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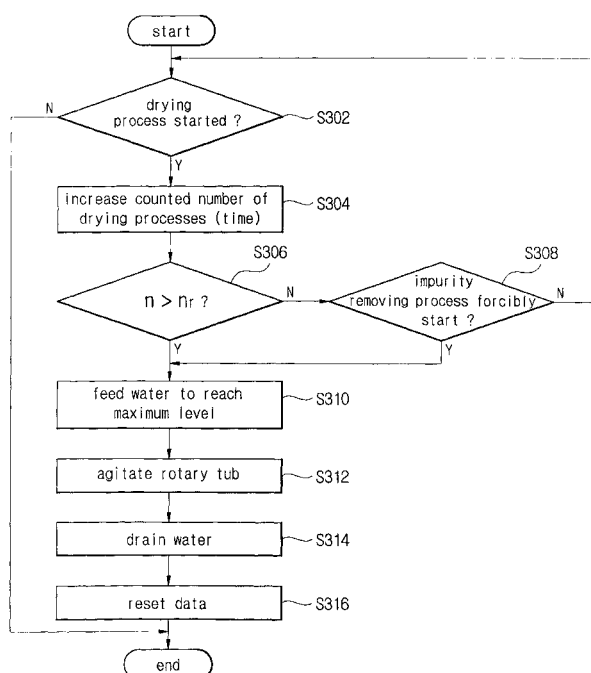
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(54) Washing and drying machine with impurity removal process

(57) A washing and drying machine has a washing tub consisting of a rotatable tub (404) and a fixed tub (402). Drying can be performed by circulating air heated by a drying heater through the washing tub for absorbing moisture contained in laundry, and by discharging the moisture-laden air to the outside. When the number of the performed drying processes exceeds a preset reference value (S306), the washing machine performs an

impurity removing process to remove dried impurities from the inside surface of the fixed tub. The impurity removing process involves filling completely the tub with water (S310), agitating the rotatable tub (S312) and emptying the machine of water (S314). Alternatively, the accumulated drying time is measured, and the impurity removing process performed when a threshold is exceeded.

FIG. 3



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Description

[0001] The present invention relates to a washing and drying machine comprising a rotatable tub and a fixed tub.

[0002] As well known to those skilled in the art, drum type washing machines are designed to wash laundry by dropping the laundry from the top to the bottom of a rotary tub by rotation thereof. Figure 1A is a perspective view showing the construction of such a conventional drum type washing machine. As shown in Figure 1A, a fixed tub 102 is horizontally set in a cabinet 100, and contains wash water therein. A rotatable tub 108 is set inside the fixed tub 102, and is rotated by the drive force of a motor 110 to perform washing and spin-drying processes. The rotatable tub 108 is perforated on its sidewall with a large number of spin-drying perforations, to allow wash water to pass from the fixed tub 102 to the rotatable tub 108, and to allow wash water separated from laundry by a centrifugal force to flow to a space defined between the fixed tub 102 and the rotatable tub 108.

[0003] Such drum type washing machines are classified into several types. One type is provided with a drying heater 114. Such a type additionally performs a drying process as well as washing, rinsing, and spin-drying processes. The drying process of drying laundry using the drying heater 114 is as follows. First, air is heated to a high temperature by the drying heater 114 to become dried air. The dried air flows into the fixed tub 102 as shown by the arrow 1 of Figure 1A to absorb moisture contained in laundry in the rotary tub 108. The resultant moisture-laden air moisture is caused to flow along the sidewall of the fixed tub 102 by a blowing fan 112 in the direction shown by the arrow 2 of Figure 1A. When air circulates in the fixed tub 102 and is forced by the fan 112 as described above, the moisture contained in the air is condensed on the inside surface of the fixed tub 102 by a condensing plate 104 mounted to the sidewall of the fixed tub 102. The condensing plate 104 condenses the moisture-laden air through the use of a small quantity of cool water, which is supplied through a condensing hose 106 connected to an external water supply source. After the moisture is removed from the air by the condensing plate 104, the air is reheated by the drying heater 114 and fed into the fixed tub 102 by the fan 112 in the direction given by the arrow 1. Moisture condensed by the condensing plate 104 flows down along the inside surface of the tub 102 to reach the bottom of the tub 102. Thereafter, the moisture is discharged to the outside by a drain pump 116.

[0004] Figure 1B is a view showing the conventional drum type washing machine, when wash water is fed into the washing machine. As shown in Figure 1B, when it is required to perform the washing and rinsing processes in the conventional drum type washing machine, wash water is fed into the fixed tub 102 until it reaches a level corresponding to one third of the entire height of the fixed tub 102. If too much wash water is fed into the

fixed tub 102, the dropping height of laundry becomes small, so effective washing may not be accomplished. During a drying process, a variety of dried impurities 154, such as lint, can be separated from the laundry and deposited on the inside surface of the fixed tub 102.

[0005] The dried impurities 154 are deposited on the upper portion of the fixed tub 102, i.e. the portion which is not bathed in wash water, thus causing the interior of the washing tub 102 to become dirty. Furthermore, it is difficult to clean the washing tub because only a small space is formed between the fixed tub 102 and the rotary tub 108.

[0006] The invention is characterised by means for detecting when an amount of drying performed exceeds a threshold, and means responsive to the detecting means for initiating an inputting removal process.

[0007] A washing machine according to this invention may include a washing tub consisting of a rotary tub and a fixed tub, and the designed to circulate air heated by a drying heater through the washing tub for absorbing moisture contained in laundry, and to perform a drying process for drying laundry by discharging the moisture-laden air to the outside. In such a washing machine, when the number of performed drying processes exceeds a preset reference value, a control unit may initiate an impurity removing process for removing dried impurities from the inside surface of the fixed tub.

[0008] An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1A is a perspective view showing a conventional drum type washing machine;

Figure 1B is a view showing the conventional drum type washing machine, when wash water is fed into the washing machine;

Figure 2 is a block diagram of a drum type washing machine according to this invention;

Figure 3 is a flowchart showing an impurity removing process of the Figure 2 washing machine; and
Figure 4 is a view showing the Figure 2 washing machine when wash water is fed into it.

[0009] In the drawings, the same reference numerals are used to designate the same or similar components.

[0010] Figure 2 is a block diagram of a drum type washing machine in accordance with this invention. Referring to Figure 2, a control unit 202 controls all processes of the washing machine, including washing, rinsing, spin-drying, and drying processes. The control unit 202 is arranged to count the number of drying processes performed, and to compare this figure to a predetermined threshold. Alternatively or in addition, the control unit is arranged to calculate the total time which the washing machine has spent performing a drying process.

[0011] A user sets a washing condition as desired or selects desired processes of the washing machine, by

means of an input unit 206. Signals representing the washing condition and command sent by the input unit 206 are applied to the control unit 202. A water level sensor 204 senses the quantity of wash water fed into a fixed tub (not shown), and outputs a signal representing a sensed value to the control unit 202. The water level sensor 204 is arranged to sense whether or not wash water in the fixed tub reaches the maximum water level during an impurity removing process.

[0012] A storage unit 208 stores data regarding the counted number of performed drying processes and/or the counted drying time in a non-volatile memory, such as EPROM (Erasable and Programmable Read Only Memory). The control unit 202 counts the number of the performed drying processes (or the drying time), stores the counted value in the storage unit 208, and displays the value on a display unit 218.

[0013] A drive unit 210 drives a motor 212, a drain pump 214, a drying heater 216, and the display unit 218. The motor 212 causes a rotary tub 220 to rotate in alternating directions at regular time intervals during the washing and rinsing processes, and to rotate in a forward direction at a high speed during spin-drying. The drain pump 214 drains water from the bottom of the fixed tub. The drying heater 216 heats air flowing into the fixed tub. The display unit 218 displays the number of the performed drying processes (or the drying time) to allow it to be viewed by a user.

[0014] Figure 3 is a flowchart of an impurity removing process of the drum type washing machine of this invention. As shown in Figure 3, after the drum type washing machine of this invention starts a drying process at step S302. The control unit 202 increases a counted value (n) of the performed drying processes (or the drying time) at step 304. In the case of counting the number of the performed drying processes, the counted value (n) is increased by one. In the case of counting or accumulating the drying time, the counted value (n) is increased by a time equal to the drying time. The number of the performed drying processes (or the drying time) is counted using a counter provided in the control unit 202, or provided at a position separate from the control unit 202. The control unit 202 compares the counted value (n) of the number of the performed drying processes (or the drying time) with a preset reference value (n) or threshold at step S306. When the counted value (n) of the number of the performed drying processes (or the drying time) exceeds the threshold (n), the control unit 202 causes an impurity removing process to be performed at steps S310 to S316. A user may cause the impurity removal process to be performed if the value (n) of the number of the performed drying process (or the drying time) does not exceed the reference value (n). A decision may be made on the basis of the number of the performed drying processes (or the drying time) displayed on the display unit 218. To forcibly perform the impurity removing process, the user appropriately manipulates the input unit 206 at step S308.

[0015] The impurity removing process is as follows. First, water is supplied to the fixed tub until it reaches the maximum water level at step S310. When the filling is complete, the rotary tub 220 is agitated for a predetermined period of time to generate water currents. As the rotary tub 220 is agitated, the dried impurities deposited on the inside surfaces of the fixed tub and the rotary tub 220 are displaced by the water currents. When the rotary tub 220 has been agitated for a preset period of time, the control unit 202 drives the drain pump 214 to perform a draining process at step S314. Here, impurities previously deposited on the inside surface of the fixed tub are discharged to the outside along with the drained wash water. When the draining process is finished, data concerning the number of performed drying processes (or the drying time), in the control unit 202 and displayed on the display unit 218, is reset at step S316. This is achieved by resetting the memory.

[0016] Figure 4 is a view showing the drum type washing machine of this invention when the washing machine is filled with wash water during the impurity removal process. Thereafter, the rotary tub 404 is agitated to remove the dried impurities 408 from the inside surface of the fixed tub 402.

[0017] As described above, the embodiment provides a drum type washing machine which automatically performs an impurity removing process when the number of the performed drying processes or an accumulated drying time exceeds a preset reference value.

[0018] The machine also displays the number of the performed drying processes or the drying time on a display unit. A user may be able to carry out the impurity removing process or not without the threshold having been exceeded. The described washing machine allows dried impurities to be easily removed from the inside surface of the fixed tub of the drum type washing machine, thus preventing the interior of the washing tub from becoming dirty.

[0019] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope of the invention as disclosed in the accompanying claims.

Claims

1. A washing and drying machine comprising a rotatable tub and a fixed tub, **characterised by** means for detecting when an amount of drying performed exceeds a threshold, and means responsive to the detecting means for initiating an impurity removal process.
2. A machine as claimed in claim 1, in which the amount of drying is the accumulated drying time.

3. A machine as claimed in claim 1, in which the amount of drying is the number of drying processes performed.
4. A machine as claimed in any preceding claim, comprising a data storage unit for storing data representing the amount of drying.
5. A machine as claimed in claim 4, in which the data storage includes a non-volatile memory.
6. A machine as claimed in claim 4 or 5, including means for resetting the data when the impurity removing process is performed.
7. A machine as claimed in any preceding claim comprising a display for displaying the amount of drying.
8. A machine as claimed in any preceding claim including means for allowing a user to initiate the impurity removing process.
9. A machine as claimed in any preceding claim comprising means responsive to the initiating means for causing water to be introduced into the machine, means for moving, preferably agitating, the rotatable drum and means for draining water from the machine.
10. A machine as claimed in claim 9, in which water is introduced to at least a half full level.
11. A machine as claimed in claim 10, in which water is introduced to a substantially full level.
12. A method of operating a washing and drying machine, the method comprising: detecting when an amount of drying performed exceeds a threshold, and, in response, initiating an impurity removal process.
13. A drum type washing machine comprising a rotatable tub and a fixed tub, means to detect when a predetermined amount of drying has been performed, and means responsive to the detecting means for removing impurities from an inside surface of the fixed tub.
14. The drum type washing machine according to claim 13, further comprising a data storage unit for storing data on the number of performed drying processes.
15. The drum type washing machine according to claim 14, wherein the data on the number of the performed drying processes stored in the storage unit is reset, when the impurity removing process is completed.
16. The drum type washing machine according to claim 14, wherein said data storage unit is a non-volatile memory.
17. The drum type washing machine according to claim 13, wherein said impurity removing process comprises the steps of:
 - feeding wash water into the fixed tub;
 - agitating the rotary tub for a predetermined period of time; and
 - draining the wash water such that the dried impurities are discharged to the outside along with the wash water.
18. The drum type washing machine according to claim 17, wherein said wash water is fed into the fixed tub until reaching a maximum water level thereof, in the impurity removing process.
19. The drum type washing machine according to claim 13, wherein said impurity removing process is carried out when a total time of the performed drying processes exceeds the preset value.
20. The drum type washing machine according to claim 13, further comprising a display unit for displaying the number of the performed drying process such that a user predicts an amount of impurities deposited on the inside surface of the fixed tub depending on the number of the performed drying processes displayed on said display unit, and determines whether the impurity removing process is forcibly carried out or not.
21. A method of controlling a drum type washing machine consisting of a rotary tub and a fixed tub, and performing a laundry drying process, said method comprising the steps of:
 - counting the number of performed drying processes; and
 - carrying out an impurity removing process of removing dried impurities from an inside surface of the fixed tub, when the number of the performed drying processes exceeds a preset reference value.
22. The method according to claim 21, wherein said impurity removing process comprises the steps of:
 - feeding wash water into the fixed tub;
 - agitating the rotary tub for a predetermined period of time; and
 - draining the wash water such that the dried impurities are discharged to the outside along with the wash water.

23. The method according to claim 22, wherein said wash water is fed into the fixed tub until reaching a maximum water level thereof, in the impurity removing process.

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24. The method according to claim 21, wherein said impurity removing process is carried out when a total time of the performed drying processes exceeds the preset reference value.

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25. The method according to claim 21, further comprising the steps of:

displaying the number of the performed drying processes on a display unit such that a user predicts an amount of impurities deposited on the inside surface of the fixed tub depending on the number of the performed drying processes displayed on said display unit, and determines whether impurity removing process is forcibly carried out or not.

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FIG. 1A
(Prior Art)

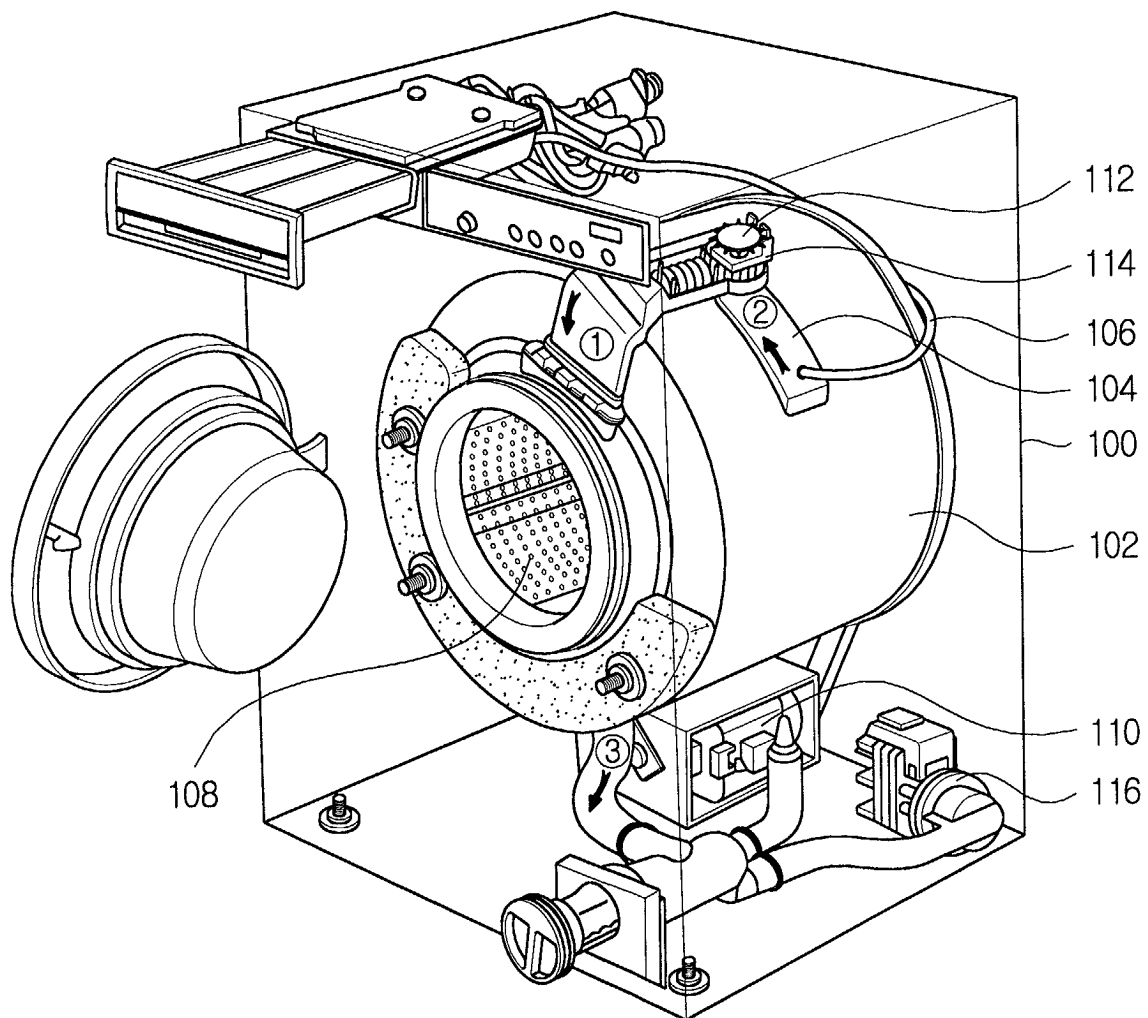


FIG. 1B
(Prior Art)

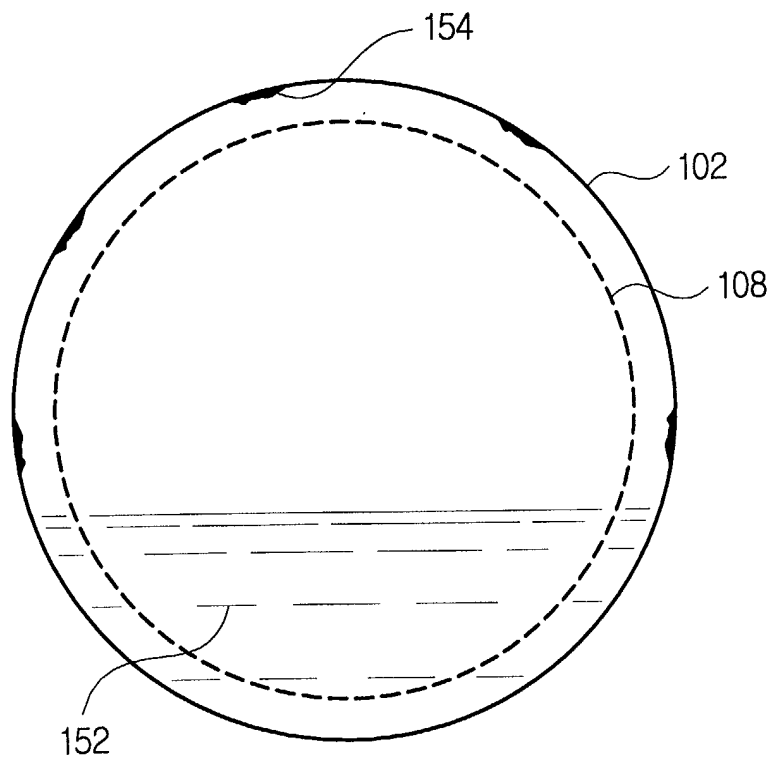


FIG. 2

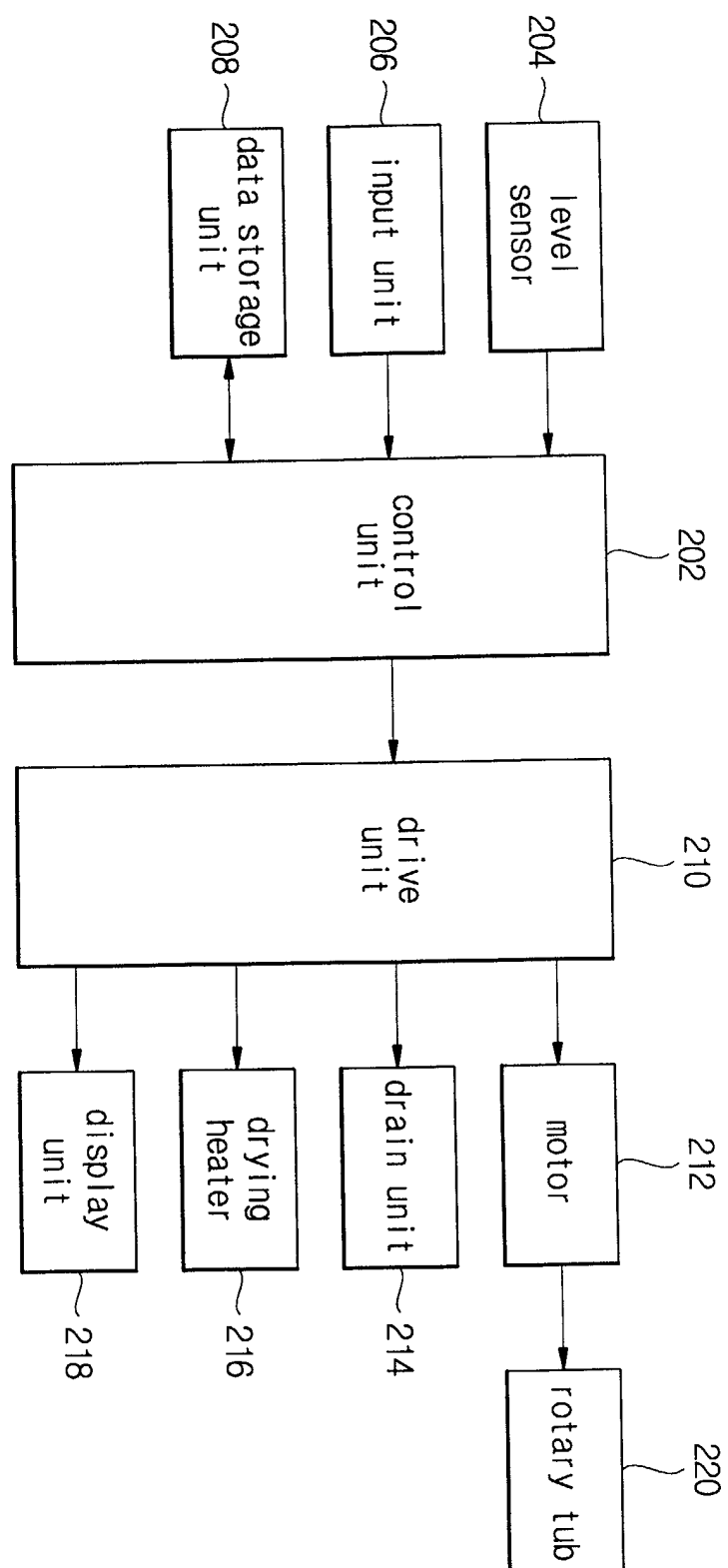


FIG. 3

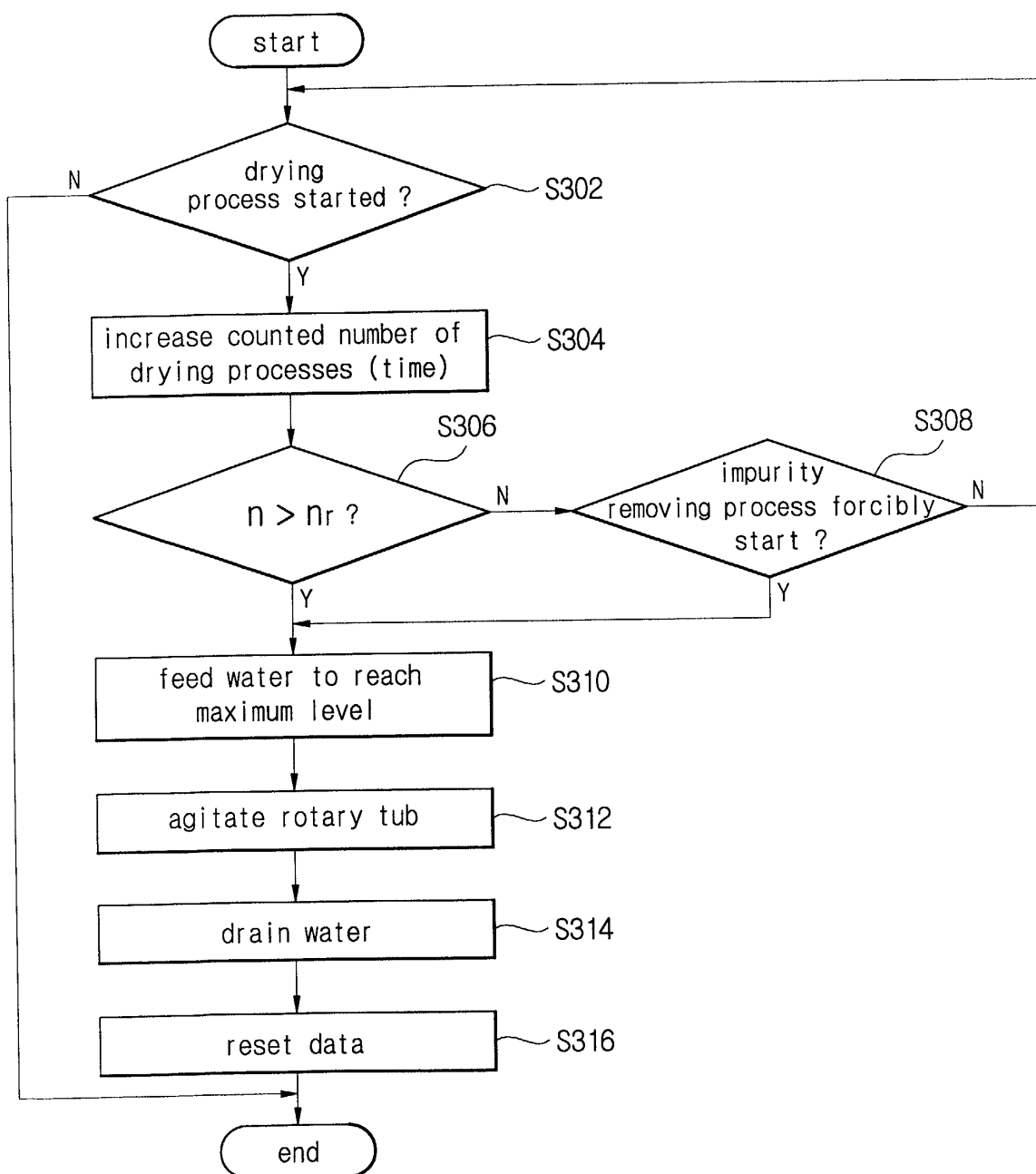
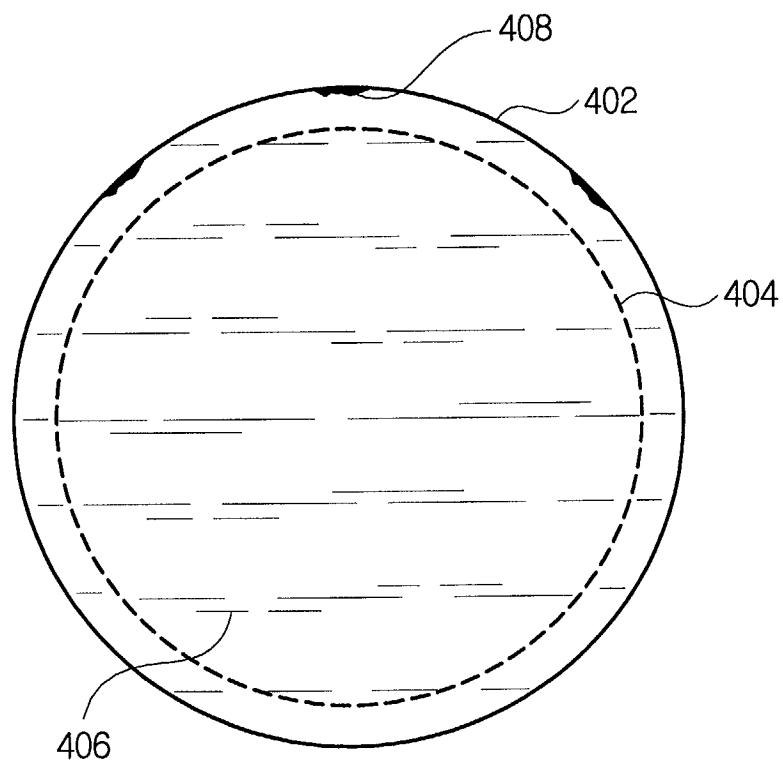


FIG. 4





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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 6241

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 24 June 2003	Examiner Falkentoft, C
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EUROPEAN SEARCH REPORT

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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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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