EUROPEAN PATENT SPECIFICATION

Date of publication and mention of the grant of the patent: 24.03.1999 Bulletin 1999/12

Application number: 95111984.1

Date of filing: 31.07.1995

Improvement in an unbalance preventing arrangement for clothes washing machines

Vorrichtung zum Vermeiden der Unwucht in Wäschewaschmaschinen
Dispositif pour éviter le balourd dans les machines à laver le linge

Designated Contracting States: DE ES FR GB IT

Priority: 28.09.1994 IT PN940057

Date of publication of application: 03.04.1996 Bulletin 1996/14

Proprietor: Electrolux Zanussi S.p.A. 33170 Pordenone (IT)

Inventor: Battistella, Silvio 1-33170 Pordenone (IT)

Representative: Giugni, Valter et al PROPIRIA Protezione Proprietà Industriale S.r.l. Via Mazzini 13 33170 Pordenone (IT)

References cited:
FR-A- 2645 553 GB-A- 2087 103

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

[0001] The present invention refers to a clothes washing machine, such as in particular a household clothes washing machine, provided with improved arrangements capable of measuring and re-balance unbalanced washloads in the rotating drum of such washing machines when the washload undergoes spin-extraction cycles in the same machines.

[0002] It is common knowledge that, during each washing process performed in household-type clothes washing machines, the clothes loaded in the rotating drum thereof tend to distribute in a sometimes quite irregular manner along the inner periphery of said drum, thereby originating unbalance moments that bring about an anomalous extent of vibrations and mechanical stresses which, if they happen to exceed pre-determined critical levels, may even cause the mechanical structure of the machine to suffer damages, particularly in the case in which the oscillations of the washing drum assembly of the machine are of such a high level as to cause said assembly to impinge against the outer casing of the washing machine.

[0003] In view of preventing such conditions from occurring, it is in practice necessary that the level of the mechanical stresses arising each time depending on the actual speed of rotation of the drum be instantly known in advance so as to prevent them from reaching their critical levels. This is usually achieved by modifying the speed of rotation of the drum in an appropriate manner, i.e. by slowing it down to such an extent as to enable the washload in the same drum to get more evenly distributed and to at the same time effect a reduction in, or even the elimination of, the unbalance conditions brought about by the uneven distribution of said washload.

[0004] A number of solutions to this problem are known in the state of the art which, although differing from each other, are all aimed at detecting the presence of some excessive extent of unbalance conditions and accordingly adjusting the manner in which the speed of rotation of the drum is increased, as well as the highest speed of rotation of the drum itself, in view of achieving the above cited goal.

[0005] Solutions are for instance disclosed in the patent specifications DE 3822924-C, FR 2629484 and DE 3606819, according to which the washload unbalance conditions are detected on the basis of either the oscillations of the current absorbed by the drum driving motor or the oscillations of the speed of rotation of the drum.

[0006] Various types of sensors are used in the solutions disclosed in the patent specifications DE 3605924, GB 2174564 and JP 60137389 to measure the oscillations in view of detecting the washload unbalance conditions, whereas in the solution described in the patent specification JP 6013 2598 unbalance conditions are determined on the basis of a comparison of the actual speed of rotation of the drum with the profile of a reference speed of rotation that has been previously stored in some appropriate memory.

[0007] The Italian patent application IT PN91A000020 by the same applicant teaches how to detect unbalance conditions on the basis of the phase shift between the absorbed current and the supply voltage of the drum driving motor.

[0008] All such solutions are to some extent effective in detecting and reducing the oscillations of the washing drum assembly within the outer casing of the machine. However, washing machine manufacturers have more recently been confronted with the need to also cope with problems connected with the reduction of the vibrations being actually transmitted by the machine to the floor, usually through the points where the machine rests on the floor itself.

[0009] It has in fact been found experimentally that such an event can take place even in the presence of substantially well-balanced, but quite large washloads which, while not being such as to undermine the integrity of the washing machine or impair its correct operation, may prove sufficient to induce the machine to transmit vibrations to the floor on which it is installed and, from there, to the whole room or building. Such an occurrence, which is usually neglectable in the presence of rigid and quite heavy building structures of the traditional type, can on the contrary become disturbingly perceptible in rooms or buildings constructed with a relatively elastic structure using light materials.

[0010] This is a circumstance, as everyone can easily understand, that tends to put a heavy penalty on all those who use washing machines of a traditional type, since it is particularly when such machines are spin-extracting at a high RPM of their drum that vibrations tend to be transmitted from the machine to the whole room or building which starts also to vibrate, thereby creating a quite annoying situation, particularly in the not-so-unusual case that parts of the surrounding building start to resonate.

[0011] From GB 2 087 103 A it is known a laundry washing machine provided with speed control means for a variable speed electric motor for rotationally driving a mass with a changeable centre of gravity, the speed control means comprising detecting means for detecting the degree of any eccentricity of the centre of gravity of such mass relative to the axis of rotation thereof, determining means for determining an optimum motor speed in dependence on the detected degree of any such eccentricity, and regulating circuit means for regulating the supply of operating current to such motor in dependence on the determined optimum speed.

Such detecting means determine the eccentricity force of the centre of gravity of the mass and feeds it as a control value to the control circuit, which in its turn delivers the target value to the regulating circuit. As a result, the maximum rotational speed of the mass, for example a loaded laundry drum, is optimally selected in correspondence with the eccentricity conditions.
However such a procedure is made at increasing speeds; this circumstance doesn't prevent clothes from tending to get pressed into the perforations in the wall of the drum during the intermediate spin sequence, such fact preventing to achieve the optimum laundry distribution and therefore the best overall drum balance for the subsequent spin extraction phase.

[0012] It would therefore be desirable, and it is actually a main purpose of the present invention, to provide a clothes washing machine which is capable of both doing away with the above cited drawback of a strong transmission of vibrations to the floor when in the presence of rather large, even if well-balanced washloads, and ensuring this additional performance capability through the implementation of some simple, unexpensive improvements and the utilization of readily available techniques.

[0013] The invention will be better understood from the description which is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is a diagrammatic view of the evolution vs. time of a spin-extraction phase as performed by a clothes washing machine according to the present invention, inclusive of some improvements and variants that will be described further on;

- Figure 2 is a block diagram showing, in the form of an operational flow-chart, the various sequences included in the spin-extraction phase according to the present invention.

[0014] In the following description, the term "water" will be used in a general way to also mean washing liquor or rinsing water. Such a simplification, however, will not impair the clear comprehensibility of the description owing to the particular context in which said terms are used, as anyone skilled in the art can readily appreciate.

[0015] Referring now to the diagram, which reflects a preferred embodiment of the present invention, a solution according to the present invention and the corresponding principle of operation will be described hereinafter.

[0016] The clothes washing machine being described comprises a washing tub, a drum that is rotatably mounted within said washing tub and is capable of holding the items forming the washload, a selectively actutable drain pump, a driving motor adapted to operate at preselectably variable speeds, an arrangement adapted to detect the unbalance condition of the washload in the rotating drum, to selectively compare it with a plurality of pre-determined unbalance levels and to selectively start different actions or operation modes according to the outcome of said comparisons.

[0017] These machines are substantially known in the art, so that they will not be illustrated here any further.

[0018] The above mentioned diagram symbolically illustrates the evolution vs. time of the speed of rotation of the drum.

[0019] In correspondence of the time T0, the drum is completing the last washing cycles at low speed BV and periodically reversing its direction of rotation. In correspondence of the time T1, said low-speed washing sequence BV is ended and a low-speed spin-extraction sequence is started along with the energization of the drain pump (not shown). At the end of this sequence, i.e. in correspondence of the time T2, the arrangement monitoring the unbalance condition of the washload in the drum is then activated: if the detected unbalance condition turns out to be lower than a pre-established value Bc1, the spin-extraction phase goes on beyond said time T2; if on the contrary said condition does not occur, the same spin-extraction sequence is brought back to the afore considered time T0 from which the just described sequence then starts again. Such a procedure of low-speed rotations BV, low-speed spin-extraction phases CBV and check-ups of the unbalance condition of the washload is repeated automatically until either a lower value than the specified level Bc1 is reached or the same procedure has been repeated for a pre-determined maximum number of times. Anyway, the just described procedure is substantially known in the art, so that it shall not be explained here any further.

[0020] As soon as such time T2 is surpassed, the drum is abruptly driven to perform a spin-extraction cycle for a short impulse, which it reaches in correspondence of the time T3 and which lasts for a very short period of time, i.e. approx. 3 seconds, at an intermediate speed of usually around 450 rpm.

[0021] The purpose of such an impulse, which plays a major role in the present invention, is to obtain the removal of a significant amount of water from the washload, while avoiding that during such a water removal process the clothes, which are still substantially soaked with water and therefore under the effect of the weight thereof, get partially pressed into the perforations provided along the cylindrical surface of the drum to let out the water removed from the clothes, since this would in fact cause the clothes to practically "stick" to the wall of the drum and it would then prove difficult, if not impossible, to even partially "unstick" said clothes, even if the rotation speed of the drum is to this purpose drastically reduced to values below the minimum spin-extraction speed itself.

[0022] Immediately following such a spin-extraction impulse, the rotation speed of the drum is again reduced, in correspondence of the time T4, down to the low-speed spin-extraction speed CBV, or similar value, while a spin-extraction sequence is subsequently started at an intermediate speed CMV, this will go on through a period comprised between the time T5 and the time T6. It has been in fact found experimentally that, owing to said short spin-extraction impulse having been performed immediately before said intermediate-speed spin-extraction sequence CMV, clothes do not tend to
get pressed into the perforations in the walls of the drum during said intermediate-speed spin-extraction sequence CMV as they on the contrary normally would if said preliminary spin-extraction impulse had not been carried out previously in correspondence of said time T3. Such an occurrence eventually plays a particularly advantageous role in the process, as it will be described in greater detail later on.

At the end of said intermediate-speed spin-extraction sequence CMV, the drum RPM is slowed down to the value of the slow-speed spin-extraction sequence CBV and is kept at that value throughout the period extending from the time T7 to the time T8, during which the unbalance condition of the washload is then measured and checked.

If the washload is found to have any greater unbalance than a pre-determined level Bc2, then the whole spin-extraction phase is cycled back to the beginning, i.e. to the time T0, since that would practically mean that the unbalance condition is still in excess of what is actually required in order to be able to safely start any further spin-extraction sequence at still higher speeds.

The advantage brought about by the afore illustrated spin-extraction impulse can at this point be appreciated in its full extent. In this case, in fact, the clothes, owing to them not having been squeezed into the perforations of the drum, are capable of freely falling down again onto the bottom of the drum, which they certainly would not be able to do, even by letting the drum rotate at a very low speed, in the case that they on the contrary get "stuck" to the walls of the drum. In such a case, therefore, the existing unbalance condition, albeit reduced in its extent, would necessarily have to be accepted as such and, at the same time, it would also be necessary that the spin-extraction speed be anyway limited to a lower value than the highest one VCmax provided for by the cycle in order to avoid creating conditions of marked vibrations, with limited-amplitude, but high-frequency oscillations of the machine which, albeit not prohibitive as far as the correct operation and the integrity of the structure of the machine are concerned, would be transmitted through the base of the machine to the surrounding structure of the building during the subsequent high-speed final spin-extraction sequence performed in the time interval T5-T6, the measurement of the unbalance condition which is subsequently performed during the intermediate-speed spin-extraction sequence in the time interval T7-T8 has the purpose to ensure that the unbalance level of the washload is as low as to be able to keep within pre-determined limits the vibrations transmitted by the machine to the surrounding structure of the building during the subsequent high-speed final spin-extraction sequence.

It will be appreciated that anyone skilled in the art is in a position as to identify further technical solutions and optimizations of the present invention by taking advantage of techniques and knowledges that are normally available in the art. It is therefore intended that the appended claims extend to include such obvious modifications that are within the capacity of anyone skilled in the art and do not depart from the scope of the present invention.

Claims

1. Clothes washing machine, particularly for household use, provided with a washing tub, a drum rotatably arranged inside said washing tub and capable to contain the washload, a motor adapted to drive said drum at variable pre-selectable speeds, and an arrangement adapted to detect the unbalance condition detected in the time interval T7-T8 is found to be at a level which is below the aforesaid pre-determined highest allowable level Bc2, but higher than a pre-determined intermediate level Bc3, the subsequent final spin-extraction sequence may be performed at a speed which is reduced to the value VC-,, ie. a value which is slightly lower than the highest spin-extraction speed VCmax, but anyway still adequate in order to ensure an acceptable spin-extraction result without giving rise to the undesired vibrations transmitted by the machine.

Finally, if the unbalance condition detected in said last time interval T7-T8 is found to be at a level which is below said intermediate level Bc3, the subsequent final spin-extraction sequence can regularly be started and performed at the highest rated speed VCmax.

Figure 2 is self-explaining for anyone skilled in the art and shows a block diagram illustrating the logical flow of the various sequences of drum rotation, measurement of the washload unbalance condition, and corresponding decision concerning the step to be taken subsequently, with reference to the most important ones cited in this description.

It will be now fully appreciated that, whereas the first measurement of the unbalance condition, which is performed in the time interval T1-T2, is required in view of protecting the washing machine against excessive unbalance conditions, even when handling moderate washloads, which might damage the same machine during the subsequent intermediate-speed spin-extraction sequence performed in the time interval T5-T6, the measurement of the unbalance condition which is subsequently performed during the intermediate-speed spin-extraction sequence in the time interval T7-T8 has the purpose to ensure that the unbalance level of the washload is as low as to be able to keep within pre-determined limits the vibrations transmitted by the machine to the surrounding structure of the building during the subsequent high-speed final spin-extraction sequence.

1. Clothes washing machine, particularly for household use, provided with a washing tub, a drum rotatably arranged inside said washing tub and capable to contain the washload, a motor adapted to drive said drum at variable pre-selectable speeds, and an arrangement adapted to detect the unbalance condition detected in the time interval T7-T8 is found to be at a level which is below the aforesaid pre-determined highest allowable level Bc2, but higher than a pre-determined intermediate level Bc3, the subsequent final spin-extraction sequence may be performed at a speed which is reduced to the value VC-, ie. a value which is slightly lower than the highest spin-extraction speed VCmax, but anyway still adequate in order to ensure an acceptable spin-extraction result without giving rise to the undesired vibrations transmitted by the machine.

Finally, if the unbalance condition detected in said last time interval T7-T8 is found to be at a level which is below said intermediate level Bc3, the subsequent final spin-extraction sequence can regularly be started and performed at the highest rated speed VCmax.

Figure 2 is self-explaining for anyone skilled in the art and shows a block diagram illustrating the logical flow of the various sequences of drum rotation, measurement of the washload unbalance condition, and corresponding decision concerning the step to be taken subsequently, with reference to the most important ones cited in this description.

It will be now fully appreciated that, whereas the first measurement of the unbalance condition, which is performed in the time interval T1-T2, is required in view of protecting the washing machine against excessive unbalance conditions, even when handling moderate washloads, which might damage the same machine during the subsequent intermediate-speed spin-extraction sequence performed in the time interval T5-T6, the measurement of the unbalance condition which is subsequently performed during the intermediate-speed spin-extraction sequence in the time interval T7-T8 has the purpose to ensure that the unbalance level of the washload is as low as to be able to keep within pre-determined limits the vibrations transmitted by the machine to the surrounding structure of the building during the subsequent high-speed final spin-extraction sequence.

It will be appreciated that anyone skilled in the art is in a position as to identify further technical solutions and optimizations of the present invention by taking advantage of techniques and knowledges that are normally available in the art. It is therefore intended that the appended claims extend to include such obvious modifications that are within the capacity of anyone skilled in the art and do not depart from the scope of the present invention.

Claims

1. Clothes washing machine, particularly for household use, provided with a washing tub, a drum rotatably arranged inside said washing tub and capable to contain the washload, a motor adapted to drive said drum at variable pre-selectable speeds, and an arrangement adapted to detect the unbalance condition detected in the time interval T7-T8 is found to be at a level which is below the aforesaid pre-determined highest allowable level Bc2, but higher than a pre-determined intermediate level Bc3, the subsequent final spin-extraction sequence may be performed at a speed which is reduced to the value VC-, ie. a value which is slightly lower than the highest spin-extraction speed VCmax, but anyway still adequate in order to ensure an acceptable spin-extraction result without giving rise to the undesired vibrations transmitted by the machine.

Finally, if the unbalance condition detected in said last time interval T7-T8 is found to be at a level which is below said intermediate level Bc3, the subsequent final spin-extraction sequence can regularly be started and performed at the highest rated speed VCmax.

Figure 2 is self-explaining for anyone skilled in the art and shows a block diagram illustrating the logical flow of the various sequences of drum rotation, measurement of the washload unbalance condition, and corresponding decision concerning the step to be taken subsequently, with reference to the most important ones cited in this description.

It will be now fully appreciated that, whereas the first measurement of the unbalance condition, which is performed in the time interval T1-T2, is required in view of protecting the washing machine against excessive unbalance conditions, even when handling moderate washloads, which might damage the same machine during the subsequent intermediate-speed spin-extraction sequence performed in the time interval T5-T6, the measurement of the unbalance condition which is subsequently performed during the intermediate-speed spin-extraction sequence in the time interval T7-T8 has the purpose to ensure that the unbalance level of the washload is as low as to be able to keep within pre-determined limits the vibrations transmitted by the machine to the surrounding structure of the building during the subsequent high-speed final spin-extraction sequence.

It will be appreciated that anyone skilled in the art is in a position as to identify further technical solutions and optimizations of the present invention by taking advantage of techniques and knowledges that are normally available in the art. It is therefore intended that the appended claims extend to include such obvious modifications that are within the capacity of anyone skilled in the art and do not depart from the scope of the present invention.

Claims

1. Clothes washing machine, particularly for household use, provided with a washing tub, a drum rotatably arranged inside said washing tub and capable to contain the washload, a motor adapted to drive said drum at variable pre-selectable speeds, and an arrangement adapted to detect the unbalance condition detected in the time interval T7-T8 is found to be at a level which is below the aforesaid pre-determined highest allowable level Bc2, but higher than a pre-determined intermediate level Bc3, the subsequent final spin-extraction sequence may be performed at a speed which is reduced to the value VC-, ie. a value which is slightly lower than the highest spin-extraction speed VCmax, but anyway still adequate in order to ensure an acceptable spin-extraction result without giving rise to the undesired vibrations transmitted by the machine.

Finally, if the unbalance condition detected in said last time interval T7-T8 is found to be at a level which is below said intermediate level Bc3, the subsequent final spin-extraction sequence can regularly be started and performed at the highest rated speed VCmax.
5. Clothes washing machine according to any of the
preceding claims, characterized in that said wash-
load balancing sequence at low spin-extraction
speed (T₁ - T₂), which consists in first reducing the
speed of rotation of the drum to a value below the
slowest spin-extraction speed and then increasing
said speed again up to said low-speed spin-extrac-
tion speed (CBV), is performed in an automatically
repeated manner until the washload is effectively
allowed to redistribute along the walls of the drum
so as to reach said first balancing level (B₁).

6. Clothes washing machine according to any of the
preceding claims, characterized in that said low-
speed spin-extraction speed (CBV) is of approx. 85
rpm.

7. Clothes washing machine according to any of the
preceding claims, characterized in that said inter-
mediate-speed spin-extraction speed (CMV) is of
approx. 450 rpm.

8. Clothes washing machine according to any of the
preceding claims, characterized in that said spin-
extraction impulse (T₃) at intermediate spin-extrac-
tion speed lasts has a duration of approx. 3 sec-
onds.

**Patentansprüche**

1. Waschmaschine, insbesondere Waschmaschine
für den Haushalt, mit einem Waschbehälter, einem
im Waschbehälter drehbar gelagerten Waschtrommel
zur Aufnahme des Waschgutes, einem Elektromotor
zum Antreiben der Waschtrommel mit unter-
schiedlichen, vorwählbaren Umdrehungsge-
schwindigkeiten, welche mit einer Vorrichtung zum
Ermitteln des Unwucht-Zustandes des Waschgutes,
versehen ist, wobei die Waschmaschine geeig-
net ist, eine Schleuder-Entwässerungs-Phase
durchzuführen, bestehend aus:

- a) einer ersten Sequenz von Waschtrommel-
Umdrehungen in einer alternierenden Dreh-
richtung mit einer Geschwindigkeit, die niedri-
ger ist als die niedrige Schleuder-Entwässer-
ungs-Geschwindigkeit (CBV),

- b) einer ersten Sequenz von Waschtrommel-
Umdrehungen bei niedriger Schleuder-Ent-
wässerungs-Geschwindigkeit (CBV), um das
Waschgut gleichmäßig an der Trommel-Innen-
seite zu verteilen;

- c) wobei überwacht wird, ob der Unwucht-Zu-
stand niedriger ist als ein erstes vorbestimmtes
Unwucht-Niveau und wobei die ersten zwei Se-
quenzen wiederholt werden, wenn der Un-
1. Lave-linge notamment destiné à l'usage domestique, comprenant une cuve de lavage ; un tambour logé à rotation à l'intérieur de ladite cuve de lavage, et apte à contenir la charge à laver ; un moteur adaptable pour entraîner ledit tambour à des vitesses variables pouvant être présélectionnées ; et un dispositif conçu pour détecter le balourd de la charge à laver, ledit lave-linge étant adapté pour effectuer une phase d'extraction par essorage comprenant :

- a) une première séquence de révolutions du tambour dans une direction de rotation alternée, à une vitesse inférieure à la faible vitesse d'extraction par essorage (CBV);
- b) une première séquence de révolutions du tambour à faible vitesse d'extraction par essorage (CBV), afin de répartir uniformément la charge à laver sur la face interne du tambour ;
- c) une surveillance établissant si le balourd est inférieur à un premier niveau de déséquilibre prédéterminé, et une réitération des deux premières séquences si le balourd excède ledit niveau ; caractérisé par le fait que :

2. Waschmaschine nach Anspruch 1, dadurch gekennzeichnet, daß, wenn der Unwucht-Zustand niedriger ist als besagtes niedriges Schleuder-Entwässerungs-Geschwindigkeit (CMV) beträgt, und für einen vorbestimmten Zeitraum aufrechterhalten wird ;

3. Waschmaschine nach Anspruch 2, dadurch gekennzeichnet, daß, wenn festgestellt wird, daß der Unwucht-Zustand wie getestet wird, unter dem zweiten voreingestellten Wert (Bc2) liegt, jedoch über einem dritten voreingestellten Wert (Bc3) liegt, die Schleuder-Entwässerungs-Phase mit einer Schleuder-Entwässerungs-Geschwindigkeit fortgesetzt wird, die auf einen Wert (VC1), begrenzt ist, welcher niedriger als der dritte vorgegebene Unwucht-Wert (Bc3) ist, die Schleuder-Entwässerungs-Phase bis zur angegebenen höchsten Schleuder-Entwässerungs-Geschwindigkeit (Vmax) der Waschmaschine fortgesetzt wird.

4. Waschmaschine nach einem der Ansprüche 2 oder 3, dadurch gekennzeichnet, daß, wenn festgestellt wird, daß besagter Unwucht-Zustand niedriger als der dritte vorgegebene Unwucht-Wert (Bc3) ist, die Schleuder-Entwässerungs-Phase bis zur angegebenen höchsten Schleuder-Entwässerungs-Geschwindigkeit (Vmax) der Waschmaschine fortgesetzt wird.

5. Waschmaschine nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß besagte Schleuder-Gleichgewichts-Geschwindigkeit bei niedriger Schleuder-Entwässerungs-Geschwindigkeit (T1, T2), welche aus einer ersten Reduzierung der Rotationsgeschwindigkeit der Waschtrommel auf einen Wert unter der niedrigsten Schleuder-Entwässerungs-Geschwindigkeit und anschließender Erhöhung besagter Geschwindigkeit wieder auf die besagte langsame Schleuder-Entwässerungs-Geschwindigkeit (CBV) besteht, solange in automatisch wiederholender Weise durchgeführt wird, bis das Waschgut sich effektiv entlang den Wänden der Trommel neu verteilt hat, sobald das erste Gleichgewichts-Niveau (Bc1) erreicht wird.

6. Waschmaschine nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß besagte langsame Schleuder-Entwässerungs-Geschwindigkeit (CBV) etwa 85 Umdrehungen pro Minute beträgt.

7. Waschmaschine nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß besagte mittlere Schleuder-Entwässerungs-Geschwindigkeit (CMV) etwa 450 Umdrehungen pro Minute beträgt.

8. Waschmaschine nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß besagter Schleuder-Entwässerungs-Impuls (T2) bei mittlerer Schleuder-Entwässerungs-Geschwindigkeit etwa drei Sekunden lang dauert.

Revidendations
d) si le balourd est inférieur au premier niveau de déséquilibre, une impulsion d'extraction par essorage est exécutée à une vitesse intermédiaire d'extraction par essorage (CMV), pendant un très court laps de temps ; et
e) la vitesse angulaire du tambour est ralentie jusqu'à la faible vitesse d'extraction par essorage (CBV), afin de maintenir l'adhérence de la charge à laver contre la paroi interne du tambour ; et
f) la vitesse angulaire du tambour est accrue jusqu'à la vitesse intermédiaire d'extraction par essorage (CMV), qui est maintenue pendant un laps de temps prédéterminé ; et
g) le ralentissement, jusqu'à la faible vitesse d'extraction par essorage (CBV), est réduit et maintenu pendant un laps de temps prédéterminé durant lequel le balourd est mesuré.

2. Lave-linge selon la revendication 1, caractérisé par le fait que, s'il est établi que le balourd, ainsi détecté, excède une deuxième valeur préréglée ($B_{c2}$), la phase d'extraction par essorage est ramenée au début de ladite séquence initiale ($T_0$) de faible vitesse et de rotation alternée du tambour.

3. Lave-linge selon la revendication 2, caractérisé par le fait que, s'il est établi que le débit balourd est inférieur à ladite deuxième valeur préréglée ($B_{c2}$), tout en excédant cependant une troisième valeur préréglée ($B_{c3}$), la phase d'extraction par essorage est poursuivie à une vitesse d'extraction par essorage limitée à une valeur ($V_{C1}$) qui est inférieure à la vitesse nominale maximale ($V_{max}$) d'extraction par essorage de la machine.

4. Lave-linge selon la revendication 2 ou 3, caractérisé par le fait que, s'il est établi que le débit balourd est inférieur à ladite troisième valeur de déséquilibre préréglée ($B_{c3}$), la phase d'extraction par essorage est poursuivie jusqu'à la vitesse nominale maximale ($V_{max}$) d'extraction par essorage de la machine.

5. Lave-linge selon l'une quelconque des revendications précédentes, caractérisé par le fait que ladite séquence d'équilibrage de la charge à laver, à faible vitesse d'extraction par essorage ($T_1$-$T_2$), qui consiste à réduire tout d'abord la vitesse angulaire du tambour jusqu'à une valeur inférieure à la vitesse minimale d'extraction par essorage, puis à accroître de nouveau ladite vitesse jusqu'à ladite faible vitesse d'extraction par essorage (CBV), est exécutée avec répétition automatique jusqu'à ce que la charge à laver soit effectivement autorisée à se répartir de nouveau le long des parois du tambour, afin d'atteindre ledit premier niveau d'équilibrage ($B_{c1}$).

6. Lave-linge selon l'une quelconque des revendica-
FIG. 2