing machines or combined clothes washing and drying machines, comprising a washing tub housing a rotating drum holding the washload, and a recirculating conduit for the wash liquor connected through at least a pump with the lower portion and with the upper portion of said washing tub, in which a device for spraying the wash liquor onto the clothes in the drum is provided, as well as comprising an electromechanical actuator means and an electronic microprocessor

means to set and control the progress of the different washing programmes performed by the machine, said electromechanical actuator means being provided with a first cam adapted to cause, through a linkage, a rotary selector means to be displaced into various operational positions so as to enable respective detergents to be added at the correct time into the washing tub for handling the washload during the corresponding phases of each washing programme selected by the user, the washing machine further comprising an electrical printed circuit provided with conductive tracks and a rotary electrical contact rotating integrally with said first cam, and adapted to selectively close various electrical contacts connected with said conductive tracks and said rotary contact, to enable said electronic microprocessor means to thereby detect and identify the corresponding operational position of said cam and, therefore, the phase of the washing programme being actually performed, **characterized** by control means (5, 7, 8) associated with the electromechanical actuator means (2) and said recirculation conduit (1), and capable of being displaced into at least two different operational positions by the action of said electromechanical actuator means (2), so as to determine corresponding variations in the flow rate of the wash liquor circulating through said recirculation conduit (1).

2. Regulation arrangement according to claim 1, **characterized in that** said control means comprise a second cam (5) attached to the shaft (6) of said electromechanical actuator means (2) along with, and coaxially to, said first cam (3), and further comprise at least a cam follower means (7) resting slidably on the outer profile of said second cam (5) and attached to one end of a rectilinear lever (8) provided with a central slot (9) in which said shaft (6) is inserted, said lever being arranged to alternately slide linearly in two mutually opposing directions (A, B) perpendicularly to said recirculation conduit (1), and being further so shaped at its other end as to close in around said recirculation conduit (1), said second cam (5) being profiled so as to be capable of alternately displacing said lever (8), through said cam follower means (7), in either one or the other one of its two sliding directions (A, B), with a resulting variation of the flow cross-section of said recirculation conduit (1) determined by the action of said lever (8) within two pre-determined values, wherein the flow rate of the wash liquor circulating through said conduit (1) changes between a highest and a lowest

value, respectively.

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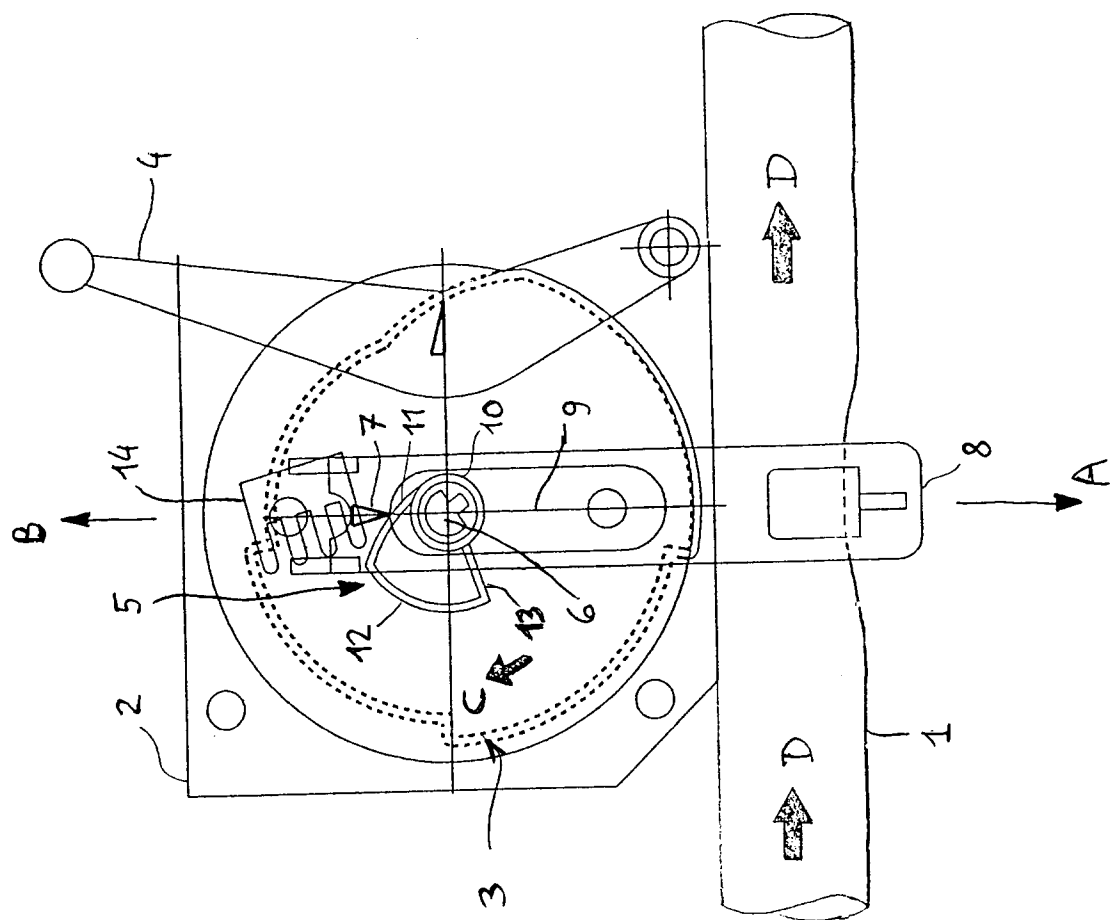
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EUROPEAN SEARCH REPORT

Application Number

EP 93 10 0643

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)
A	DE-A-1 811 106 (SIEMENS-ELECTROGERÄTE GMBH) * page 6, line 1 - line 14; figures 1-7 * ---	1,2	D06F39/08
A	US-A-3 129 574 (K.H. WOLVERTON) 21 April 1964 * the whole document * ---	1,2	
A	DE-B-959 822 (SIEMENS-SCHUCKERWERKE) 14 March 1957 * the whole document * ---	1,2	
A	EP-A-0 335 485 (FISHER & PAYKEL LTD) * page I, line 1 - line 45; figures 1-6 * -----	1,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D06F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25 MAY 1993	Examiner HENNINGSEN O.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			