

Description

This invention relates to laundry machines and/or methods of controlling the same.

It is an object of the present invention to provide a laundry machine and/or methods of controlling the same to provide an optimum water level for a load of clothes automatically without any information or decisions being supplied by the operator.

Accordingly, in one aspect the present invention provides a method of providing a required level of washing liquid in a laundry machine having a cabinet, a washing container within said cabinet, a rotatable assembly including a spin tub within said container and an agitator within said spin tub, a motor driving said agitator conjointly with said spin tub or separately on disconnection of said spin tub from said agitator as required, and washing liquid level control means to control washing liquid level in said washing container, the method comprising:

placing a load of clothes in said spin tub, initiating the supply of washing liquid to said container and energizing said motor intermittently to produce changes in the rotational speed of said rotatable assembly as washing liquid is being supplied to said container;

sensing the changes in speed of said rotatable assembly relative to energy input to said motor with a sensing means;

passing signals indicative of the total rotating mass of said rotatable assembly including the washing liquid in said container and the clothes in said spin tub from said sensing means to said liquid level control means;

said method being characterised in that the point of disconnection of said spin tub from said agitator is determined dependent on said signals by said control means, said signals passed from said sensing means to said control means at the time of disconnection being indicative of the mass of said load of clothes;

and being further characterised in that said required level of washing liquid is determined with said control means from said signals at the time of disconnection, said required level being dependent on the mass of the load of clothes;

controlling the supply of further washing liquid to said container to said required level with said control means; and

causing the wash routine to start when said required level is reached.

In a further aspect the invention consists in a cabinet; a washing container; within said cabinet; a rotatable assembly comprising a spin tub within said container and an agitator within said spin tub; disconnecting means for disconnecting said spin tub from said agitator for spinning action when

required; a motor driving said agitator conjointly with said spin tub and separately on disconnection of said spin tub from said agitator as required; sensing means to sense the changes in speed of said rotatable assembly including the mass of clothes load in said assembly relative to energy input to said motor; washing liquid level control means comprising washing liquid admission means, control means comprising means for intermittently energising said motor, and washing liquid admission control means arranged to control said washing liquid admission means in said washing container in response to signals passed by said sensing means to said washing liquid level control means; the construction and arrangement being such that at each intermittent energising of said motor said sensing means pass signals indicative of the total mass of said rotatable assembly including the washing liquid in said container and at least the clothes in said spin tub to said washing liquid level control means,

characterised in that said washing liquid level control means detect the point of disconnection of said spin tub from said agitator through receipt of said signals, said signals passed including a disconnection signal indicating the point of disconnection of said spin tub from said agitator and being indicative of the mass of said load of clothes, and

further characterised in that upon detection of said disconnection, said washing liquid level control means also determine a required washing liquid level dependent on said signals and control the supply of further washing liquid to said container to control the level of washing liquid to said required level which is dependent upon the mass of clothes load sensed by said sensing means and causing the wash routine to start when said required level is reached.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

The invention consists in the foregoing and also envisages constructions of which the following gives examples only.

One preferred form of the invention will now be described with reference to the accompanying drawings, in which;

Figure 1 is a cross section elevation of one form of laundry machine to which the invention is applicable,

Figure 2 is a flow chart of one form of control means incorporated in the laundry machine of Figure 1,

Figure 3 is a flow chart of a further form of control means,

Figure 4 is a flow chart of a part of the control means of Figures 2 and 3, and

Figures 5 and 6 are graphs of rotational velocity versus time of the rotatable assembly of the laundry machine of Figure 1.

Referring to the drawings, Figure 1 illustrates a cross section of a preferred form of laundry machine, a full description of which appears in published U.S. patent specification No. 4,813,248 and the description of that laundry machine in that specification is incorporated herein by reference.

For the purposes of the present invention the laundry machine comprises a cabinet 1 within which there is a fixed container 2 and within that container is a rotatable spin tub 3 and within the spin tub is an agitator 4. An inter-engagement mechanism is provided to enable the spin tub 3 and the agitator 4 to be raised and lowered when washing liquids hereinafter referred to as water enters the container 1 and such mechanism includes an air chamber shown generally by the reference 5 and is described in the said specification. The agitator 4 is driven by an electronically commutated motor 10, driving a shaft 11 carried in bearings 12. This construction is fully described in the above United States patent specification which is incorporated herein by reference, including a reference to parts of a dog clutch or inter engagement mechanism 13.

A control means 15 is provided preferably associated with the stator of the motor 10 and such control means include starting means arranged so that on appropriate operation of manually operable controls in a console 16 by an operator, starting up of a washing cycle is commenced and water is admitted into the container 2 through a valve 17. Motor controls 19 including sensing means to sense changes in speed and energy input to said rotatable assembly are also provided and the sensing means pass signals indicating these parameters to the control means.

The washing machine has washing liquid level detection means which comprise the spin tub 3, the disengagement of which from the agitator which is caused by its floating and the air chamber in liquid in the container disengaging the parts of the dog clutch mechanism 13 and also lifts the spin tub 3 and this is sensed by sensing means. The washing machine container 2 also has an auxiliary washing liquid level detection means comprising for example a pressure transducer 18 which provides the control means 15 with a signal indicative of the level of water in the container 2.

It has been found that there are two main methods by which the control means may determine the load in a washing machine and therefore

control the supply of water or washing liquid to the level which provides the most effective wash performance.

In each method, the operator places a load eg. of clothes in the spin tub 3 and appropriately operates the manual controls to give a desired wash.

In one form of the invention relating to a first control method, the control equipment includes a microprocessor programmed in accordance with a flow chart shown in Figure 2, and referring to that flow chart, the operator operates the appropriate controls in the console 16 such that the microprocessor enters the flow chart at the start, block 20. The microprocessor causes the agitator and spin tub to rotate to a suitable speed eg. approximately 100 rpm and the supply of power to the motor is controlled by the microprocessor to provide such a speed. Thus a certain amount of energy is imparted to the motor rotor, spin tub, and agitator which together comprise the rotatable assembly of the washing machine, and which, with the load of clothes, provide the initial resistance to rotation. Thus energy is imparted to the clothes in the spin tub. Changes in the velocity of the rotatable assembly correspond to changes in kinetic energy of the rotatable assembly and clothes load. Therefore if electrical energy is provided to the motor such that a certain velocity (and rotational kinetic energy) is attained, the time taken for the motor to coast to zero velocity will be a measure of the mass of the rotatable assembly and the load of clothes in the spin tub. The changes or rates of change of kinetic energy of the spin tub and contents are a measure of the mass of the rotatable assembly and the load of clothes in the spin tub. The changes or rates of change of kinetic energy of the spin tub and contents are a measure of the mass of clothes therein. In Figure 2 the load size is determined at block 22 before water is supplied to the washing container.

Referring now to Figure 4 which is a flow chart applicable to both methods. This figure is a flow chart showing the steps involved in the preferred form of load determination according to the present invention.

The method of Figure 4 determines the changes in kinetic energy of the rotatable assembly comprising the motor, drive shaft, interconnecting means, spin tub, agitator and clothes by supplying a minimum amount of energy to the motor such that the rotatable assembly approximates a predetermined velocity eg. 40 rpm. The motor and motor controls referred to in the specification are of the same form as those described in the specification of our New Zealand patent application no 213489/213490 filed 16 September 1985, (US Patent No 4,857,814) which is incorporated herein by reference. The predetermined velocity is stored in

an information storage means comprising a memory of the microprocessor which controls the motor and is compared with the instantaneous velocity of the motor, which as described in the above specification is constantly calculated by the microprocessor as part of the motor control system function. The motor control system thus provides sensing means which sense the kinetic energy of the rotatable assembly and provide signals indicating the mass of the rotatable assembly and the rotatable contents (clothes load) thereof to the microprocessor. To enable the rotatable assembly to reach the predetermined velocity the pwm period is controlled, effectively controlling the current input to the motor as it is being commutated so that the velocity of the rotatable assembly slowly increases. Referring to Figure 4, the algorithm there illustrated begins at the start block 50. Power is supplied to the motor winding stages at block 51, as described above. It has been found that supplying a minimal amount of energy to the rotatable assembly is desirable, since large amounts of energy in the rotatable assembly mean measurements take a longer time to obtain. When power is supplied to the motor windings, the velocity of the motor and rotatable assembly is then monitored by the motor controller at block 52. A predetermined motor velocity eg. 40 rpm is stored in the memory of the microprocessor and this predetermined velocity is compared at block 53 with the instantaneous motor velocity measured in block 52. When the motor velocity is equal to the predetermined motor velocity, power is removed from the windings and a timer begins at blocks 54 and 55. At this stage the motor velocity is still being measured. After power is removed from the windings the motor speed will gradually decrease until it eventually stops. The point at which the motor velocity reaches zero is determined at block 56 and at this point the timer is stopped at block 57 and the elapsed time is stored in the memory of the microprocessor. This cycle is repeated, the motor being energised and de-energised intermittently.

Referring now to Figure 5, a graph of velocity versus time is shown, the origin representing the point at which the motor velocity is zero, before power is applied to the motor windings. The point 58 on the vertical velocity axis represents the predetermined velocity and the point 59 on the horizontal time axis is a measure of the time taken to reach the predetermined velocity. When the rotatable assembly reaches the predetermined velocity 58 the pwm period is adjusted by means of the motor control system such that the predetermined velocity is maintained. The period for which this is maintained is shown as the time between points 59 and 60 in Figure 5. The points 59 and 60 could be substantially coincidental. The motor is then turned

off at time 60 and allowed to coast. As soon as power is removed from the motor windings a timer is activated in the microprocessor and the back emf induced in the motor windings or the output of hall effect sensors mounted on the stator is monitored, so that the speed of rotation of the motor is known. When the rotatable assembly stops rotating the timer in the microprocessor records the time taken for the motor to decelerate to zero. This time may be for example, time 61 or 62 shown in Figure 5 and this time is representative of the inertia of the rotatable assembly. For example, if there is a large mass of clothes in the spin tub then the inertia of the rotatable assembly will be greater and the time taken for the rotational velocity of the rotatable assembly to reach zero will be significantly longer than the time taken if the spin tub had no clothes therein, for example. Since at this point in the wash cycle the agitator and spin tub are interconnected and the inertia of this apparatus is constant, the only factor which will change the time taken for the motor speed to ramp down will be the load of clothes in the spin tub and therefore the load is known.

However, due to some spurious variables such as the changing position of the clothes within the spin tub, any one reading of the time taken for the speed of the motor to reach zero will not necessarily be precisely representative of the load of clothes in the spin tub. Therefore it has been found that a number of readings eg. at least one reading in each direction of rotation is desirable in order to obtain a true indication of the load of clothes in the machine. If the readings in each direction provide times which are within acceptable tolerances of each other, then these times are compared with time values stored in look up tables in the memory of the microprocessor which provide the control system with an indication of the load of clothes in the machine and therefore the water level which will be required for the wash routine for that load to commence. Once the appropriate water level is known by the control system the wash profile of agitation stroke time, desired speed of rotation and acceleration is selected in accordance with the specification of our New Zealand patent application No 213489/213490.

Although in this form of the invention load measuring may be carried out with the load of clothes dry, the accuracy of load measurements may also be increased by dampening the clothes before taking the measurements. Such dampening is effected by rotating the spin tub slowly while spraying water from the outlet of valve 17 over the clothes in the spin tub.

Once the load size check has been carried out at block 22 of Figure 2 the microprocessor causes valve 17 to be opened by a signal from the "water

on" block 23. Slow stirring with reversals or with intermittent supply of power is carried on at block 24 as has been described above. At this point the load comprises clothes and water. The change in kinetic energy is continuously checked as shown by the circuit 25 containing the slow stir routine at 24. The declutch and disconnection of the agitator 4 from the spin tub 3 is detected by the air chamber or float 5 interrogation at 26. The spin tub and the agitator are connected together by the mechanism 13 and initially a relatively large inertia is present in the associated spin tub, agitator and load of clothes. The inertia of the rotatable assembly and load is measured as a change in kinetic energy when the power to the motor is cut off and the motor is allowed to slow to zero speed after being maintained at a predetermined velocity as described above. The water level in the container increases until the float 5 floats the spin tub upwardly in a manner such as to disconnect the interconnecting means between the agitator and the spin tub. When the disconnection occurs there is a sudden decrease in the inertia of the rotatable assembly which is detected by the sensing means. Referring again to Figure 5, the disconnection is seen by the sensing means as a sudden decrease in the time taken for the rotatable assembly to decelerate from the predetermined velocity to zero. The time taken for the rotatable assembly to decelerate after disconnection may for example be only one tenth that taken prior to disconnection. Thus the time between points 60 and 62 in Figure 5 may represent the time taken for the rotatable assembly to decelerate when the spin tub and agitator are interconnected and the time between points 61 and 60 may represent the time taken for the rotatable assembly to decelerate after declutching has occurred. Thus it can be seen that there is a clear indication provided to the sensing means that disconnection has occurred.

It should be noted that the time taken for the rotatable assembly to accelerate to the predetermined speed may also be used as an indication of the inertia of the rotatable assembly and water and clothes therein. The change in the time required to accelerate the rotatable assembly is not shown in Figure 5 in order to simplify the diagram.

Referring now to Figure 6, the time required for the rotatable assembly of clothes load to reach the predetermined velocity 58 prior to disconnection is the time between the origin and point 63. If the same torque is applied to the motor after disconnection the time taken to reach velocity 58 is that between the origin and point 59. Again the disconnection of the spin tub from the agitator is sensed, the signal change indicated to the control means where, by reference to the look up tables, a water level for the load is selected. The ramp down

times are not shown for simplicity.

Thus when declutching occurs a further timer commences operation, allowing the water supply to remain on for a desired water on overrun time, which is either a predetermined period, or is of say 10-20% of the time to fill the container 2 to declutch. The water on overrun time is operated in block 27 and when that time has elapsed at block 28 the "water off" signal operates at 29 causing valve 17 to close. The load measured from block 22 indicates the washing profile at block 30 and washing started at block 31. The washing profile control is described in the specification of our New Zealand patent application No 213489/213490.

Thus in this first method the water level is determined by adding water after declutching for a period of time which is either a proportion of the time to fill to declutching or a fixed further period of time dependent on the sensed load in the machine.

Referring again to Figure 1, water pressure indicator 18 senses pressure of water in the base of the washing container and therefore also provides an indication of the water level in the container 2. If the pressure indicator 18 is present, the routine to time further water supply in block 27 is not necessary and a branch may be taken from block 26 to block 32 (dashed lines) which checks the water level indicator and compares this at block 33 with the desired water level which has been obtained from look up tables relating to the load size stored in information storage means which comprise the memory of the microprocessor. If the correct water level has been reached the water off block is returned to at 29, the wash profile is set by reference to the look up tables and the wash begins.

Although the load of clothes in the spin tub may be sensed before water is added to the spin tub by the method previously described, a second method of determining the load of clothes in the spin tub is to start the washing machine motor from a stand still as previously described but in addition, substantially simultaneously or earlier admitting water to the container, increasing the rotational velocity of the motor up until a predetermined velocity is obtained and then measuring the time taken for the rotational velocity to drop to zero, as the water is being allowed to enter the washing container. When a certain known quantity of water is present in the container, float 5 will rise and the spin tub will be disconnected from the agitator such that the spin tub is stationary. As with the first method, since the spin tub comprises a significant proportion of the mass of the rotatable assembly, the inertia of the assembly will suddenly decrease and after the predetermined velocity is reached, the time taken for the rotatable assembly to come to a halt will suddenly decrease by a significant

time period. The microprocessor has in its memory a figure representative of a sufficiently large time period such that if the measured time period decreases by an amount which is equal to or greater than the value stored in a memory of the microprocessor, the microprocessor will signal that disconnection of the spin tub from the agitator has occurred. The amount of water necessary for disconnection to occur will vary depending on the load of clothes in the spin tub. The microprocessor has stored the time value indicative of the total load of the rotatable assembly from the last iteration prior to disconnection. Thus the load of clothes and water in the machine is known just prior to disconnection. Since the time from when water was first introduced to the container to the time at which disconnection occurs is a relative measure of the load of clothes in the spin tub depending on the rate of water flow into the machine, the microprocessor may now refer to a look up table in order to obtain a value of the time required to fill the container to a desired water level. The look up table in the microprocessor provides a further "water on" time after disconnection which is a percentage overrun time based on the time taken to fill the container to declutch.

In the routine of Figure 3, as stated above, operating the controls causes a routine to start at 20 and the microprocessor causes the valve 17 to be opened by a signal from the "water on" block 21. Before load measurement begins the spin tub may be rotated slowly such that the outlet of valve 17 sprays water on top of the clothes in the container in order to ensure that the clothes are uniformly wet before load measurement begins. In addition slow stirring is commenced by a signal from block 35, such slow stir includes acceleration and deceleration sequences during which there are changes in kinetic energy and the speed changes and the mass of the load can be indicated by sensing means which sense the changes in kinetic energy over a predetermining time or between predetermined speeds. As explained above with reference to Figures 4 and 5, signals indicating the changes in kinetic energy are then passed from block 36. The spin tub and the agitator are connected together by the mechanism 13 and initially a relatively large inertia is present in the associated spin tub agitator and load of clothes. This inertia is measured for example as a change in kinetic energy when the power to the motor is cut off and allowed to slow to zero speed as previously described. The water level in the container increases, until the float 5 floats the spin tub upwardly in a manner such as to disconnect the interconnecting means between the agitator and spin tub. At this point there is a sudden decrease in the inertia of the rotatable assembly and this decrease in inertia

is detected by the sensing means and instead of the microprocessor indicating that the slow stir is to continue, causes at 37 a signal to be passed by block 36 indicating that disconnection has occurred as indicated by the block 38. The momentum or kinetic energy signal reached in the final stages before declutching is recorded at block 38 and is passed to block 42. The mass of the clothes load in the spin tub has been found by experiment to be directly proportional to the quantity of water required to float the spin tub. The water or washing liquid is supplied to the container at a fixed rate and therefore the time between turning the water valve "on" and disconnection is also an indication of the load of clothes in the container. Since the water level at disconnection is known from pressure indicator 18 the load of clothes is known and the control means can supply the appropriate water level for washing. If water pressure indicator 18 is not present the mass of the clothes load and the desired washing water level may be calculated by the control means eg. by the look up tables in the microprocessor since the relationship between water level at disconnection and clothes load is known and the total load of water and clothes is known at disconnection. The operator will have selected a desired degree of vigorousness of wash and this vigorousness is affected by the momentum of the spin tub, agitator, clothes and water container at the declutch level. Accordingly a desired rotary stroke of the agitator during washing is set up according to the momentum figure stored in block 42 as is described in New Zealand patent specification No 213489/213490.

Once disconnection or declutching has occurred according to signals from block 36, (and the timing of such disconnection depends on the size of the clothes load) the microprocessor continues to check the load which is still influenced by the filling of water into the container 2 as is indicated in block 39 and the microprocessor determines at block 40 as to whether a desired water level and load measurement has been reached. This is achieved by means of the water pressure indicator 18 from which the microprocessor has determined the water level at disconnection. Knowing the water level at this point means that the load of clothes in the spin tub is known and the microprocessor then refers to a look up table to determine the desired water level. The water level may then be monitored by checking the pressure indicator at block 39. Also, once the time to declutch is known the correct water level may be reached by timing the further water supply as shown in the block 44 with dashed lines, this time being an empirically decided percentage overrun time from the time taken for declutch to occur. When the correct water level has been reached in block 45 the water valve 17 is

turned off in block 41 and the wash begins in block 43.

After the washing container has been filled to the desired level and before the wash begins, the clothes in the washing container will often have a number of air bubbles therein and when agitation begins these will be expelled and the water level in the container may drop significantly. Therefore in each of the methods described, in machines which are provided with a water pressure indicator 18, before the wash is started the agitator is rotated back and forth a small number of strokes in order to expel the air trapped in the clothes in the spin tub. Once the air is removed the water valve 17 is turned on again in order to refill the water container 2 to the desired level.

From the foregoing it will be seen that methods of providing an optimum water level for a load of clothes in a washing machine are provided which are performed automatically by the machine without any necessary information or decisions being supplied by the operator, other than decisions regarding vigorousness of wash.

Claims

1. A method of providing a required level of washing liquid in a laundry machine having a cabinet (1), a washing container (2) within said cabinet (1), a rotatable assembly including a spin tub (3) within said container (2) and an agitator (4) within said spin tub, a motor (10) driving said agitator conjointly with said spin tub or separately on disconnection of said spin tub from said agitator as required, and washing liquid level control means (15, 16, 17) to control washing liquid level in said washing container, the method comprising:

placing a load of clothes in said spin tub (3), initiating the supply of washing liquid to said container (2) and energizing said motor (10) intermittently to produce changes in the rotational speed of said rotatable assembly as washing liquid is being supplied to said container;

sensing the changes in speed of said rotatable assembly relative to energy input to said motor with a sensing means (19);

passing signals indicative of the total rotating mass of said rotatable assembly including the washing liquid in said container and the clothes in said spin tub from said sensing means (19) to said liquid level control means (15, 16, 17);

said method being characterised in that the point of disconnection of said spin tub (3) from said agitator (4) is determined dependent on said signals by said control means (15, 16,

17), said signals passed from said sensing means (19) to said control means at the time of disconnection being indicative of the mass of said load of clothes;

and being further characterised in that said required level of washing liquid is determined with said control means (15, 16, 17) from said signals at the time of disconnection, said required level being dependent on the mass of the load of clothes;

controlling the supply of further washing liquid to said container to said required level with said control means (15, 16, 17); and

causing the wash routine to start when said required level is reached.

2. A method as claimed in claim 1 wherein:
 - sensing said total rotating mass of said rotatable assembly comprises controlling the supply of power to said motor (10) with said control means (15, 16, 17) so that said rotatable assembly is accelerated to a required rotational velocity;
 - removing power from the motor (10);
 - measuring the time taken for the rotatable assembly to attain zero rotational velocity, said time indicating total rotating mass, said time being passed to said control means (15, 16, 17) as said signal; and
 - repeating said steps to obtain further time measurements as required.
3. A method as claimed in claim 1 wherein:
 - sensing said total rotating mass of said rotatable assembly comprises controlling the supply of power to said motor (10) and with said control means (15, 16, 17) so that said rotatable assembly is accelerated to a required rotational velocity;
 - measuring the time taken for the rotatable assembly to attain said required velocity, said time indicating said total rotating mass;
 - passing said time to said control means as said signal; and
 - repeating said steps to obtain further time measurements as required.
4. A method as claimed in any one of the preceding claims and further comprising:
 - storing information of the mass of the load of clothes in information storage means (15, 19) after sensing the load of clothes in the spin tub (3) and using the stored information to provide routines (30, 42, 63) selected from giving an indication of a wash profile of agitation stroke times, required speed of rotation and acceleration requested for the sensed selected load of clothes to be washed and to

turned off in block 41 and the wash begins in block 43.

After the washing container has been filled to the desired level and before the wash begins, the clothes in the washing container will often have a number of air bubbles therein and when agitation begins these will be expelled and the water level in the container may drop significantly. Therefore in each of the methods described, in machines which are provided with a water pressure indicator 18, before the wash is started the agitator is rotated back and forth a small number of strokes in order to expel the air trapped in the clothes in the spin tub. Once the air is removed the water valve 17 is turned on again in order to refill the water container 2 to the desired level.

From the foregoing it will be seen that methods of providing an optimum water level for a load of clothes in a washing machine are provided which are performed automatically by the machine without any necessary information or decisions being supplied by the operator, other than decisions regarding vigorousness of wash.

Claims

1. A method of providing a required level of washing liquid in a laundry machine having a cabinet (1), a washing container (2) within said cabinet (1), a rotatable assembly including a spin tub (3) within said container (2) and an agitator (4) within said spin tub, a motor (10) driving said agitator conjointly with said spin tub or separately on disconnection of said spin tub from said agitator as required, and washing liquid level control means (15, 16, 17) to control washing liquid level in said washing container, the method comprising:

placing a load of clothes in said spin tub (3), initiating the supply of washing liquid to said container (2) and energizing said motor (10) intermittently to produce changes in the rotational speed of said rotatable assembly as washing liquid is being supplied to said container;

sensing the changes in speed of said rotatable assembly relative to energy input to said motor with a sensing means (19);

passing signals indicative of the total rotating mass of said rotatable assembly including the washing liquid in said container and the clothes in said spin tub from said sensing means (19) to said liquid level control means (15, 16, 17);

said method being characterised in that the point of disconnection of said spin tub (3) from said agitator (4) is determined dependent on said signals by said control means (15, 16,

17), said signals passed from said sensing means (19) to said control means at the time of disconnection being indicative of the mass of said load of clothes;

and being further characterised in that said required level of washing liquid is determined with said control means (15, 16, 17) from said signals at the time of disconnection, said required level being dependent on the mass of the load of clothes;

controlling the supply of further washing liquid to said container to said required level with said control means (15, 16, 17); and

causing the wash routine to start when said required level is reached.

2. A method as claimed in claim 1 wherein:

sensing said total rotating mass of said rotatable assembly comprises controlling the supply of power to said motor (10) with said control means (15, 16, 17) so that said rotatable assembly is accelerated to a required rotational velocity;

removing power from the motor (10);

measuring the time taken for the rotatable assembly to attain zero rotational velocity, said time indicating total rotating mass, said time being passed to said control means (15, 16, 17) as said signal; and

repeating said steps to obtain further time measurements as required.

3. A method as claimed in claim 1 wherein:

sensing said total rotating mass of said rotatable assembly comprises controlling the supply of power to said motor (10) and with said control means (15, 16, 17) so that said rotatable assembly is accelerated to a required rotational velocity;

measuring the time taken for the rotatable assembly to attain said required velocity, said time indicating said total rotating mass;

passing said time to said control means as said signal; and

repeating said steps to obtain further time measurements as required.

4. A method as claimed in any one of the preceding claims and further comprising:

storing information of the mass of the load of clothes in information storage means (15, 19) after sensing the load of clothes in the spin tub (3) and using the stored information to provide routines (30, 42, 63) selected from giving an indication of a wash profile of agitation stroke times, required speed of rotation and acceleration requested for the sensed selected load of clothes to be washed and to



control the washing routine to give a required degree of wash to the clothes.

5. A method as claimed in any one of the preceding claims and further comprising:

rotating said container (2) slowly in one direction and supplying a required quantity of washing liquid to said container (2) before energizing said motor (10) intermittently so that said load of clothes is damp before intermittent energisation of said motor (10).

6. A method as claimed in any one of the preceding claims and further comprising:

commencing a gentle wash agitation of the clothes for a predetermined time after said control means (15, 16, 17) have supplied washing liquid to said container to said required level;

stopping said gentle wash agitation;
detecting the washing liquid level in said container (2); and

if said washing liquid level is below said required level, supplying further washing liquid to said container (2) so that said washing liquid level becomes said required level, and when said washing liquid is at said required level, causing continuous washing action to commence.

7. A method as claimed in claim 1 and further comprising:

measuring the time taken to supply washing liquid into the container (2) to a level which causes disconnection of said agitator (4) from said spin tub (3); and

effecting the supply of further washing liquid to said container (2) by said control means (15, 16, 17) dependent on timing means which time the supply of further washing liquid to said container as a proportion of the time taken for the level of washing liquid necessary for disconnection.

8. A method as claimed in any one of the preceding claims and further comprising:

effecting the supply of further washing liquid to said container (2) by said control means (15, 16, 17) dependent on auxiliary washing liquid detection means (18) which detect the level of washing liquid in said container.

9. A laundry machine comprising:

a cabinet (1); a washing container (2), within said cabinet; a rotatable assembly comprising a spin tub (3) within said container (2) and an agitator (4) within said spin tub (3); disconnecting means (5, 13) for disconnecting

said spin tub (3) from said agitator (4) for spinning action when required; a motor (10) driving said agitator conjointly with said spin tub (3) and separately on disconnection of said spin tub from said agitator as required; sensing means (19) to sense the changes in speed of said rotatable assembly including the mass of clothes load in said assembly relative to energy input to said motor; washing liquid level control means (15, 16, 17) comprising washing liquid admission means (17), control means comprising means (15) for intermittently energising said motor (10), and washing liquid admission control means (16) arranged to control said washing liquid admission means (17) in said washing container in response to signals passed by said sensing means (19) to said washing liquid level control means (15, 16, 17); the construction and arrangement being such that at each intermittent energising of said motor said sensing means (19) pass signals indicative of the total mass of said rotatable assembly including the washing liquid in said container (2) and the clothes in said spin tub (3) to said washing liquid level control means (15, 16, 17),

characterised in that said washing liquid level control means (15, 16, 17) detect the point of disconnection of said spin tub (3) from said agitator (4) through receipt of said signals, said signals passed including a disconnection signal indicating the point of disconnection of said spin tub from said agitator and being indicative of the mass of said load of clothes, and

further characterised in that upon detection of said disconnection, said washing liquid level control means (15, 16, 17) also determine a required washing liquid level dependent on said signals and control the supply of further washing liquid to said container to control the level of washing liquid to said required level which is dependent upon the mass of clothes load sensed by said sensing means and causing the wash routine to start when said required level is reached,

10. A laundry machine as claimed in claim 9 wherein:

said means for intermittently energising said motor controls the supply of power to said motor so that said rotatable assembly is accelerated to a predetermined rotational velocity, and then power is removed from the motor, and further comprising timer means which measure the time taken for the rotatable assembly to attain zero rotational velocity from said predetermined velocity, said time indica-



tive of said total rotating mass, and supply said disconnection signal when the measured time is greatly reduced compared to the previously measured time.

11. A laundry machine as claimed in claim 9 wherein:

said means for intermittently energising said motor controls the supply of power to said motor so that said rotatable assembly is accelerated to a desired rotational velocity, and further comprising timer means which measure the time taken for the rotatable assembly to attain said desired velocity, said time indicative of said total rotating mass, and supply said disconnection signal when the measured time is greatly reduced compared to the previously measured time.

12. A laundry machine as claimed in any one of claims 9 to 11 and further comprising:

information storage means (15, 19) for storing of information of the mass of the load of clothes responsive to said signals and using the stored information to provide routines selected from giving an indication of a wash profile of agitation stroke times, required speed of rotation and acceleration required for the sensed selected load of clothes to be washed and to control the washing routine to give a required degree of wash to the clothes.

13. A laundry machine as claimed in any one of claims 9 to 12 and further comprising:

means for rotating said container slowly in one direction and supplying a required quantity of washing liquid to said container before energizing said motor (10) intermittently so that said load of clothes is damp before intermittent energisation of said motor (10).

14. A laundry machine as claimed in any one of claims 9 to 12 and further comprising:

means for commencing a gentle wash agitation of the clothes for a predetermined time after said washing liquid has been supplied to said container (2) to said required level; stopping said gentle wash agitation; detecting the washing liquid level in said container (2); and

if said washing liquid level is below said required level, supplying further washing liquid to said container (2) so that said washing liquid level becomes said required level, and when said washing liquid is at said required level, causing continuous washing action to commence.

15. A laundry machine as claimed in any one of claims 9 to 14 and further comprising:

means to measure the time taken for supply of washing liquid into the container (2) to a level which causes disconnection of said agitator (4) from said spin tub (3) and the supply of further washing liquid to said container effected by said washing liquid level control means dependent on timing means which time the supply of further washing liquid to said container as a proportion of the time taken for the level of washing liquid necessary for disconnection.

16. A laundry machine as claimed in any one of claims 9 to 15 wherein:

an auxiliary washing liquid level detection means (18) is provided, said washing liquid level control means (15, 16, 17) effecting the supply of further washing liquid dependent on said auxiliary liquid level detection means (18).

17. A laundry machine as claimed in any one of claims 9 to 16 wherein:

said control means comprises means for sensing said total rotating mass of said rotatable assembly and causing a predetermined level of power to be supplied to said motor for a predetermined time to thereby cause the rotatable assembly to accelerate from an initial known velocity to a final velocity, and for determining the velocity difference from which a signal indicative of the total rotating mass is passed to said liquid level control means as said disconnection signal.

Patentansprüche

1. Ein Verfahren zum Schaffen eines erforderlichen Pegels einer Waschflüssigkeit in einer Waschmaschine, die ein Gehäuse (1), einen Waschbehälter (2) in dem Gehäuse (1), eine drehbare Anordnung mit einer Trommel (3) in dem Behälter (2) und ein Rührwerk (4) in der Trommel, einen Motor (10), der das Rührwerk gemeinsam mit der Trommel oder gesondert von der Trommel bei einer Loslösung der Trommel von dem Rührwerk wie erforderlich, und Steuermitteln für den Pegel der Waschflüssigkeit (15, 16, 17) zum Steuern des Pegels der Waschflüssigkeit in dem Waschbehälter, hat, mit den folgenden Verfahrensschritten: Einbringen einer Menge von Wäsche in die Trommel (3), Starten der Zufuhr von Waschflüssigkeit in den Behälter (2) und Erregen des Motors (10) intermittierend zum Erzeugen von Änderungen der Drehgeschwindigkeit der drehbaren Anordnung, während Waschflüssig-



keit dem Behälter zugeführt wird;

Messen der Änderungen der Geschwindigkeit der drehbaren Anordnung relativ zu der Energiezufuhr zur dem Motor mittels eines Meßmittels (19);

Führen von Signalen, die die gesamte drehende Masse der drehbaren Anordnung einschließlich der Waschflüssigkeit in dem Behälter und der Wäsche in der Trommel angeben, von dem Meßmittel (19) zum dem den Flüssigkeitspegel steuernden Mittel (15, 16, 17);

wobei das Verfahren dadurch gekennzeichnet ist, daß der Punkt der Loslösung der Trommel (3) von dem Rührwerk (4) in Abhängigkeit von Signalen durch das Steuermittel (15, 16, 17) bestimmt wird, wobei die Signale von dem Meßmittel (19) zu dem Steuermittel zu dem Zeitpunkt der Loslösung, die die Masse der Menge an Wäsche angeben, geführt werden; und weiter dadurch gekennzeichnet, daß der erforderliche Pegel der Waschflüssigkeit mittels des Steuermittels (15, 16, 17) von den Signalen zu dem Zeitpunkt der Loslösung bestimmt wird, wobei der erforderliche Pegel von der Masse der Menge an Wäsche abhängig ist;

Steuern der Zufuhr der Waschflüssigkeit zu dem Behälter auf den erforderlichen Pegel mittels des Steuermittels (15, 16, 17) und Bewirken des Starts des Waschvorgangs, wenn der erforderliche Pegel erreicht ist.

2. Verfahren nach Anspruch 1, unter:

Messen der gesamten drehenden Masse der drehbaren Anordnung einschließlich Steuern der Zufuhr von Leistung zu dem Motor (10) mittels des Steuermittels (15, 16, 17), so daß die drehbare Anordnung auf eine erforderliche Drehgeschwindigkeit beschleunigt wird;

Entfernen der Leistung von dem Motor (10); Messen der Zeit, die die drehbare Anordnung benötigt, um eine Drehgeschwindigkeit von null zu erreichen, wobei die Zeit die gesamte drehende Masse angibt und die Zeit zu dem Steuermittel (15, 16, 17) als Signal geführt wird; und

Wiederholen der Schritte, um weitere Zeitmessungen zu erreichen, wie erforderlich.

3. Ein Verfahren, wie in Anspruch 1 beansprucht, wobei:

das Messen der gesamten drehenden Masse der drehbaren Anordnung das Steuern der Zufuhr von Leistung zu dem Motor (10) aufweist und wobei das Steuermittel (15, 16, 17) derart wirken, daß die drehbare Anordnung auf eine erforderliche Drehgeschwindigkeit beschleunigt wird;

die Zeit gemessen wird, die die drehbare Anordnung benötigt, um die erforderliche Geschwindigkeit zu erreichen, wobei die Zeit die gesamte drehende Masse angibt;

die Zeit als das Signal zu dem Steuermittel geführt wird, und

diese Schritte wiederholt werden, um weitere Zeitmessungen zu erhalten, falls erforderlich.

4. Ein Verfahren nach einem der vorangehenden Ansprüche und weiter mit:

Speichern von Information über die Masse der Menge an Wäsche in dem Informationsspeichermittel (15, 19) nach dem Messen der Menge an Wäsche in der Trommel (3) und Verwenden der gespeicherten Information zur Schaffung von Routinen (30, 42, 63), die aus einer gegebenen Angabe eines Waschprofils der Anzahl der Rührvorgänge, der erforderlichen Geschwindigkeit der Drehung und der Beschleunigung, die für die gemessene gewählte Menge an Wäsche, die zu waschen ist, erforderlich sind, und zum Steuern der Waschroutine, um ein gewünschtes Ausmaß der Waschung der Wäsche zu erreichen.

5. Ein Verfahren wie in einem der vorangehenden Ansprüche beansprucht und weiter mit:

Drehen des Behälters (2) langsam in eine Richtung und Zuführen einer erforderlichen Menge der Waschflüssigkeit zu dem Behälter (2) vor dem intermittierenden Erregen des Motors (10) derart, daß die Menge an Wäsche vor dem intermittierenden Erregen des Motors (10) befeuchtet wird.

6. Ein Verfahren wie in einem der vorangehenden Ansprüche beansprucht und weiter mit:

Bewirken eines sanften Rührens der Wäsche für eine vorgegebene Zeit, nachdem die Steuermittel (15, 16, 17) eine Waschflüssigkeit zu dem Behälter auf den erforderlichen Pegel gebracht haben;

Stoppen des sanften Rührens der Wäsche;

Bestimmen des Pegels der Waschflüssigkeit in dem Behälter (2); und

wenn der Pegel der Waschflüssigkeit unterhalb des erforderlichen Pegels ist, weiteres Zuführen von Waschflüssigkeit zu dem Behälter (2), so daß der Pegel der Waschflüssigkeit den erforderlichen Pegel erreicht, und wenn die Waschflüssigkeit bei dem gewünschten Pegel ist, bewirken des Beginnens des kontinuierlichen Waschvorgangs.

7. Ein Verfahren nach Anspruch 1 und weiter mit:

Messen der Zeit, die erforderlich ist, um Waschflüssigkeit in den Behälter (2) zuzufüh-



ren auf einen Pegel, der die Loslösung des Rührwerks (4) von der Trommel (3) bewirkt; und

Bewirken der Zufuhr weiterer Waschflüssigkeit zu dem Behälter (2) durch die Steuermittel (15, 16, 17) abhängig von einem Zeitmittel, das die Zufuhr der weiteren Waschflüssigkeit zu dem Behälter zeitlich bestimmt als ein Verhältnis der Zeit, die erforderlich ist zum Erreichen eines Pegels der Waschflüssigkeit, die für die Loslösung notwendig ist.

8. Ein Verfahren nach einem der vorangehenden Ansprüche und weiter mit:

Bewirken der Zufuhr weiterer Waschflüssigkeit zu dem Behälter (2) durch die Steuermittel (15, 16, 17) in Abhängigkeit von zusätzlichen Erkennungsmitteln für die Waschflüssigkeit (18), die den Pegel der Waschflüssigkeit in dem Behälter bestimmen.

9. Eine Waschmaschine mit:

einem Gehäuse (1); einem Waschbehälter (2) in dem Gehäuse; einer drehbaren Anordnung mit einer Trommel (3) in dem Behälter (2) und einem Rührwerk (4) in der Trommel (3); Mitteln (5, 139 zum Loslösen der Trommel (3) von dem Rührwerk (4) zum Bewirken des Schleudervorgangs, wenn erforderlich; einem Motor (10), der das Rührwerk gemeinsam mit der Trommel (3) antreibt und gesondert bei einer Loslösung der Trommel von dem Rührwerk, wenn erforderlich; Meßmitteln (19) zum Messen der Änderungen der Geschwindigkeit der drehbaren Anordnung, einschließlich der Masse der Menge an Wäsche in der Anordnung relativ zu der Energiezufuhr zu dem Motor; Steuermitteln (15, 16, 17) zum Bestimmen des Pegels der Waschflüssigkeit einschließlich Mitteln zum Zuführen der Waschflüssigkeit, Steuermitteln mit Mitteln (15) zum intermittierenden Erregen des Motors (10) und Steuermitteln (16) für die Zufuhr an Waschflüssigkeit, die zur Steuerung der Mittel zum Zuführen von Waschflüssigkeit (17) in dem Waschbehälter angeordnet sind in Abhängigkeit von Signalen, die von dem Meßmittel (19) zu den Steuermitteln für den Pegel der Waschflüssigkeit (15, 16, 17) herangeführt sind; wobei der Aufbau und die Anordnung derart sind, daß bei jedem intermittierenden Erregen des Motors das Meßmittel (19) Signale heranzuführt, die die Gesamtmasse der drehbaren Anordnung einschließlich der Waschflüssigkeit in dem Behälter und der Wäsche in der Trommel (3) angeben zu den Steuermitteln (15, 16, 17) für den Pegel der Waschflüssigkeit, dadurch gekennzeichnet, daß die Steuermittel

(15, 16, 17) für den Pegel der Waschflüssigkeit den Punkt der Lösung der Trommel (3) von dem Rührwerk (4) durch die Aufnahme von Signalen erkennen, wobei die herangeführten Signale ein Loslösungssignal beinhalten, das den Punkt der Loslösung der Trommel von dem Rührwerk beinhaltet und für die Masse der Menge an Wäsche indikativ ist, und weiter dadurch gekennzeichnet, daß die Steuermittel (15, 16, 17) für den Pegel der Waschflüssigkeit auch bei dem Erkennen der Loslösung einen erforderlichen Pegel der Waschflüssigkeit in Abhängigkeit von den Signalen erkennt und die Zufuhr weiterer Waschflüssigkeit in den Behälter steuert, um den Pegel der Waschflüssigkeit auf den erforderlichen Pegel zu bestimmen, der von der Masse der Menge an Wäsche, die von dem Meßmittel gemessen ist, abhängt und ein Starten des Waschvorgangs bewirkt, wenn der erforderliche Pegel erreicht ist.

10. Eine Waschmaschine, wie in Anspruch 9 beansprucht, wobei:

die Mittel zum intermittierenden Erregen des Motors die Zufuhr von Leistung zu dem Motor derart steuern, daß die drehbare Anordnung auf eine vorgegebene Drehgeschwindigkeit beschleunigt wird und sodann die Leistung von dem Motor entfernt wird und weiter mit einem Zeitgeber, der die Zeit mißt, die die drehbare Anordnung benötigt, um die Drehgeschwindigkeit von null von der vorgegebenen Geschwindigkeit zu erreichen, wobei die Zeit für die gesamte drehende Masse indikativ ist, und der das Loslösungssignal liefert, wenn die gemessene Zeit erheblich geringer ist, als die vorangehend gemessene Zeit.

11. Eine Waschmaschine, wie in Anspruch 9 beansprucht, wobei:

das Mittel zum intermittierenden Erregen des Motors die Zufuhr der Leistung zu dem Motor steuert, so daß die drehbare Anordnung auf eine gewünschte Drehgeschwindigkeit beschleunigt wird und weiter mit einem Zeitgeber, der die Zeit mißt, die die drehbare Anordnung benötigt, um die gewünschte Geschwindigkeit zu erreichen, wobei die Zeit für die gesamte drehende Masse repräsentativ ist und der das Loslösungssignal liefert, wenn die gemessene Zeit gegenüber der vorangehend gemessenen Zeit erheblich verringert ist.

12. Eine Waschmaschine wie in einem der Ansprüche 9 bis 11 beansprucht und weiter mit: Informationsspeichermitteln (15, 19) zum Speichern von Information über die Masse der



Menge der Wäsche, die für die Signale verantwortliche ist und Verwenden der gespeicherten Information, um Routinen zu schaffen, ausgewählt aus einer Angabe eines Waschprofils der Anzahl von Rühhüben, der erforderlichen Geschwindigkeit der Drehung und der Beschleunigung, die für die gemessene ausgewählte Menge an zu waschender Wäsche erforderlich ist und zum Steuern der Waschroutine, um ein erforderliches Ausmaß des Waschens der Wäsche zu geben.

13. Eine Waschmaschine wie in einem der Ansprüche 9 bis 12 beansprucht und weiter mit: Mitteln zum langsamen Drehen des Behälters in eine Richtung und Zuführen einer erforderlichen Menge der Waschflüssigkeit zu dem Behälter vor dem intermittierenden Erregen des Motors (11), so daß die Menge der Wäsche vor dem intermittierenden Erregen des Motors (10) feucht ist.

14. Eine Waschmaschine wie in einem der Ansprüche 9 bis 11 beansprucht und weiter mit: Mitteln zum Beginnen eines sanften Waschrührens der Wäsche für einen vorgegebenen Zeitraum, nachdem die Waschflüssigkeit in dem Behälter (2) auf den erforderlichen Pegel angegeben worden ist; Stoppen des sanften Waschrührens; Erkennen des Pegels der Waschflüssigkeit in dem Behälter (2); und wenn der Waschpegel unterhalb des erforderlichen Pegels ist, Zuführen von weiterer Waschflüssigkeit zu dem Behälter (2), so daß der Waschpegel den erforderlichen Pegel erreicht und wenn die Waschflüssigkeit auf dem erforderlichen Pegel ist, Bewirken des Beginnens eines kontinuierlichen Waschvorgangs.

15. Eine Waschmaschine wie in einem der Ansprüche 9 bis 11 beansprucht und weiter mit: Mitteln zum Messen der Zeit, die für die Zufuhr der Waschflüssigkeit in dem Behälter (2) auf einem Pegel, der die Loslösung des Rührwerks (7) der Trommel (3) bewirkt, erforderlich ist, und die Zufuhr weiterer Waschflüssigkeit zu dem Behälter, die durch das Steuermittel für den Waschflüssigkeitspegel bewirkt wird, unabhängig von Zeitgebermitteln, wobei die Zeit der Zufuhr von weiterer Waschflüssigkeit zu dem Behälter ein Teil der Zeit ist, die erforderlich ist, um den Pegel der Waschflüssigkeit zu erreichen, der für die Loslösung notwendig ist.

16. Eine Waschmaschine wie in einem der Ansprüche 9 bis 15 beansprucht, wobei:

ein zusätzliches Erkennungsmittel (18) für den Pegel der Waschflüssigkeit vorgesehen ist, wobei die Steuermittel (15, 16, 17) für den Pegel der Waschflüssigkeit die Zufuhr einer weiteren Waschflüssigkeit unabhängig von dem zusätzlichen Mittel (18) zum Bestimmen des Flüssigkeitspegels ist.

17. Eine Waschmaschine wie in einem der Ansprüche 9 bis 16 beansprucht, wobei: das Steuermittel Mittel zum Messen der gesamten drehenden Masse der drehbaren Anordnung und zum Bewirken einer vorgegebenen Menge an Leistung, die dem Motor für eine vorgegebene Zeit zuzuführen ist, um so die drehbare Anordnung zu veranlassen, von einer anfänglichen bekannten Geschwindigkeit auf eine Endgeschwindigkeit zu beschleunigen, und zum Bestimmen der Geschwindigkeitsdifferenz, aus der ein Signal, welches für die gesamte Drehmasse repräsentativ ist, zu dem Steuermittel für den Flüssigkeitspegel als das Loslösungssignal geführt wird.

Revendications

1. Procédé pour indiquer un niveau requis du liquide de lavage dans une machine à laver le linge comportant une enceinte (1), une cuve de lavage (2) située dans ladite enceinte (1), un ensemble rotatif comportant un tambour rotatif (3) situé dans ladite cuve (2) et un agitateur (4) situé dans ledit tambour rotatif, un moteur (10) entraînant l'agitateur conjointement avec ledit tambour rotatif ou séparément dans le cas du débranchement dudit tambour rotatif par rapport audit agitateur lorsque cela est requis, et des moyens (15,16,17) de commande du niveau de liquide de lavage pour commander le niveau du liquide de lavage dans ladite cuve de lavage, le procédé consistant à :

placer une charge de vêtements dans ledit tambour rotatif (3), déclencher l'envoi du liquide de lavage à ladite cuve (2) et activer par intermittence ledit moteur (10) pour produire des modifications de la vitesse de rotation dudit ensemble rotatif, lorsque le liquide de lavage est envoyé à ladite cuve;

détecter les variations de la vitesse dudit ensemble rotatif par rapport à l'envoi d'énergie audit moteur, à l'aide de moyens de détection (19);

transmettre des signaux indicatifs de la masse totale en rotation dudit ensemble rotatif incluant le liquide de lavage dans ladite cuve et les vêtements situés dans ledit tambour rotatif, depuis lesdits moyens de détection (19) auxdits moyens (15,16,17) de commande du



niveau de liquide;

ledit procédé étant caractérisé en ce que l'instant de débranchement dudit tambour rotatif (3) par rapport audit agitateur (4) est déterminé en fonction desdits signaux par lesdits moyens de commande (15,16,17), lesdits signaux transmis par lesdits moyens de détection (19) auxdits moyens de commande au moment du débranchement étant indicatifs de la masse de ladite charge en vêtements; et

caractérisé en outre en ce que ledit niveau requis du liquide de lavage est déterminé avec lesdits moyens de commande (15,16,17) à partir desdits signaux au moment du débranchement, ledit niveau requis dépendant de la masse de la charge de vêtements;

commander l'envoi d'une quantité supplémentaire de liquide de lavage à ladite cuve jusqu'audit niveau requis, à l'aide desdits moyens de commande (15,16,17); et

déclencher le programme de lavage lorsque ledit niveau requis est atteint.

2. Procédé selon la revendication 1, selon lequel :

la détection de ladite masse totale en rotation dudit ensemble rotatif comprend la commande de l'envoi d'énergie audit moteur (10), par lesdits moyens de commande (15,16,17) de telle sorte que ledit ensemble rotatif est accéléré jusqu'à une vitesse de rotation requise;

la suppression de l'envoi d'énergie au moteur (10);

la mesure de la durée nécessaire à l'ensemble rotatif pour atteindre la vitesse de rotation nulle, ladite durée indiquant la masse totale en rotation, cette durée étant transmise auxdits moyens de commande (15,16,17) pour constituer ledit signal; et

la répétition desdites étapes pour obtenir d'autres mesures de durée, comme cela est requis.

3. Procédé selon la revendication 1, selon lequel :

la détection de ladite masse totale en rotation dudit ensemble rotatif comprend la commande de l'envoi d'énergie audit moteur (10) et avec lesdits moyens de commande (15,16,17) de sorte que ledit ensemble rotatif est accéléré jusqu'à une vitesse de rotation requise;

mesurer la durée nécessaire à l'ensemble rotatif pour atteindre ladite vitesse requise, ladite durée étant indicative de ladite masse totale en rotation;

la transmission de ladite durée auxdits

moyens de commande en tant que ledit signal; et

la répétition desdites étapes pour obtenir d'autres mesures de durée, comme cela est requis.

4. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre :

une mémorisation de l'information de la masse de la charge de vêtements dans des moyens formant mémoire d'informations (15,19) après détection de la charge de vêtements dans le tambour rotatif (3) et l'utilisation de l'information mémorisée pour obtenir des programmes (30,42,63) sélectionnés à partir de la délivrance d'une indication d'un profil de lavage pour des durées de courses d'agitation, la vitesse requise de rotation et l'accélération requise pour la charge sélectionnée détectée de vêtements devant être lavés, et pour commander le programme de lavage pour obtenir un degré requis de lavage des vêtements.

5. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre :

l'entraînement en rotation lente de ladite cuve (2) dans un sens et l'envoi d'une quantité requise du liquide de lavage à ladite cuve (2) avant activation intermittente dudit moteur (10) de telle sorte que ladite charge de vêtements soit humide avant une activation intermittente dudit moteur (10).

6. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre :

un démarrage avec une agitation lente pour le lavage des vêtements, pendant une durée prédéterminée après que lesdits moyens de commande (15,16,17) ont envoyé du liquide de lavage à ladite cuve jusqu'audit niveau requis;

l'arrêt de ladite agitation de lavage en douceur;

la détection du niveau du liquide de lavage dans ladite cuve (2); et

si ledit niveau du liquide de lavage est inférieur audit niveau requis, l'envoi d'une quantité supplémentaire du liquide de lavage à ladite cuve (2) de sorte que ledit niveau du liquide de lavage devient ledit niveau requis, et lorsque ledit liquide de lavage est au niveau requis, le déclenchement d'une action continue de lavage.

7. Procédé selon la revendication 1, comprenant en outre :

la mesure de la durée nécessaire pour envoyer le liquide de lavage dans la cuve (2)



jusqu'à un niveau provoquant un débranchement dudit agitateur (4) par rapport audit tambour rotatif (3); et

l'exécution de l'envoi d'une quantité supplémentaire du liquide de lavage à ladite cuve (2) par lesdits moyens de commande (15,16,17) en fonction de moyens de cadencement, qui commandent le cadencement de l'envoi du liquide de lavage supplémentaire à ladite cuve proportionnellement à la durée nécessaire pour que le niveau du liquide de lavage soit atteint pour le débranchement.

8. Procédé selon l'une quelconque des revendications précédentes, comprenant en outre :

l'exécution de l'envoi d'une quantité supplémentaire du liquide de lavage à ladite cuve (2) par lesdits moyens de commande (15,16,17) en fonction de moyens auxiliaires (18) de détection du liquide de lavage, qui détectent le niveau du liquide de lavage dans ladite cuve.

9. Machine à laver le linge comprenant :

une enceinte (1); une cuve de lavage (2) située à l'intérieur de ladite enceinte; un ensemble rotatif comprenant un tambour rotatif (3) situé à l'intérieur de ladite cuve (2) et un agitateur (4) situé à l'intérieur dudit tambour rotatif (3); des moyens de débranchement (5,7) pour débrancher ledit tambour rotatif (3) par rapport audit agitateur (4) pour l'action de rotation lorsque cela est requis; le moteur (10) entraînant ledit agitateur conjointement avec ledit tambour rotatif (3) et séparément lors du débranchement dudit tambour rotatif par rapport audit agitateur lorsque cela est requis; des moyens de détection (19) pour détecter les variations de la vitesse dudit ensemble rotatif incluant la masse de vêtements chargés dans ledit ensemble en rapport avec l'énergie envoyée audit moteur; des moyens (15,16,17) de commande du niveau du liquide de lavage comprenant des moyens (17) d'admission du liquide de lavage, des moyens de commande comprenant des moyens (15) pour activer de façon intermittente ledit moteur (10), et des moyens (16) de commande d'admission du liquide de lavage agencé de manière à commander lesdits moyens (17) d'admission du liquide de lavage dans ladite cuve de lavage en réponse à des signaux transmis par lesdits moyens de détection (19) auxdits moyens (15,16,17) de commande du niveau du liquide de lavage; la constitution et l'agencement étant tels que lors de chaque action intermittente dudit moteur, lesdits moyens de détection (19) transmettent des signaux indicatifs de la mas-

se totale dudit ensemble rotatif incluant le liquide de lavage situé dans ladite cuve (2) et les vêtements situés dans ledit tambour rotatif (3), auxdits moyens (15,16,17) de commande du niveau du liquide de lavage,

caractérisée en ce que lesdits moyens (15,16,17) de commande du niveau du liquide de lavage détectent l'instant de débranchement dudit tambour rotatif (3) par rapport audit agitateur (4) moyennant la réception desdits signaux, lesdits signaux transmis comprenant un signal de débranchement indiquant l'instant de débranchement dudit tambour rotatif par rapport audit agitateur et étant indicatif de la masse de ladite charge en vêtements, et

caractérisé en outre en ce que, lors de la détection dudit débranchement, lesdits moyens (15,16,17) de commande du niveau du liquide de lavage déterminent également un niveau du liquide de lavage requis en fonction desdits signaux et commandent l'envoi d'une quantité supplémentaire du liquide de lavage à ladite cuve pour régler le niveau du liquide de lavage sur ledit niveau requis, qui dépend de la masse de vêtements chargés, qui est détectée par lesdits moyens de détection et déclenchant le programme de lavage, lorsque ledit niveau requis est atteint.

10. Machine à laver le linge selon la revendication 9, dans laquelle :

lesdits moyens d'activation intermittente dudit moteur commandent l'envoi d'énergie audit moteur de sorte que ledit ensemble rotatif est accéléré jusqu'à une vitesse de rotation prédéterminée, puis l'énergie appliquée au moteur est supprimée, et il est prévu en outre des moyens formant minuterie, qui mesurent la durée nécessaire pour que l'ensemble rotatif atteigne la vitesse de rotation nulle à partir de ladite vitesse prédéterminée, ladite durée étant indicative de ladite masse totale en rotation, et envoient ledit signal de débranchement lorsque ladite durée mesurée est fortement réduite par rapport à la durée mesurée précédemment.

11. Machine à laver le linge selon la revendication 9, dans laquelle :

lesdits moyens d'activation intermittente dudit moteur commandent l'application d'énergie audit moteur de telle sorte que ledit ensemble rotatif est accéléré jusqu'à une vitesse de rotation désirée, et il est prévu en outre des moyens formant minuterie qui mesurent la durée que met l'ensemble rotatif pour atteindre ladite vitesse désirée, ladite durée étant indicative de ladite masse totale en rotation, et qui



envoient ledit signal de débranchement lorsque la durée mesurée est fortement réduite par rapport à la durée mesurée précédente.

12. Machine à laver le linge selon l'une quelconque des revendications 9 à 11, comprenant en outre :
des moyens de mémorisation d'informations (15,19) pour mémoriser une information de la masse de la charge de vêtements, sensibles auxdits signaux et utilisant l'information enregistrée pour délivrer les programmes sélectionnés à partir de l'envoi d'une indication d'un profil de lavage de durée de course d'agitation, de la vitesse de rotation requise et de l'accélération requise pour la charge détectée sélectionnée de vêtements devant être lavés, et pour commander le programme de lavage de manière à obtenir un degré désiré de lavage des vêtements. 5 10 15 20
13. Machine à laver le linge selon l'une quelconque des revendications 9 à 12, comprenant en outre :
des moyens pour faire tourner lentement ladite cuve dans un sens et envoyer une quantité requise du liquide de lavage dans ladite cuve avant l'activation intermittente dudit moteur (10) de telle sorte que ladite charge de vêtements soit mouillée avant l'activation intermittente dudit moteur (10). 25 30
14. Machine à laver le linge selon l'une quelconque des revendications 9 à 12, comprenant en outre :
des moyens pour déclencher une agitation de lavage en douceur des vêtements pendant un intervalle de temps prédéterminé après que ledit liquide de lavage ait été envoyé à ladite cuve (2) jusqu'audit niveau requis;
arrêter ladite agitation de lavage en douceur;
détecter le niveau du liquide de lavage dans ladite cuve (2) et
si ledit niveau du liquide de lavage est inférieur audit niveau requis, envoyer une quantité supplémentaire du liquide de lavage à ladite cuve (2) de telle sorte que ledit niveau du liquide de lavage devient ledit niveau requis et, lorsque ledit liquide de lavage se situe audit niveau requis, déclencher une action continue de lavage. 35 40 45 50
15. Machine à laver le linge selon l'une quelconque des revendications 9 à 14, comprenant en outre :
des moyens mesurant la durée nécessaire pour que le liquide de lavage introduit dans la 55

cuve (2) atteigne le niveau qui entraîne le débranchement dudit agitateur (4) par rapport audit tambour rotatif (3), et l'envoi d'une quantité supplémentaire du liquide de lavage à ladite cuve exécuté par lesdits moyens de commande du niveau du liquide de lavage, en fonction de moyens de cadencement, qui commandent de façon cadencée l'envoi d'une quantité supplémentaire de liquide de lavage à ladite cuve proportionnellement à la durée nécessaire pour que le niveau du liquide de lavage déclenche le débranchement.

16. Machine à laver le linge selon l'une quelconque des revendications 9 à 15, dans laquelle :
il est prévu des moyens auxiliaires (18) de détection du niveau du liquide de lavage, lesdits moyens (15,16,17) de commande du niveau du liquide de lavage exécutant l'envoi d'une quantité supplémentaire de liquide de lavage en fonction desdits moyens auxiliaires (18) de détection du niveau du liquide. 15 20 25 30 35 40 45 50
17. Machine à laver le linge selon l'une quelconque des revendications 9 à 16, dans laquelle :
lesdits moyens de commande comprennent des moyens pour détecter la masse totale en rotation dudit ensemble rotatif et déclencher l'envoi d'un niveau déterminé d'énergie audit moteur pendant un intervalle de temps prédéterminé pour provoquer une accélération de l'ensemble rotatif depuis une vitesse initiale connue jusqu'à une vitesse finale, et pour déterminer la différence de vitesse à partir de laquelle un signal indicatif de la masse totale en rotation est transmis auxdits moyens de commande du niveau de liquide, en tant que ledit signal de débranchement.

