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

(11) EP 1 803 846 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.07.2007 Bulletin 2007/27

(51) Int Cl.:
D06F 35/00 *(2006.01)*

(21) Application number: **05113093.8**

(22) Date of filing: **30.12.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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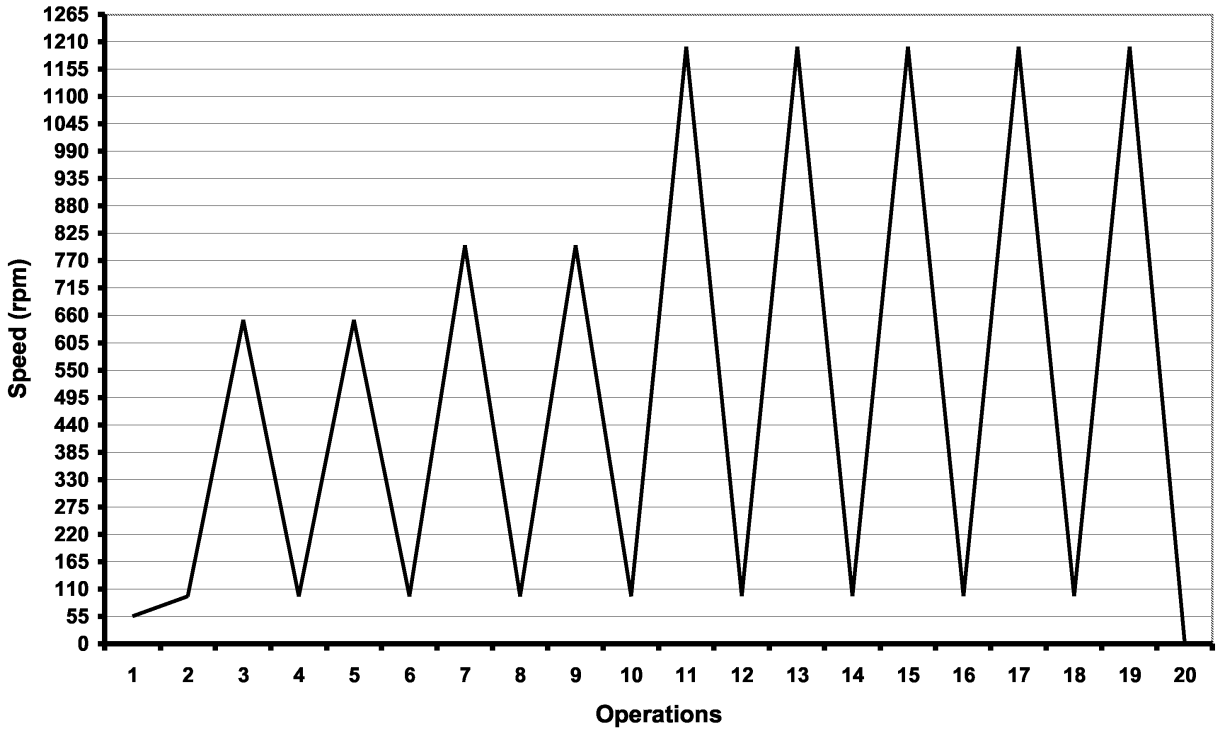
(54) Spin drying process for washing machines

(57) A spin drying process for laundry washing machines, preferably of the type having an electronic control system, comprises a plurality of impulses or steps (3 or 5,7 or 9,11 or 13 or 15 or 17 or 19) at increasing speeds of rotation of the drum containing the laundry, alternated with periods during which the speed tends to zero i.e. phases (2,4,6,8,10,12,14,16,18) during which the speed of rotation of the drum is drastically reduced.

Fig. 2



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Description

[0001] The present invention relates to a spin drying process for laundry washing machines.

[0002] More in particular, the present invention relates to a spin drying process applied to laundry washing machines equipped with a control system of the electronic type, preferably for household use.

[0003] It is known that laundry washing machines provide for the possibility of setting different alternative washing cycles depending on the type of laundry to be washed. The chief variables considered in this connection relate to duration of cycle, temperature of water, and quantity of detergent used, which is for example reduced in the case of cycles without pre-wash and/or limited to short rinses.

[0004] At the end of the washing phase, and sometimes also during the washing phase itself and before rinsing, the different programmed cycles provide for a spin phase, in which the rotating drum in which the laundry is placed is made to rotate at high speed so as to eliminate as much of the water as possible and make it possible to hang out the laundry without its dripping. For this purpose, the spin phases, in particular the final one that takes place at the end of the washing cycle, is traditionally set to rotate at incremental steps at increasing speeds, which may reach as much as 1800 revs per minute.

[0005] This operative procedure on one hand makes it possible to wring out the laundry very thoroughly, but it also presents significant drawbacks. Indeed, it must be considered that the high-speed rotation of the drum produces considerable stress on the mechanical components involved that, over time, are subjected to wear and, in consequence, require laborious and costly interventions for maintenance or renovation. In the presence of high speed rotation of the drum, the entire structure of the machine is also strongly stressed and high levels of vibration and noise are also produced.

[0006] The laundry itself, due to the high speed of rotation, is also subjected to considerable stress which reduces its duration over time. The laundry also tends to "stick" to itself and to the inner walls of the drum, with the consequence that it is more difficult for the water to be eliminated from those parts that are less exposed, and therefore the wringing process is not uniform.

[0007] The present invention proposes to solve one or more of the above drawbacks.

[0008] In this sphere, one purpose of the present invention is to provide a spin drying process for laundry washing machines that enables optimal results to be achieved in terms of wringing the laundry, without producing high levels of stress on the mechanical components.

[0009] Another purpose of the invention is to provide a drying process as defined above that can avoid high stress on the entire structure of the washing machine, also avoiding the consequent vibration and noise.

[0010] Another purpose of the invention is to provide a spin drying process that avoids subjecting the laundry to wringing stress which would limit its duration over time.

[0011] Another purpose of the invention is to provide a spin drying process such that it can be easily and economically be implemented.

[0012] These and further purposes are achieved through the spin drying process for laundry washing machines according to the present invention, which comprises a plurality of impulses or steps at increasing speed of the drum containing the laundry, alternated by brief pauses during which the speed tends to zero, or steps during which the rotation of the drum is drastically reduced.

[0013] The functional characteristics of the spin drying process for laundry washing machines according to the present invention may be better understood in the description that follows, with reference to the enclosed drawings, in which:

- figure 1 represents in table form a spin drying cycle, according to a preferred operative sequence, without limiting intent on the invention, in which the values indicated relate to intervals of time and to speeds of rotation of the drum;
- figure 2 represents the spin drying cycle of figure 1 in graph form.

[0014] With reference to these figures, the spin drying process according to the present intervention comprises a plurality of phases of rotation of the drum according to impulses or steps at increasing maximum speed, or impulse ramps, alternated by brief pauses during which the speed tends to zero, or steps during which the rotation of the drum is drastically reduced.

[0015] The continual alternation of phases of rotation with impulse ramps of the drum - that, having reached a set speed, tends to return to an almost stationary condition or one at very much reduced speed - produces uniform wringing of the laundry.

[0016] As indicated in diagram form in figure 1, in which the term "distribution" identifies the phase preceding the spin phase, the maximum speed of the drum in the various phases of the process is approximately between 500 and 1400 revs per minute (rpm). The maximum speed in absolute terms is preferably in the order of 1200 rpm and is reached repeatedly in the second part of the process, or starting from approximately the middle of the spin cycle and until its termination. The minimum speed of rotation is preferably constant, for example between 90 and 100 rpm. The spin impulses or steps at minimum speed configure brief periods during which the speed tends to zero, which occur after each phase of impulses or steps at high speed.

[0017] Two or more phases at which the maximum speed of rotation of the drum varies in a range between 600 and 850 rpm are programmed in the first part of the spin cycle; preferentially, there are four such phases, the

first two at approximate speed of 650 rpm, and the remaining two, subsequent, phases at a speed of approximately 800 rpm.

[0018] There are preferably at least four phases with rotation at maximum speed in the second part of the spin cycle, occurring consecutively but always alternating with pauses during which the speed tends to zero, or with drastically reduced speed compared to the maximum speed.

[0019] Overall, as may be seen in the graph in figure 2, which indicates in diagram form a spin drying process with impulse ramps according to a preferred embodiment, the maximum speeds reached by the drum increase progressively, in the sense that the first impulses produce a rotation of approximately 650 rpm, whereas the last impulses, which are five in number in the example, produce a rotation of approximately 1200 rpm. Between these two groups of impulses there are intermediate and consecutive phases with rotation of approximately 800 rpm.

[0020] The table in figure 1 also shows the time spans of the various high-speed impulses or steps, that vary from a minimum of a few seconds to a maximum of some minutes and increase progressively; the steps during which the speed tends to zero are, on the contrary, preferably of substantially constant duration. The longest periods of time are those of the phases of rotation at maximum speed during the second part of the process, which vary from two to four minutes (with maximum in the last phase). The shortest periods of time are those concerning the high speed rotation impulses in the first part of the process, that is those at speeds of approximately 650 rpm and 800 rpm, whose duration is roughly between 3 and 15 seconds respectively. The reduced-speed rotation impulses or steps, roughly at about 95 rpm, are of substantially constant duration of approximately one minute.

[0021] For preference, at the start of the spin cycle, or before the first high-speed phase, an impulse or step is programmed that brings the drum to a speed of a few revs per minute for a short period of time, which comprises a preliminary phase to rearrange the laundry in the drum uniformly. The speed during this preliminary step is roughly between 40 and 60 rpm, preferably about 55 rpm. This preliminary phase is followed by a phase of drainage and distribution.

[0022] In all the phases of the spin cycle, water is drained from the tank in which the drum is housed, since the conventional drainage pump with which the washing machine is equipped operates continually.

[0023] The overall duration of the spin cycle, according to the preferred embodiment of the process, described above, is between 20 and 25 minutes. Experimental tests carried out by the applicant have shown that, on putting the laundry through the process according to the present invention, residual dampness of the laundry is not above 45%. This places laundry washing machines utilising the spin drying process according to the present invention in Class A in regard to the regulations in force. The various phases of the cycle that activate impulses to rotate at different speeds and the respective times are managed through a microprocessor or electronic card.

[0024] As may be seen from the above, the advantages offered by the invention are clear.

[0025] The spin drying process according to the present invention, unlike known solutions in which the spin drying system is of the gradual ramp type and with long periods at which the maximum speed is maintained, utilises a method with impulse ramps, which makes it possible to achieve effective and uniform wringing of the laundry without the need for prolonged periods of rotation of the drum at high speeds. Consequently the process avoids wear and tear on the mechanical components of the washing machine and substantially reduces the stress to which the laundry itself is subjected.

[0026] Although the invention has been described above with particular reference to one embodiment, purely as an example and without any limiting intent, numerous modifications and variants will appear clear to a man skilled in the art in the light of the above description. This invention therefore intends to encompass all modifications and variants that enter into the spirit and the sphere of protection of the following claims. In this light, for example, it is clear that the invention can be applied to machines of the so-called washing-drying machine type.

Claims

1. A spin drying process for laundry washing machines, preferably of the type having an electronic control system, **characterised by** comprising a plurality of impulses or steps (3 or 5, 7 or 9, 11 or 13 or 15 or 17 or 19) at increasing speeds of rotation of the drum containing the laundry, alternated with periods during which the speed tends to zero, or phases (2, 4, 6, 8, 10, 12, 14, 16, 18) during which the speed of rotation of the drum is drastically reduced.

2. The process according to claim 1, wherein said plurality comprises at least two consecutive steps (3, 5) at a first maximum speed, at least two consecutive steps (7, 9) at a second maximum speed and at least two, preferably at least four, consecutive steps (11, 13, 15, 17) at a third maximum speed.

3. The process according to claim 1, wherein said plurality comprises, in a first part of the process, one or more steps (3, 5, 7, 9) at a speed of rotation between approximately 200 and 850 revs per minute (rpm).

4. The process according to claim 3, wherein said plurality comprises, in a second part of the process, at least two steps (11, 13, 15, 17), preferably at least four, in which the drum is brought to a speed of rotation between approximately 500 and 1400 rpm,

preferably between approximately 1150 and 1250 rpm.

5. The process according to claim 4, wherein said first part comprises at least two consecutive steps (3, 5) at maximum speed between approximately 600 and 700 rpm and at least a further two consecutive steps (7, 9) at a maximum speed between approximately 750 and 850 rpm.

6. The process according to any of the above claims, wherein, before said plurality, a preliminary impulse or step (1) is provided, to obtain a rotation of the drum at a speed of a few revs per minute, preferably between approximately 40 and 60 rpm.

7. The process according to claim 1, wherein in said phases (2, 4, 6, 8, 10, 12, 16, 18) or during said periods when the speed tends to zero that are interposed between each impulse or step (3, 5, 7, 9, 11, 13, 15, 17, 19), the drum is brought to a speed of rotation between approximately 90 and 100 rpm, said phases having a preferably constant duration of approximately one minute.

8. The process according to one or more of the preceding claims, wherein said plurality includes one or more steps (3, 5) with speed of rotation of the drum between approximately 600 and 700 rpm, with duration not above approximately 10 seconds, preferably of approximately 3 seconds.

9. The process according to one or more of the preceding claims, wherein said plurality includes one or more steps (7, 9) with speed of rotation of the drum between approximately 750 and 850 rpm, with duration not above approximately 20 seconds, preferably of approximately 15 seconds.

10. The drying process according to one or more of the preceding claims, wherein said plurality includes one or more steps (11, 13, 15, 17, 19) with speed of rotation of the drum between approximately 1150 and 1250 rpm, with duration between approximately 1 and 5 minutes, preferably between approximately 2 and 4 minutes.

11. The process according to any of the preceding claims, having an overall duration between approximately 20 and 25 minutes.

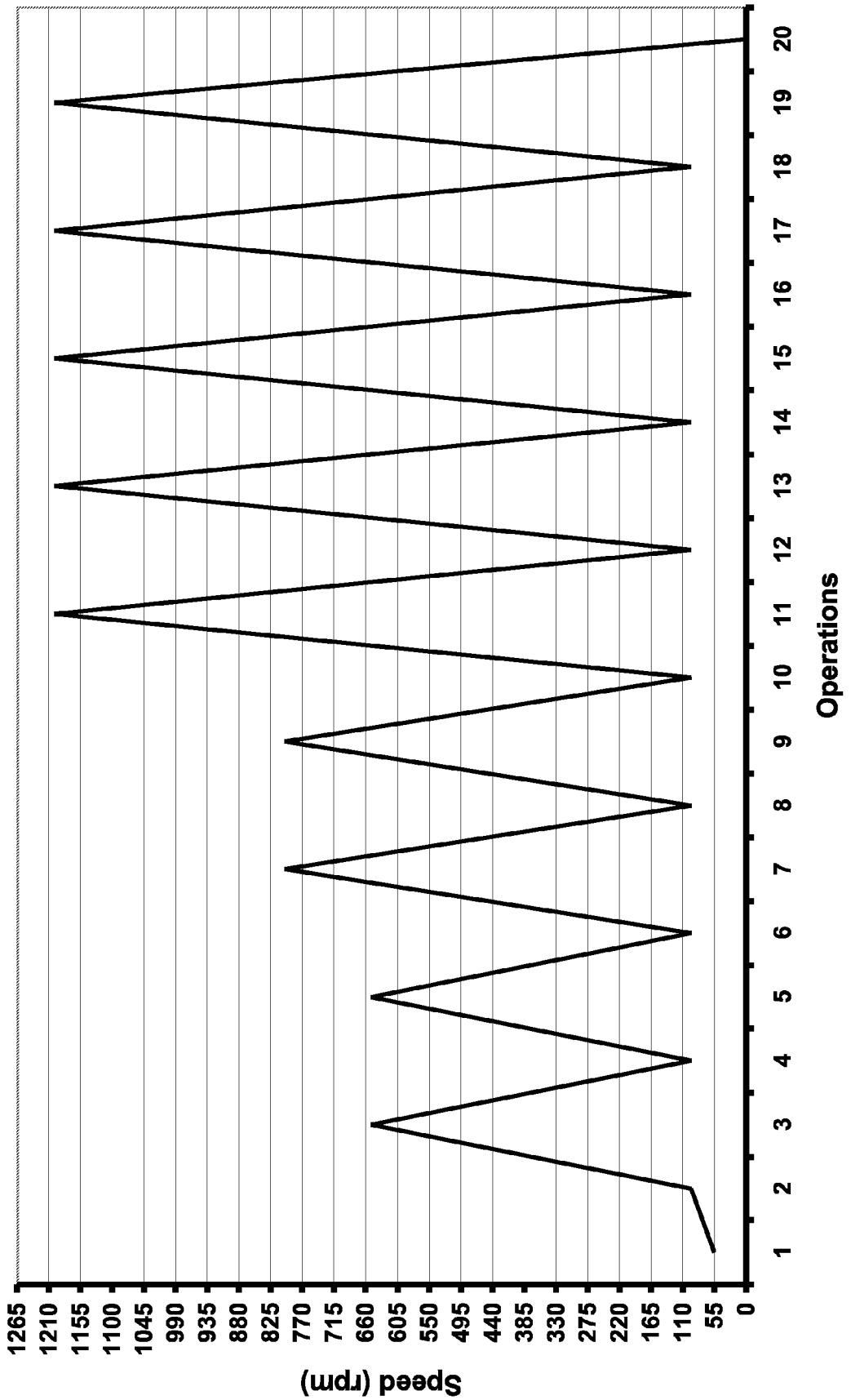
12. The process according to any of the preceding claims, wherein during said impulses or steps (3, 5, 7, 9, 11, 13, 15, 17, 19) and phases (2, 4, 6, 8, 10, 12, 14, 16, 18) the water is continually discharged, or a washing machine's discharge pump is in continual operation.

13. A laundry washing machine that implements the process according to one or more of the preceding claims, including a tank, a drum housed within said tank, means to cause the drum to rotate, a discharge pump and a control system, preferably of the electronic type.

Fig. 1

	OPERATIONS			TIME		TEMP.	SPEED
				Seconds	Minutes	°C	Rpm
1	Drain + Wash	V	+	15	0,25	-	55
2	Drain + Distribution			45	0,75	-	95
3	Drain + Centrifuga			3	0,05	-	650
4	Drain + Distribution			60	1	-	95
5	Drain + Centrifuga			3	0,05	-	650
6	Drain + Distribution			60	1	-	95
7	Drain + Centrifuga			15	0,25	-	800
8	Drain + Distribution			60	1	-	95
9	Drain + Centrifuga			15	0,25	-	800
10	Drain + Distribution			60	1	-	95
11	Drain + Centrifuga			120	2	-	1200
12	Drain + Distribution			60	1	-	95
13	Drain + Centrifuga			120	2	-	1200
14	Drain + Distribution			60	1	-	95
15	Drain + Centrifuga			120	2	-	1200
16	Drain + Distribution			60	1	-	95
17	Drain + Centrifuga			120	2	-	1200
18	Drain + Distribution			60	1	-	95
19	Drain + Centrifuga			240	4	-	1200
20	Drain			60	1	-	0
		TOTAL		1356	22,6		

Fig. 2


Speed (rpm)
1265
1210
1155
1100
1045
990
935
880
825
770
715
660
605
550
495
440
385
330
275
220
165
110
55
0
Operations
1
2
3
4
5
6
7
8
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11
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20

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EUROPEAN SEARCH REPORT

Application Number
EP 05 11 3093

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 May 2006	Lodato, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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