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EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.01.2006 Bulletin 2006/01

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

(21) Application number: **04425468.8**

(22) Date of filing: **30.06.2004**

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

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(54) Washing process for a washing machine

(57) A washing process for washing machines comprises in time sequence a first stage of movement of the drum comprising a plurality of angular movements in one direction (α_1 , α_2 , α_3 , α_4 , α_5) and consecutive stop times (t_1 , t_2 , t_3 , t_4) distributed substantially within one complete turn of the drum performed in a first rotary direction of

movement, a pause stage which is protracted for a pre-determined time, and a second stage of movement of the drum comprising a plurality of angular movements in one direction (α_5 , α_4 , α_3 , α_2 , α_1) and consecutive stop times (t_4 , t_3 , t_2 , t_1) distributed substantially within one complete turn of the drum made in the rotary direction of movement opposite to the first.

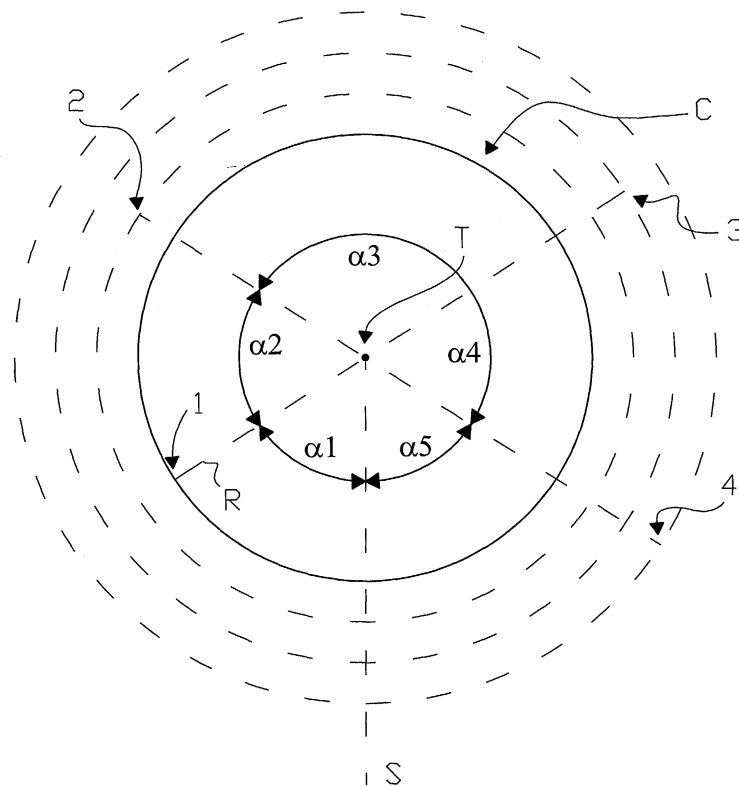


Fig. 1

Description

[0001] This invention relates to a washing process for a washing machine, particularly but not exclusively of the domestic type, in which the clothes are inserted in a drum rotatably mounted about its horizontal longitudinal axis and positioned in a vessel with its axis substantially parallel to that of the vessel into which a predetermined quantity of water and washing agents are introduced and in which the washing operation is performed by imparting angular movements to the drum containing the laundry in one direction and the opposite direction alternately about its axis of rotation, interspersed with rest periods, repeated several times until completion of a complete washing cycle of predetermined length.

[0002] Washing processes of the type indicated above are known in the art and in their continuing development provision has been made for the use of drum rotation cycles having variable speeds from a minimum for the initial cycles to a maximum for the rotation cycles terminating the wash in order to increase washing efficiency, reduce washing times, avoid damage to the laundry and avoid excessive felting of the same when the laundry comprises items of clothing made of wool.

[0003] Processes have also been proposed in which the drum, instead of completing full rotations in one direction and rotations in the opposite direction after an adequate rest period, is subjected to opposing angular oscillations.

[0004] Known washing processes and in particular those of the type mentioned above, while achieving an acceptable result in terms of cleaning the items of laundry being washed, are nevertheless not free of disadvantages and defects, the removal or at least substantial reduction of which is the main object of this invention.

[0005] In washing processes with drum rotation cycles alternating in one direction and the opposite direction with an increasing rotation speed, one of the problems which is encountered is that a layer of laundry adheres to the drum walls and despite reversal of the direction of the drum's rotation tends to continue to comprise the same items of clothing without bringing about that mixing of the items which would distribute the same washing action to all the items. Even in washing processes using only stages of angular movement of the drum in one direction and in the opposite direction a defective mixing action of the items of laundry is encountered in that these tend to undergo an action of the pendular type which causes them to remain adhering with the same side to the drum wall for a long time and notwithstanding the fact that the angle of oscillation has been increased with respect to the resting position between one oscillating cycle and another.

[0006] This lack of adequate mixing of the items of laundry gives rise to both a limitation on washing efficiency and the possibility of increased felting, particularly of woollen items.

[0007] The problem underlying this invention is therefore that of devising a washing process for washing ma-

chines to permit greater washing and less felting of the items.

[0008] The problem is resolved through the washing process according to the invention described in claim 1 below.

[0009] The invention will now be more particularly described with reference to an embodiment provided purely by way of indication and without restriction with the help of the diagram in Figure 1 of the appended drawings in which stages in the process are illustrated diagrammatically.

[0010] With reference to the diagram in Figure 1 which illustrates the movement of the laundry-holding drum of a conventional washing machine diagrammatically, central point T represents the line of the axis of rotation of the drum, not illustrated, in the plane of the figure.

[0011] Circumference C of radius R represents the track of the periphery of the drum during washing operations.

[0012] Point S represents the lower stationary position of the drum periphery when the machine is stopped.

[0013] Points 1, 2, 3 and 4 represent positions at which consecutive angular movements of the drum in a single direction begin and end during a first stage of movement of the drum, which takes place for example clockwise, and in a second stage of movement of the drum which instead takes place in the anticlockwise direction.

[0014] Positions 1, 2, 3 and 4 are separated from stationary position S by angles α_1 , α_2 , α_3 , α_4 and α_5 , which may be the same as each other during both the first stage of clockwise movement and the second stage of anticlockwise movement. These angles may also differ from each other, just as the angular velocities through which the said angles are travelled by the drum during angular movement may also be different or the same.

[0015] According to a preferred embodiment the sum of the angles α_1 , α_2 , α_3 , α_4 and α_5 defining the positions S, 1, 2, 3 and 4 adds up together to $360^\circ \pm 10^\circ$.

[0016] Corresponding to each position 1, 2, 3 and 4 according to the invention a corresponding time t_1 , t_2 , t_3 and t_4 during which movement of the drum is stopped is provided, these rests therefore following after the angular movements in one direction.

[0017] The abovementioned stop times t_1 , t_2 , t_3 and t_4 may be of equal duration, preferably of between 0.8 sec and 1.2 sec, or may be of different duration either during the first stage of movement in the clockwise direction or during the second stage of movement of the drum in the anticlockwise direction.

[0018] Again in accordance with the invention the washing process comprises a protracted pause for a predetermined time between the end of the first stage of movement in a clockwise direction and the start of the second stage of movement of the drum in the opposite direction, that is, in the example described, in the anticlockwise direction.

[0019] This pause, which occurs corresponding to position S, may have a duration of between 10 and 360 sec.

[0020] By repeating the washing stages described above by a number of times to cover the length of a conventional washing cycle which, as is known, on average varies between 25 minutes and 70 minutes, an excellent result was achieved in terms of both cleaning and in terms of lack of felting of the items washed.

[0021] It remains understood that the pause times indicated above, the angular velocities of drum movement and the extent of the said angular movements may vary according to requirements without thereby going beyond the scope of this invention as described and claimed below.

Claims

1. Washing process for washing machines, particularly but not exclusively of the domestic type, in which the clothes are inserted in a drum rotatably mounted about its horizontal longitudinal axis and positioned within a vessel having its axis substantially parallel to that of the vessel, into which a predetermined quantity of water and washing agents is inserted and in which the washing operation is performed imparting angular movements about its axis of rotation alternately in one direction and in the opposite direction to the drum containing the laundry which has to be washed, interrupted by pauses, repeated several times up to the completion of a complete washing cycle of predetermined length, **characterised in that** it comprises in time sequence a first stage of movement of the drum comprising a plurality of angular movements in one direction (α_1 , α_2 , α_3 , α_4 , α_5) and consecutive stop times (t_1 , t_2 , t_3 , t_4) substantially distributed within a full turn of the drum performed in a first direction of rotary movement, a protracted pause for a predetermined length of time, and a second stage of movement of the drum comprising a plurality of angular movements in one direction (α_5 , α_4 , α_3 , α_2 , α_1) and consecutive stop times (t_4 , t_3 , t_2 , t_1) distributed substantially within one complete turn of the drum performed in the direction of rotary movement opposite to the first.
2. Washing process according to claim 1, **characterised in that** the said angular movements and the said consecutive stop times comprising the first stage of movement of the drum take place through angles and corresponding times which are the same as each other.
3. Washing process according to claim 1 **characterised in that** the said angular movements and the said consecutive stop times comprising the said first stage of movement of the drum take place through angles and corresponding times which are different from each other.

4. Washing process according to claims 1 and 2 **characterised in that** the said angular movements and the said consecutive stop times comprising the said second stage of movement of the drum take place through angles and corresponding times which are the same as each other.
5. Washing process according to claims 1 and 2, **characterised in that** the said angular movements and the said consecutive stop times comprising the said second stage of movement of the drum take place through angles and corresponding times which differ from each other.
6. Washing process according to claims 1 and 3, **characterised in that** the said angular movements and the said consecutive stop times comprising the said second stage of movement of the drum take place through angles and corresponding times which are the same as each other.
7. Washing process according to claims 1 and 3, **characterised in that** the said angular movements and the said consecutive stop times comprising the second stage of movement of the drum take place through angles and corresponding times which are different from each other.
8. Washing process according to claims 1 to 7, **characterised in that** the succession of consecutive angular movements comprising the said first and the said second stage of movement of the drum extend for $360^\circ \pm 10^\circ$.
9. Washing process according to claims 1 to 8, **characterised in that** each of the said times during which the drum movement stops consecutive upon the angular movements comprising the said first and the second stage of movement of the drum last for a time of between 0.8 and 1.2 sec.
10. Washing process according to claims 1 to 9, **characterised in that** the said pause stage between the said first and the said second stage of movement of the drum lasts for a time of between 10 sec and 360 sec.
11. Washing process according to claims 1 to 10, **characterised in that** the average angular velocity with which the said consecutive angular movements are made lies between 0.10 and 0.20 degrees/sec.

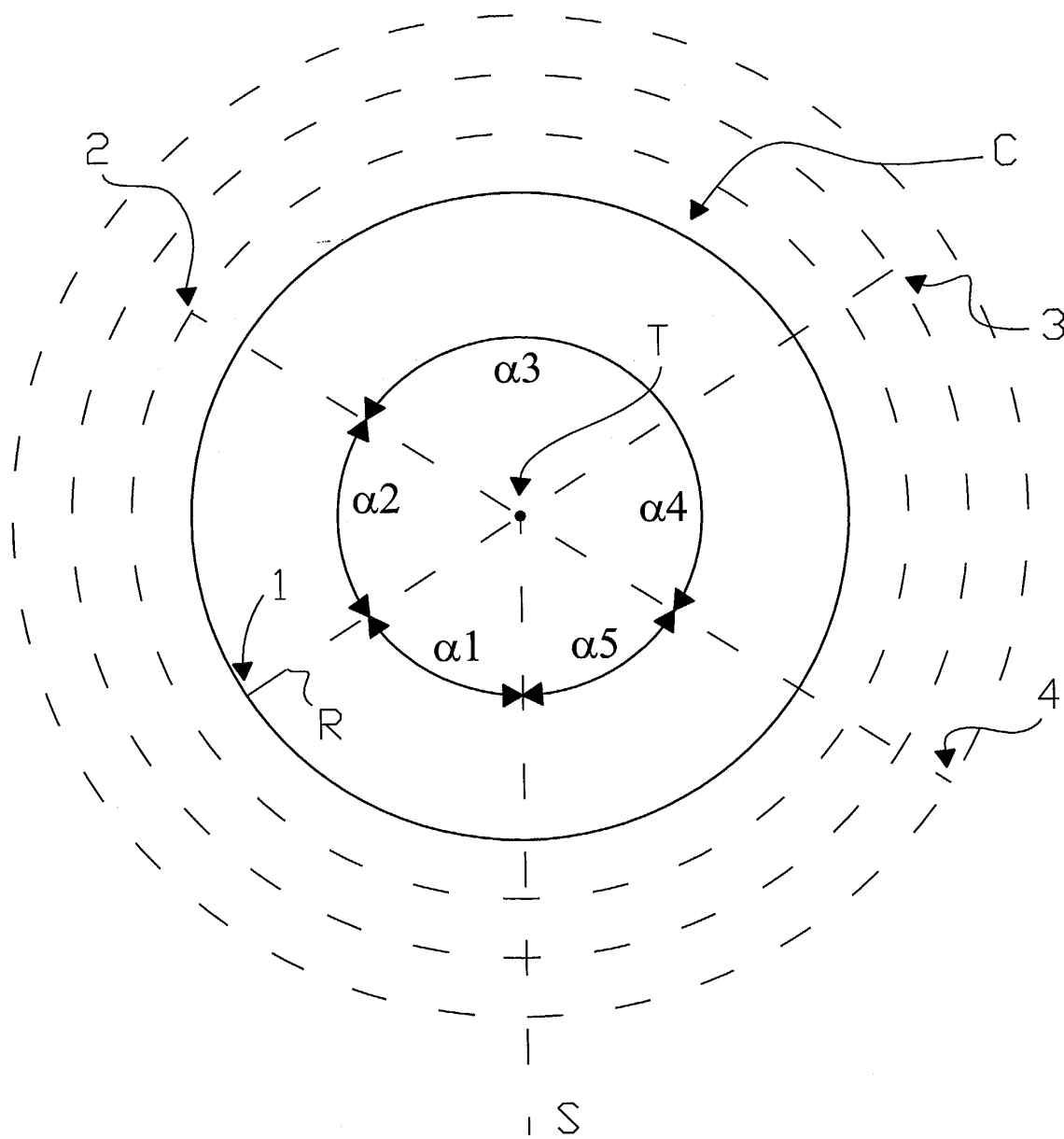


Fig. 1



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5468

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 241 567 A (WFK TESTGEWEBE GMBH) 21 October 1987 (1987-10-21) * the whole document *	1-11	D06F35/00
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 9 December 2004	Examiner Norman, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 42 5468

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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09-12-2004

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