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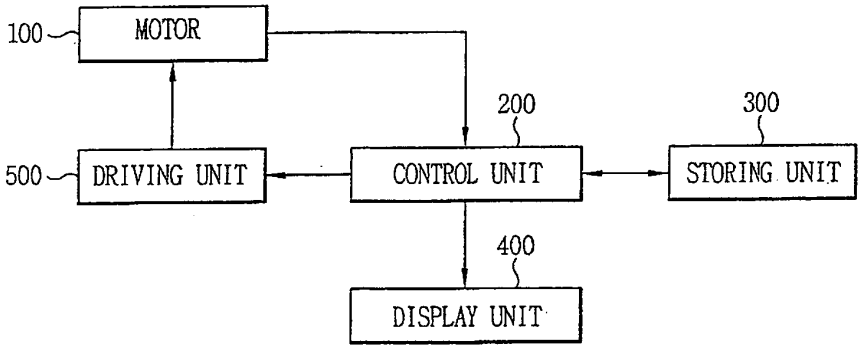
(54) Dehydration control apparatus and method for washing machine

(57) The present invention discloses a dehydration control apparatus and method for a washing machine. The dehydration control apparatus for the washing machine includes: a storing unit for storing reference unbalance quantities according to each load quantity; and a control unit for detecting a load quantity and an unbalance quantity by accelerating or decelerating a motor of the washing machine, comparing a reference unbalance quantity from the stored reference unbalance quantities that correspond to the detected load quantity with the detected unbalance quantity, and determining dehydration completion according to the comparison result.

FIG. 3



EP 1 760 181 A1

Description

[0001] This application claims the benefit of Korean Patent Application No. 2005-82319, filed September 5, 2005, which is hereby incorporated by reference for all purposes as if fully set forth herein.

[0002] This application claims the benefit of Korean Patent Application No. 2005-82319, filed September 5, 2005, which is hereby incorporated by reference for all purposes as if fully set forth herein.

The present invention relates to a washing machine, and more particularly, to a dehydration control apparatus and method for a washing machine which can sense variations of a dehydration quantity and apply different reference unbalance quantities according to the varied load quantities.

[0003] Generally, a washing machine applies a mechanical operation, such as friction or vibration, to the laundry put in a washing solution, thereby separating contaminants from the laundry.

[0004] For this, the washing machine performs a washing step for applying a mechanical force to the laundry mixed with the washing solution, a rinsing step for separating the washing solution containing contaminants from the laundry, and a dehydration step for separating the rinsing water from the laundry.

[0005] When the laundry is not evenly distributed in the washing machine, namely, when an unbalance of the laundry is generated, serious vibration and noise occur in the dehydration operation.

[0006] Therefore, the washing machine needs a laundry leveling function of detecting an unbalance quantity and evenly distributing the laundry according to the detected unbalance quantity.

[0007] FIG. 1 is a flowchart illustrating a related art unbalance quantity detecting and dehydration method for a washing machine.

[0008] In FIG. 1, the related art unbalance quantity detecting and dehydration method for the washing machine includes the steps of: operating a motor of the washing machine at a low speed (S11); detecting an unbalance quantity by sensing variations of a speed (RPM) of the motor (S12); comparing a preset reference unbalance quantity with the detected unbalance quantity (S13); when the detected unbalance quantity is larger than the reference unbalance quantity, performing a laundry leveling function (S14A), and when the detected unbalance quantity is smaller than the reference unbalance quantity, performing the dehydration operation by increasing the speed of the motor (S14B).

[0009] The step (S12) for detecting the unbalance quantity will now be explained in detail with reference to FIG. 2.

[0010] Variations in the spinning speed (RPM) of the motor of the washing machine are detected by measuring the spinning speed of the motor at intervals of a predetermined time and period using a speed detecting unit mounted on the motor.

[0011] An unbalance quantity and a load quantity at point A of FIG. 2 are detected using a maximum variation and a minimum variation among the variations of the spinning speed of the motor of the washing machine.

[0012] The detected unbalance quantity is compared with a reference unbalance quantity corresponding to a preset load quantity. When the detected unbalance quantity is larger than the reference unbalance quantity, the motor of the washing machine is stopped, the spinning direction of the motor is changed, and the laundry leveling function is performed again.

[0013] When the detected unbalance quantity is smaller than the reference unbalance quantity, the dehydration operation is performed to remove moisture from the laundry by increasing the speed of the motor below a resonance speed. Thereafter, the speed of the motor is decreased and an unbalance quantity in point B of FIG. 2 is detected.

[0014] When the unbalance quantity detected in the point B is smaller than the reference unbalance quantity, the dehydration operation is performed by increasing the speed of the motor. When the speed of the motor reaches a preset dehydration speed, the speed of the motor is decreased after a predetermined time, and an unbalance quantity at point C of FIG. 2 is detected.

[0015] When the unbalance quantity detected at the point C of FIG. 2 is larger than the reference unbalance quantity, the motor of the washing machine is stopped, the spinning direction of the motor is changed, and the laundry leveling function is performed again.

[0016] When the detected unbalance quantity is smaller than the reference unbalance quantity, the speed of the motor is increased to a preset dehydration speed, and the dehydration operation is performed at the dehydration speed for a preset time and stopped.

[0017] The load quantities in A, B and C of FIG. 2 are varied by increase of the dehydration speed. However, the related art dehydration control apparatus and method for the washing machine determine the reference unbalance quantity by using the first sensed load quantity.

[0018] Accordingly, when the first sensed reference unbalance quantity is an error, noise and vibration are generated in the dehydration operation. In addition, since a reattempt number for dehydration acceleration is increased by strictly applying the standard, it takes a long time to enter into the dehydration stage

[0019] Accordingly, the present invention is directed to a dehydration control apparatus and method for washing machine that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0020] An advantage of the present invention is to provide a dehydration control apparatus and method for a washing

machine which can restrict noise and vibration resulting from mis-application of a reference unbalance quantity and reduce a dehydration entering time, by sensing variations of a dehydration quantity and applying different reference unbalance quantities according to the varied load quantities.

[0021] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. These and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0022] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a dehydration control apparatus for a washing machine, including: a storing unit for storing reference unbalance quantities according to each load quantity; and a control unit for detecting a load quantity and an unbalance quantity by accelerating or decelerating a motor of the washing machine, comparing a reference unbalance quantity corresponding to the detected load quantity with the detected unbalance quantity, and determining dehydration completion based upon the comparison result.

[0023] In another aspect of the present invention, there is provided a dehydration control method for a washing machine which spin-dries the laundry in an optimum state, the method including: detecting a load quantity and an unbalance quantity of the laundry by increasing or decreasing a dehydration speed; and comparing a reference unbalance quantity corresponding to the detected load quantity with the detected unbalance quantity, and determining dehydration completion according to the comparison result.

[0024] In another aspect of the present invention, there is provided a dehydration control method for a washing machine which spin-dries the laundry in optimum state, the method including: detecting a first load quantity and a first unbalance quantity at a first target speed in a dehydration mode; comparing the first unbalance quantity with a first reference unbalance quantity corresponding to the first load quantity, one of accelerating a wash tub to a second target speed according to the comparison result and decelerating the wash tub to the first target speed, and detecting a second load quantity and a second unbalance quantity; comparing the second unbalance quantity with a second reference unbalance quantity corresponding to the second load quantity, one of accelerating the wash tub to a third target speed according to the comparison result and decelerating the wash tub to the first target speed, and detecting a third load quantity and a third unbalance quantity; and comparing the third unbalance quantity with a third reference unbalance quantity corresponding to the third load quantity, and confirming final dehydration according to the comparison result.

[0025] It is to be understood that both the foregoing description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

[0026] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a flowchart illustrating a related art unbalance quantity detecting and dehydration method for a washing machine;

FIG. 2 is a graph illustrating a related art dehydration process;

FIG. 3 is a block diagram illustrating a structure of a dehydration control apparatus for a washing machine in accordance with an embodiment of the present invention;

FIG. 4 is a flowchart illustrating a dehydration control method for a washing machine in accordance with an embodiment of the present invention; and

FIG. 5 is a graph illustrating a dehydration process of the washing machine in accordance with the present invention

[0027] Reference will now be made in detail to embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0028] A dehydration control apparatus and method for a washing machine which can restrict noise and vibration resulting from mis-application of a reference unbalance quantity and reduce a dehydration time, by sensing variations of a dehydration quantity and applying different reference unbalance quantities according to the varied load quantities will now be described in detail with reference to the accompanying drawings.

[0029] FIG. 3 is a block diagram illustrating the structure of the dehydration control apparatus for the washing machine in accordance with an embodiment of the present invention.

[0030] In FIG. 3, the dehydration control apparatus for the washing machine includes a motor 100, a driving unit 500, a storing unit 300, a display unit 400 and a control unit 200.

[0031] The motor 100 rotates a wash tub in the washing machine.

[0032] The driving unit 500 drives the motor 100.

[0033] The storing unit 300 stores reference unbalance quantities corresponding to each load quantity.

[0034] The display unit 400 displays a washing operation proceeding state of the washing machine.

[0035] The control unit 200 wholly controls the washing operation of the washing machine.

[0036] In accordance with the present invention, the control unit 200 detects a load quantity and an unbalance quantity by increasing or decreasing a dehydration speed of the washing machine, compares the reference unbalance quantity corresponding to the detected load quantity with the detected unbalance quantity, and determines dehydration completion according to the compared result.

[0037] The dehydration control method for the washing machine in accordance with the present invention will now be described in more detail with reference to FIG. 4.

[0038] The storing unit 300 stores, in advance, pre-determined optimum reference unbalance quantities corresponding to each load quantity.

[0039] The storing unit 300 may be comprised of a ROM table for storing the reference unbalance quantities corresponding to each load quantity in the form of database.

[0040] In a dehydration mode (SP1), the control unit 200 maintains a first target speed (about 100 RPM) at point A of FIG. 5, and calculates a first load quantity and a first unbalance quantity (SP2).

[0041] The control unit 200 selects a first reference unbalance quantity that corresponds to the first load quantity from the storing unit 300, and compares the selected first reference unbalance quantity with the first unbalance quantity (SP3).

[0042] If the first unbalance quantity is larger than the first reference unbalance quantity corresponding to the first load quantity, the control unit 200 repeatedly performs the dehydration operation by applying the first unbalance quantity at the first target speed, to complete dehydration (SP4 and SP5).

[0043] Conversely, when the first unbalance quantity is smaller than the first reference unbalance quantity corresponding to the first load quantity, the control unit 200 increases the dehydration speed to a second target speed (about 200 PRM) at point B of FIG. 5 (SP6), constantly maintains the second target speed, and performs the dehydration operation (SP7).

[0044] After performing the dehydration operation at the second target speed for a predetermined time, the control unit 200 decreases the second target speed to the first target speed by dynamic braking (SP8), and calculates a second load quantity and a second unbalance quantity.

[0045] Here, the second load quantity is represented by the following formula:

[Formula]

$$J = \frac{(k1 \times PWM + K2 \times \omega_0) s_1 + k3 t_1 + k4 s_1 + k5 \sum \omega \Delta s}{\omega_0^2}$$

ω0 : sensing start rpm
PWM : ω0 rpm control PWM value
s1 : revolution angle in braking
t1 : braking time
Σω·Δs : sum of speed in braking

[0046] In the dynamic braking, three terminals (positive/negative terminals and ground terminal) of the motor are shorted by a switch for driving the motor, and a braking torque generated by the short is controlled and applied to the motor.

[0047] The control unit 200 compares the second unbalance quantity with the second reference unbalance quantity corresponding to the second load quantity (SP10).

[0048] If the second unbalance quantity is larger than the second reference unbalance quantity corresponding to the second load quantity, the control unit 200 repeatedly performs the dehydration operation by applying the second unbalance quantity at the second target speed to complete dehydration (SP11 and SP5).

[0049] Conversely, when the second unbalance quantity is smaller than the second reference unbalance quantity corresponding to the second load quantity, the control unit 200 increases the dehydration speed of the washing machine to a third target speed (about 400 PRM) at point C of FIG. 5 (SP12), constantly maintains the third target speed, and performs the dehydration operation (SP13).

[0050] After performing the dehydration operation at the third target speed for a predetermined time, the control unit 200 decreases the third target speed to the first target speed by dynamic braking (SP14), and calculates a third load quantity and a third unbalance quantity.

[0051] Here, the third load quantity is detected using the formula above for calculating the second load quantity.

[0052] In addition, the first target speed, the second target speed and the third target speed satisfy 'the first target speed < the second target speed < the third target speed'.

[0053] The control unit 200 compares the third unbalance quantity with the third reference unbalance quantity corresponding to the third load quantity (SP16).

[0054] If the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity, the control unit 200 repeatedly performs the dehydration operation by applying the third unbalance quantity to complete dehydration (SP17 and SP5).

[0055] Conversely, when the third unbalance quantity is smaller than the third reference unbalance quantity corresponding to the third load quantity, the control unit 200 increases the dehydration speed of the washing machine to the third target speed (about 400 PRM) (SP12), constantly maintains the third target speed, and performs the dehydration operation (SP13).

[0056] After performing the dehydration operation at the third target speed for a predetermined time, the control unit 200 decreases the third target speed to the first target speed by dynamic braking (SP14), and repeatedly updates the third load quantity and the third unbalance quantity until the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity.

[0057] In accordance with the present invention, the actual weight of the laundry varied by the laundry leveling function and the dehydration operation is applied in the dehydration mode of the washing machine. The dehydration operation is carried out using the reference unbalance quantity corresponding to the actual weight of the laundry.

[0058] Therefore, in the dehydration mode of the washing machine, the variations of the dehydration quantity of the laundry are sensed, and different allowable unbalance quantities are applied according to the varied load quantities.

[0059] As discussed earlier, the dehydration control apparatus and method for the washing machine can restrict noise and vibration resulting from mis-application of the reference unbalance quantity and reduce the dehydration entering time, by sensing variations of the dehydration quantity and applying different reference unbalance quantities according to the varied load quantities in the dehydration mode.

[0060] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A dehydration control apparatus for a washing machine, comprising:

   a storing unit for storing reference unbalance quantities according to each load quantity; and
   a control unit for detecting a load quantity and an unbalance quantity by accelerating or decelerating a motor of the washing machine, comparing a reference unbalance quantity from the stored reference unbalance quantities that corresponds to the detected load quantity with the detected unbalance quantity, and determining dehydration completion based upon the comparison.

2. The dehydration control apparatus as claimed in claim 1, wherein the control unit detects first, second and third load quantities and first, second and third unbalance quantities at first, second and third target speeds, selects first, second and third reference unbalance quantities corresponding to the detected first, second and third load quantities, compares the selected first, second and third reference unbalance quantities with the first, second and third unbalance quantities, respectively, and determines final dehydration based upon the comparison.

3. The dehydration control apparatus as claimed in claim 2, wherein the first target speed, the second target speed and the third target speed satisfy 'the first target speed < the second target speed < the third target speed'.

4. The dehydration control apparatus as claimed in claim 2, wherein, when the first unbalance quantity detected at the first target speed is smaller than the first reference unbalance quantity corresponding to the first load quantity, the control unit increases the dehydration speed to the second target speed, constantly maintains the second target speed, and performs the dehydration operation, after performing the dehydration operation at the second target speed for a predetermined time, the control unit decreases the second target speed to the first target speed by dynamic braking and detects the second load quantity and the second unbalance quantity, when the first unbalance quantity is larger than the first reference unbalance quantity corresponding to the first load quantity, the control unit repeatedly performs the dehydration operation by applying the first unbalance quantity and determines final dehydration., when the second unbalance quantity detected at the second target speed is smaller than the second reference unbalance quantity corresponding to the second load quantity, the control unit increases the dehydration speed to the third target speed, constantly maintains the third target speed and performs the dehydration operation,

and after performing the dehydration operation at the third target speed for a predetermined time, the control unit decreases the third target speed to the first target speed by dynamic braking and detects the third load quantity and the third unbalance quantity.

5. The dehydration control apparatus as claimed in any of claims 2 to 4, wherein, when the second unbalance quantity is larger than the second reference unbalance quantity corresponding to the second load quantity, the control unit repeatedly performs the dehydration operation by applying the second unbalance quantity, and determines final dehydration.

6. The dehydration control apparatus as claimed in any of claims 2 to 5, wherein when the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity, the control unit repeatedly performs the dehydration operation by applying the third unbalance quantity and determines final dehydration., and when the third unbalance quantity is smaller than the third reference unbalance quantity corresponding to the third load quantity, the control unit increases the dehydration speed to the third target speed, decreases the third target speed to the first target speed, and repeatedly updates the third load quantity and the third unbalance quantity until the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity.

7. A dehydration control method for a washing machine which spin-dries the laundry in an optimum state, the method comprising:

detecting a first load quantity and a first unbalance quantity at a first target speed in a dehydration mode;
comparing the first unbalance quantity with a first reference unbalance quantity corresponding to the first load quantity, one of accelerating a wash tub to a second target speed according to the comparison result and decelerating the wash tub to the first target speed, and detecting a second load quantity and a second unbalance quantity;
comparing the second unbalance quantity with a second reference unbalance quantity corresponding to the second load quantity, one of accelerating the wash tub to a third target speed according to the comparison result and decelerating the wash tub to the first target speed, and detecting a third load quantity and a third unbalance quantity; and
comparing the third unbalance quantity with a third reference unbalance quantity corresponding to the third load quantity, and confirming final dehydration according to the comparison result.

8. The dehydration control method as claimed in claim 7, wherein detecting the second load quantity and the second unbalance quantity comprises:

when the first unbalance quantity is smaller than the first reference unbalance quantity corresponding to the first load quantity, increasing a dehydration speed to the second target speed;
when the dehydration speed reaches the second target speed, constantly maintaining the second target speed and performing the dehydration operation; and
after a predetermined time, decreasing the second target speed to the first target speed by dynamic braking, and calculating the second load quantity and the second unbalance quantity.

9. The dehydration control method as claimed in claim 7 or 8, wherein detecting the third load quantity and the third unbalance quantity comprises:

when the second unbalance quantity is smaller than the second reference unbalance quantity corresponding to the second load quantity, increasing the dehydration speed to the third target speed;
when the dehydration speed reaches the third target speed, constantly maintaining the third target speed and performing the dehydration operation;
after a predetermined time elapses, decreasing the third target speed to the first target speed by dynamic braking, and calculating the third load quantity and the third unbalance quantity; and
repeatedly performing the dehydration operation by applying the second unbalance quantity, and determining final dehydration, when the second unbalance quantity is larger than the second reference unbalance quantity corresponding to the second load quantity.

10. The dehydration control method as claimed in any of claims 7 to 9, wherein confirming final dehydration comprises:

when the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity, repeatedly performing the dehydration operation by applying the third unbalance quantity, and determining final dehydration; and

when the third unbalance quantity is smaller than the third reference unbalance quantity corresponding to the third load quantity, increasing the dehydration speed to the third target speed, decreasing the third target speed to the first target speed, and repeatedly updating the third load quantity and the third unbalance quantity until the third unbalance quantity is larger than the third reference unbalance quantity corresponding to the third load quantity.

FIG. 1

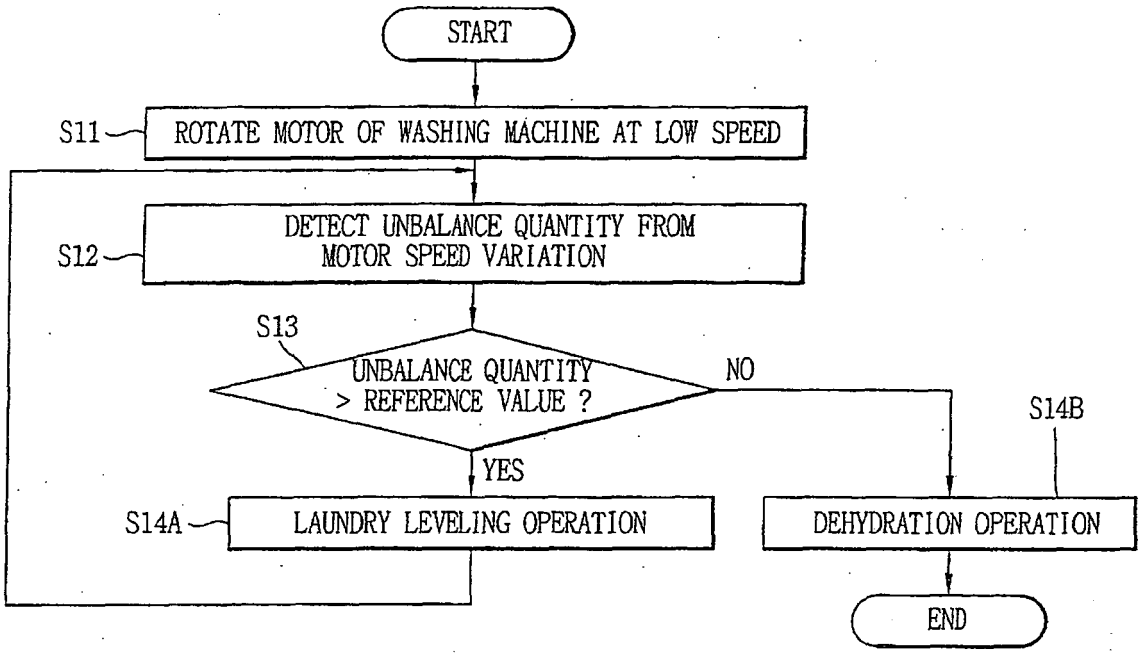

START
S11
ROTATE MOTOR OF WASHING MACHINE AT LOW SPEED
S12
DETECT UNBALANCE QUANTITY FROM MOTOR SPEED VARIATION
S13
UNBALANCE QUANTITY > REFERENCE VALUE ?
NO
YES
S14A
LAUNDRY LEVELING OPERATION
S14B
DEHYDRATION OPERATION
END

FIG. 2

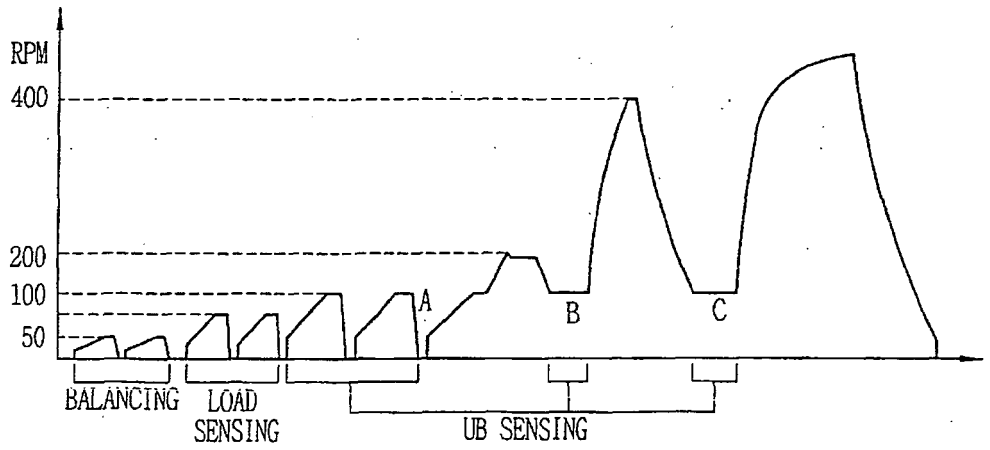

RPM
400
200
100
50
A
B
C
BALANCING
LOAD SENSING
UB SENSING

FIG. 3

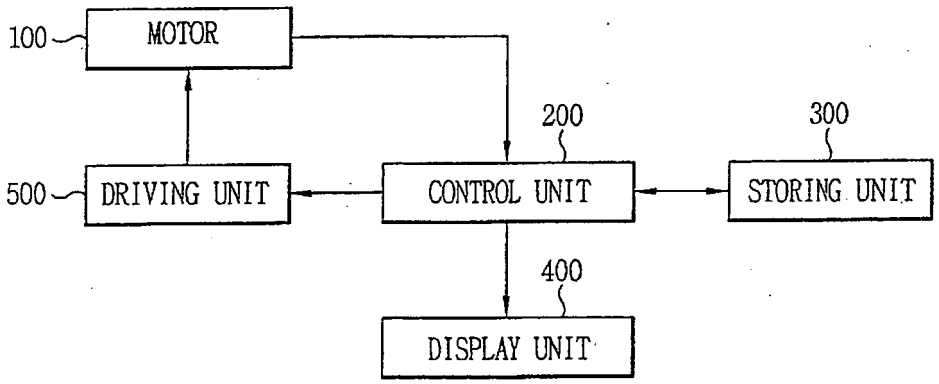

100
MOTOR
200
300
500
DRIVING UNIT
CONTROL UNIT
STORING UNIT
400
DISPLAY UNIT

FIG. 4

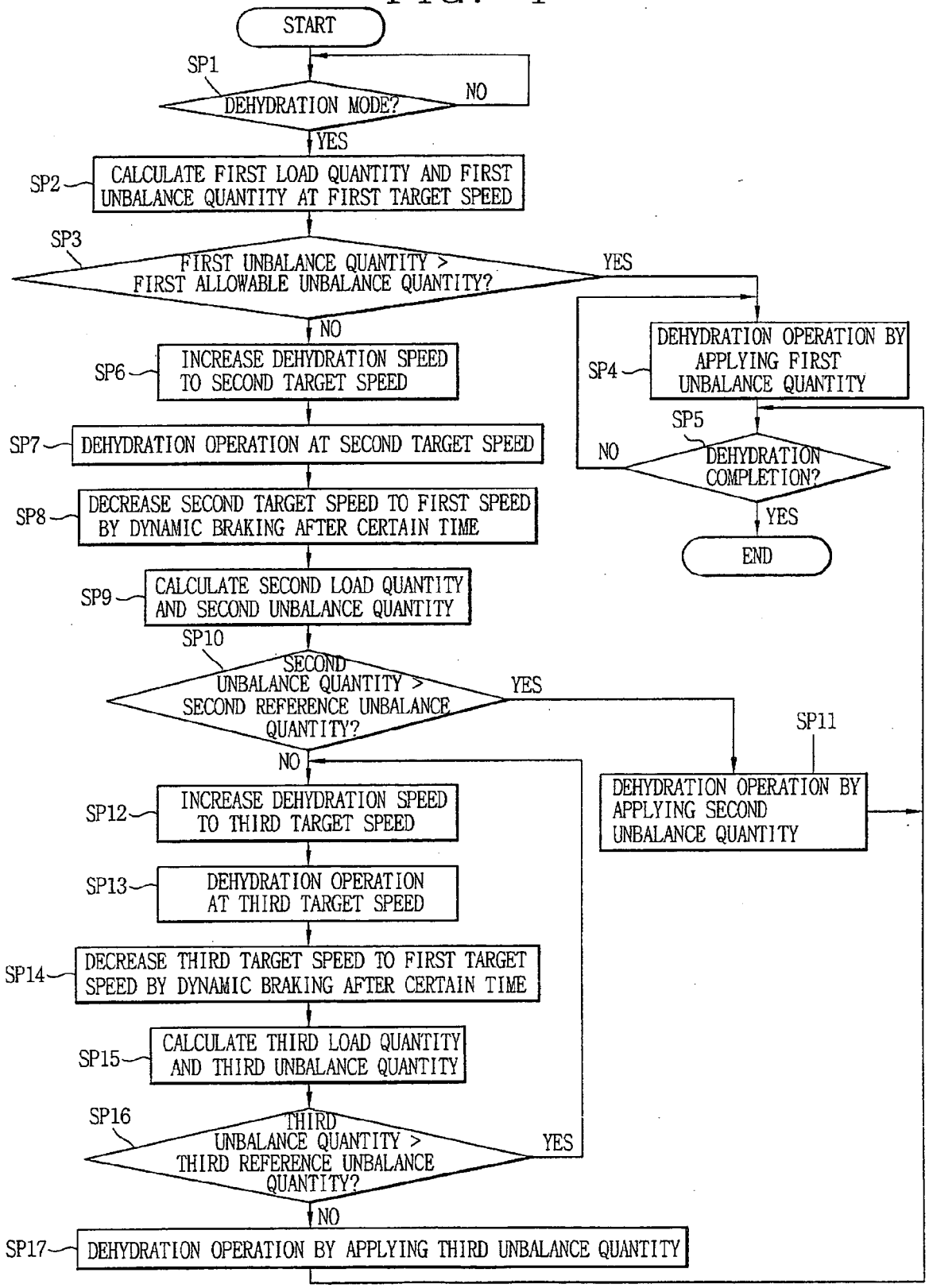
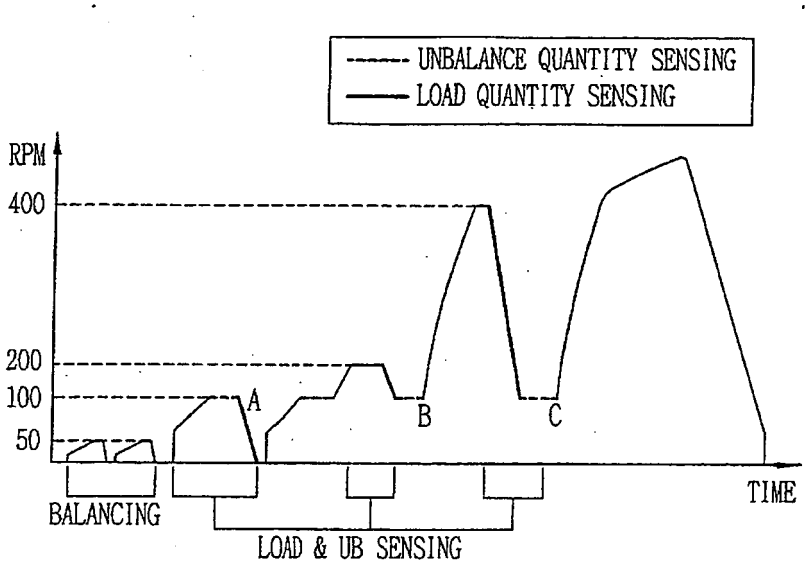

START
SP1
DEHYDRATION MODE?
NO
YES
SP2
CALCULATE FIRST LOAD QUANTITY AND FIRST UNBALANCE QUANTITY AT FIRST TARGET SPEED
SP3
FIRST UNBALANCE QUANTITY > FIRST ALLOWABLE UNBALANCE QUANTITY?
YES
NO
SP4
DEHYDRATION OPERATION BY APPLYING FIRST UNBALANCE QUANTITY
SP5
NO
DEHYDRATION COMPLETION?
YES
END
SP6
INCREASE DEHYDRATION SPEED TO SECOND TARGET SPEED
SP7
DEHYDRATION OPERATION AT SECOND TARGET SPEED
SP8
DECREASE SECOND TARGET SPEED TO FIRST SPEED BY DYNAMIC BRAKING AFTER CERTAIN TIME
SP9
CALCULATE SECOND LOAD QUANTITY AND SECOND UNBALANCE QUANTITY
SP10
SECOND UNBALANCE QUANTITY > SECOND REFERENCE UNBALANCE QUANTITY?
YES
NO
SP11
DEHYDRATION OPERATION BY APPLYING SECOND UNBALANCE QUANTITY
SP12
INCREASE DEHYDRATION SPEED TO THIRD TARGET SPEED
SP13
DEHYDRATION OPERATION AT THIRD TARGET SPEED
SP14
DECREASE THIRD TARGET SPEED TO FIRST TARGET SPEED BY DYNAMIC BRAKING AFTER CERTAIN TIME
SP15
CALCULATE THIRD LOAD QUANTITY AND THIRD UNBALANCE QUANTITY
SP16
THIRD UNBALANCE QUANTITY > THIRD REFERENCE UNBALANCE QUANTITY?
YES
NO
SP17
DEHYDRATION OPERATION BY APPLYING THIRD UNBALANCE QUANTITY

FIG. 5


UNBALANCE QUANTITY SENSING
LOAD QUANTITY SENSING
RPM
400
200
100
50
A
B
C
TIME
BALANCING
LOAD & UB SENSING

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 01 8555

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2005/016227 A1 (LEE PHAL JIN [KR]) 27 January 2005 (2005-01-27)	1	INV. D06F35/00
A	* page 2, paragraph 27 - paragraph 29; figure 2 *	2-10	D06F37/20
P,X	WO 2005/106096 A (LG ELECTRONICS INC [KR]; LEE PHAL-JIN [KR]) 10 November 2005 (2005-11-10)	1	
P,A	* figure 4 *	2-10	
A	US 2005/028296 A1 (LEE TAE HEE [KR] ET AL) 10 February 2005 (2005-02-10) * the whole document *	1-10	
A	US 2005/102766 A1 (VANDE HAAR EVAN R [US] ET AL) 19 May 2005 (2005-05-19) * the whole document *	1-10	
A	EP 1 538 251 A (SAMSUNG ELECTRONICS CO LTD [KR]) 8 June 2005 (2005-06-08) * the whole document *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 January 2007	Lodato, Alessandra

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 01 8555

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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23-01-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005016227 A1	27-01-2005	NONE	
WO 2005106096 A	10-11-2005	NONE	
US 2005028296 A1	10-02-2005	CN 1580358 A	16-02-2005
		JP 2005052659 A	03-03-2005
US 2005102766 A1	19-05-2005	CA 2484406 A1	17-05-2005
EP 1538251 A	08-06-2005	CN 1621596 A	01-06-2005
		JP 2005152604 A	16-06-2005
		US 2005108830 A1	26-05-2005

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 200582319 **[0001] [0002]**