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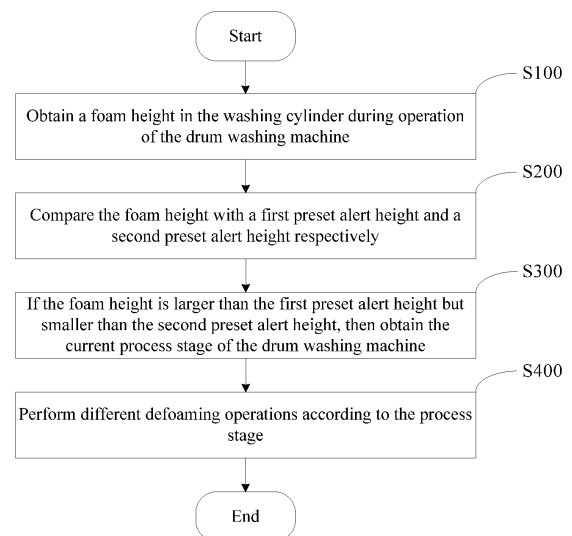
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(54) **DEFOAMING METHOD FOR WASHING DEVICE**

(57) A defoaming method for a washing device, comprising the following steps: during the operation of the washing device, acquiring the foam height in a washing drum; respectively comparing the foam height with a first preset warning height and a second preset warning height; if the foam height is greater than the first preset warning height but less than the second preset warning height, then acquiring the current process stage of the washing device; and executing different defoaming operations on the basis of the process stage; thus, whether the foam in the washing drum needs defoaming processing can be judged in advance, preventing a ventilation pipe from being blocked due to a large amount of foam filling the washing drum; defoaming treatment can be carried out in a targeted manner, and the foam in the washing drum can be quickly and effectively removed, ensuring the normal operation of the washing device.



**FIG. 1**

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## Description

### FIELD OF THE INVENTION

**[0001]** The present disclosure relates to the technical field of smart home, and specifically provides a defoaming method for a washing apparatus.

### BACKGROUND OF THE INVENTION

**[0002]** A washing machine is a common household clothing washing apparatus. According to the washing method, the washing machine can be roughly divided into a pulsator washing machine and a drum washing machine. Taking the drum washing machine as an example, it is usually necessary to add a corresponding amount of detergent to washing water before the clothing is washed in the drum washing machine. However, when there is too much detergent dispensed into the drum washing machine, air and the detergent will be in continuous contact due to stirring, impact on the detergent by water flow, and the like, which is easy to produce excessive foam. If not removed in time, the large amount of foam will fill up washing cylinders and will block a vent pipe, so that the pressure in the cylinders will be too high, thus inhibiting water inflow of the drum washing machine. Moreover, the foam filling up inner and outer cylinders will also produce resistance, which will lead to overload and heating of motor, incomplete rinsing, foam residue and other problems, causing user complaints.

**[0003]** In order to solve the above problem, in the prior art, when a large amount of foam is filling up the washing cylinder, the washing cylinder is controlled to stop rotating and wait until the foam disappears. However, the efficiency of the above defoaming method is low, and treatment measures are lagging behind, which makes it impossible to effectively remove the foam and reduces the user experience.

**[0004]** Accordingly, there is a need for a new defoaming method for a washing apparatus in the art to solve the above problem.

### SUMMARY OF THE INVENTION

**[0005]** In order to solve the above problem in the prior art, that is, to solve the problem that the defoaming effect of the existing washing apparatuses is not ideal, the present disclosure provides a defoaming method for a washing apparatus, in which the washing apparatus includes a washing cylinder, and the defoaming method includes the following steps: obtaining a foam height in the washing cylinder during operation of the washing apparatus; comparing the foam height with a first preset alert height and a second preset alert height respectively; if the foam height is larger than the first preset alert height but smaller than the second preset alert height, then obtaining the current process stage of the washing apparatus; and performing different defoaming operations ac-

ording to the process stage, in which the first preset alert height is smaller than the second preset alert height.

**[0006]** In a preferred technical solution of the above defoaming method, the step of "performing different defoaming operations according to the process stage" specifically includes: if the washing apparatus is in a washing stage, then reducing a rotation/stop ratio of the washing cylinder to a first rotation/stop ratio, and/or canceling an agitating operation; obtaining the foam height in the washing cylinder again after a first preset time; comparing the foam height obtained again with the first preset alert height and a first preset height respectively; selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result; in which the first preset height is larger than the first preset alert height but smaller than the second preset alert height, and the first preset height is larger than or equal to the foam height obtained last time.

**[0007]** In a preferred technical solution of the above defoaming method, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically includes: if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the first preset height, then controlling the washing cylinder to continue to operate according to the first rotation/stop ratio; reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of washing to a first preset emptying water level, and controlling the washing apparatus to perform a rotational draining operation when the washing apparatus performs the draining operation; and reducing a spinning acceleration of the washing cylinder when the washing apparatus subsequently performs a spinning operation after completion of draining to a first preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a first preset speed.

**[0008]** In a preferred technical solution of the above defoaming method, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes: if the foam height obtained again is larger than the first preset height, then reducing the rotation/stop ratio of the washing apparatus to a second rotation/stop ratio, in which the second rotation/stop ratio is smaller than the first rotation/stop ratio; reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of washing to a second preset emptying water level, and controlling the washing apparatus to perform a rotational draining operation when the washing apparatus performs the draining operation; reducing a spinning acceleration of the washing cylinder when the washing apparatus subsequently performs a spinning operation after completion of draining to a second preset acceleration, and/or reducing a maximum

spinning speed of the washing cylinder to a second preset speed; obtaining a set number of rinsing times of the washing apparatus after completion of spinning of the washing apparatus; judging whether the set number of rinsing times is smaller than a first preset number of times; increasing the number of rinsing times if the set number of rinsing times is smaller than the first preset number of times; and/or not adjusting the number of rinsing times if the set number of rinsing times is larger than or equal to the first preset number of times.

**[0009]** In a preferred technical solution of the above defoaming method, the step of "performing different defoaming operations according to the process stage" further includes: if the washing apparatus is in a rinsing stage, then reducing a rotation frequency of the washing cylinder to a preset rotation frequency; obtaining the foam height in the washing cylinder again after a second preset time; comparing the foam height obtained again with the first preset alert height and a second preset height respectively; and selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result; in which the second preset height is larger than the first preset alert height but smaller than the second preset alert height, and the second preset height is larger than or equal to the foam height obtained last time.

**[0010]** In a preferred technical solution of the above defoaming method, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically includes: if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the second preset height, then controlling the washing cylinder to continue to operate according to the preset rotation frequency; reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of rinsing to a third preset emptying water level; after the washing apparatus completes draining, controlling the washing apparatus to perform a spray-rinsing operation, and controlling the washing apparatus to perform a rotational draining operation; reducing a spinning acceleration of the washing cylinder when the washing apparatus subsequently performs a spinning operation after completion of draining to a third preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a third preset speed; after the washing apparatus completes spinning, controlling the washing apparatus to perform the spray-rinsing operation again; after the washing apparatus completes spray-rinsing again, obtaining the number of remaining rinsing times of the washing apparatus; judging whether the number of remaining rinsing times is larger than or equal to a second preset number of times; if the number of remaining rinsing times is larger than or equal to the second preset number of times, then controlling the washing apparatus to continue to perform the rinsing operation; and/or if the number of remaining rinsing times

is smaller than the second preset number of times, then controlling the washing apparatus to end operation.

**[0011]** In a preferred technical solution of the above defoaming method, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes: if the foam height obtained again is larger than the second preset height, then controlling the washing cylinder to stop rotating and making the washing apparatus perform a draining operation; controlling the washing apparatus to perform a spinning operation after the washing apparatus completes draining; obtaining the number of remaining rinsing times of the washing apparatus after the washing apparatus completes spinning; judging whether the number of remaining rinsing times is smaller than a third preset number of times; if the number of remaining rinsing times is smaller than the third preset number of times, then obtaining a set number of rinsing times of the washing apparatus; judging whether the set number of rinsing times is smaller than a fourth preset number of times; and if the set number of rinsing times is smaller than the fourth preset number of times, then increasing the number of rinsing times.

**[0012]** In a preferred technical solution of the above defoaming method, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes: if the number of remaining rinsing times is larger than or equal to the third preset number of times, then controlling the washing apparatus to continue to perform the rinsing operation; and/or if the set number of rinsing times is larger than or equal to the fourth preset number of times, then controlling the washing apparatus to end operation.

**[0013]** In a preferred technical solution of the above defoaming method, the defoaming method further includes: if the foam height obtained again is smaller than the first preset alert height, then controlling the washing apparatus to execute the remaining set programs.

**[0014]** In a preferred technical solution of the above defoaming method, the defoaming method further includes: if the foam height is larger than the second preset alert height, then controlling the washing cylinder to stop rotating; and/or if the foam height is smaller than the first preset alert height, then not performing the defoaming operation, and continuing to execute set programs.

**[0015]** It can be understood by those skilled in the art that in the preferred technical solutions of the defoaming method of the present disclosure, the foam height in the washing cylinder is obtained; the foam height is compared with the first preset alert height and the second preset alert height respectively; if the foam height is larger than the first preset alert height but smaller than the second preset alert height, the current process stage of the drum washing machine is obtained; and different defoaming operations are performed according to the process stage, in which the first preset alert height is smaller

than the second preset alert height.

**[0016]** Compared with the technical solution in the prior art in which static defoaming is performed only when a large amount of foam is filling up the washing cylinder, in the present disclosure, the foam height is compared with the first preset alert height and the second preset alert height respectively, which can predict in advance whether the foam in the washing cylinder needs to be defoamed, thus avoiding blocking a vent pipe due to a large amount of foam filling up the washing cylinder, avoiding hindering water inflow into the drum washing machine due to the pressure in the washing cylinder being too high, avoiding overload and heating of the motor, and ensuring the normal operation of the drum washing machine. When the foam height in the washing cylinder is higher than the first preset alert height but lower than the second preset alert height, that is, when defoaming is required, different defoaming operations can be performed according to the process stage of the drum washing machine, so that the defoaming can be carried out in a targeted manner, the foam in the washing cylinder can be quickly and effectively removed, the residual amount of foam on the clothing can be reduced, and the clothing can be rinsed clean, thus further improving the user experience.

**[0017]** Further, when the drum washing machine is in the washing stage, generally, in order to improve the washing effect, an agitating operation is set and the rotation/stop ratio of the washing cylinder is set higher to improve the intensity of water flow. Therefore, the intensity of water flow can be reduced by reducing the rotation/stop ratio, canceling the agitating operation, etc., so as to effectively inhibit the generation of foam and achieve the purpose of defoaming; after the first preset time, according to the comparison result between the foam height obtained again and the first preset alert height and the first preset height, the drum washing machine is selectively controlled to execute the remaining set programs or continue to perform the defoaming operation, which avoids execution of the remaining set programs when the defoaming effect does not reach the preset effect, thus preventing the foam in the washing cylinder from continuing to rise to the second preset alert height. As such, the purpose of providing the most reasonable defoaming method for the drum washing machine is achieved, thus further improving the user experience.

**[0018]** Further, when the drum washing machine is in the rinsing stage, generally, in order to improve the rinsing effect, the rotation frequency of the washing cylinder is set higher to increase the intensity of water flow, so as to improve the rinsing effect. Therefore, the intensity of water flow can be reduced by reducing the rotation frequency of the washing cylinder, etc., so as to effectively inhibit the generation of foam and achieve the purpose of defoaming; after the second preset time, according to the comparison result between the foam height obtained again and the first preset alert height and the second

preset height, the drum washing machine is selectively controlled to execute the remaining set programs or continue to perform the defoaming operation, which avoids execution of the remaining set programs when the defoaming effect does not reach the preset effect, thus preventing the foam in the washing cylinder from continuing to rise to the second preset alert height. As such, the purpose of providing the most reasonable defoaming method for the drum washing machine is achieved, thus further improving the user experience.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** The defoaming method of the present disclosure will be described below with reference to the accompanying drawings and in connection with a drum washing machine. In the drawings:

FIG. 1 is a main flowchart of the defoaming method of the present disclosure;

FIG. 2 is a complete flowchart of the defoaming method of the present disclosure;

FIG. 3 is a first flowchart of the defoaming method of the present disclosure when the drum washing machine is in a washing stage;

FIG. 4 is a second flowchart of the defoaming method of the present disclosure when the drum washing machine is in the washing stage;

FIG. 5 is a third flowchart of the defoaming method of the present disclosure when the drum washing machine is in the washing stage;

FIG. 6 is a first flowchart of the defoaming method of the present disclosure when the drum washing machine is in a rinsing stage;

FIG. 7 is a second flowchart of the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage;

FIG. 8 is a third flowchart of the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage;

FIG. 9 is a first logic diagram of the defoaming method of the present disclosure; and

FIG. 10 is a second logic diagram of the defoaming method of the present disclosure.

#### DETAILED DESCRIPTION OF THE EMBODIMENT(S) OF THE INVENTION

**[0020]** Preferred embodiments of the present disclosure will be described below with reference to the accompanying drawings. It should be understood by skilled in the art that these embodiments are only used to explain the technical principles of the present disclosure, and are not intended to limit the scope of protection of the present disclosure. For example, although the present disclosure is described in connection with a drum washing machine, the technical solutions of the present disclosure are not limited to this. The defoaming method can obviously also

be applied to other washing apparatuses such as pulsator washing machines, washing-drying integrated machines, etc., and such changes do not deviate from the principles and scope of the present disclosure.

**[0021]** It should be noted that in the description of the present disclosure, terms "first", "second", "third", and "fourth" are only used for descriptive purposes, and should be understood as indicating or implying relative importance.

**[0022]** In view of the technical problem pointed out in the "BACKGROUND OF THE INVENTION", the present disclosure provides a defoaming method for a drum washing machine, which aims to compare the foam height with a first preset alert height and a second preset alert height respectively, so as to predict in advance whether the foam in the washing cylinder needs to be defoamed, thus avoiding blocking a vent pipe due to a large amount of foam filling up the washing cylinder, avoiding hindering water inflow into the drum washing machine due to the pressure in the washing cylinder being too high, avoiding overload and heating of the motor, and ensuring the normal operation of the drum washing machine. When the foam height in the washing cylinder is higher than the first preset alert height but lower than the second preset alert height, that is, when defoaming is required, different defoaming operations can be performed according to the process stage of the drum washing machine, so that the defoaming can be carried out in a targeted manner, the foam in the washing cylinder can be quickly and effectively removed, the residual amount of foam on the clothing can be reduced, and the clothing can be rinsed clean, thus further improving the user experience.

**[0023]** First, referring to FIGS. 1 and 2, the defoaming method of the present disclosure will be described. FIG. 1 is a main flowchart of the defoaming method of the present disclosure, and FIG. 2 is a complete flowchart of the defoaming method of the present disclosure.

**[0024]** As shown in FIG. 1, the drum washing machine of the present disclosure includes washing cylinders, which include an outer cylinder and an inner cylinder rotatably arranged inside the outer cylinder; and the defoaming method of the present disclosure includes the following steps:

S100: obtaining a foam height in the washing cylinder during operation of the drum washing machine;

S200: comparing the foam height with a first preset alert height and a second preset alert height respectively;

S300: if the foam height is larger than the first preset alert height but smaller than the second preset alert height, then obtaining the current process stage of the drum washing machine; and

S400: performing different defoaming operations according to the process stage.

**[0025]** The first preset alert height is smaller than the

second preset alert height, and the second preset alert height is smaller than a lowest height when the foam is filling up the washing cylinder to block a vent pipe, or the second preset alert height is a height set by those skilled in the art according to experiments or experience, at which the foam will not block the vent pipe. The first preset alert height and the second preset alert height can be adjusted and set in any way, as long as whether it is required to defoam the foam in the washing cylinder can be predicted in advance, so as to prevent a large amount of foam from filling up the washing cylinder and blocking the vent pipe.

**[0026]** The foam height refers to the height corresponding to a highest position reached by the foam in the washing cylinder.

**[0027]** Preferably, the washing cylinder is provided with a foam detection port, and a foam detection member for detecting the foam height in the washing cylinder is arranged at the foam detection port. The foam detection member can be an infrared sensor, an electrode sensor, a float sensor or another detection member. No matter what kind of detection member is used, the corresponding specific detection method thereof will not limit the present disclosure.

**[0028]** In step S100, the foam height can be detected in real time by the foam detection member, or the foam height can be detected by the foam detection member at a time interval. The time interval can be 5s, 10s or 15s, etc. The above first time interval is only illustrative, not restrictive. Those skilled in the art can flexibly adjust and set the first time interval in practical applications. The first time interval can be adjusted and set in any way, as long as the foam height can be detected timely and accurately.

**[0029]** In step S300, if the foam height in the washing cylinder is larger than the first preset alert height but smaller than the second preset alert height (for example, the first preset alert height is 200mm, the second preset alert height is 400mm, and the detected foam height is 210mm, which is larger than the first preset alert height but smaller than the second preset alert height), it means that the foam height detected this time is large and exceeds the first preset alert height, and if the foam in the washing cylinder continues to increase and rise, it may reach the second preset alert height and may further block the vent pipe, thus affecting the normal operation of the drum washing machine. In order to avoid such a situation, defoaming is required. However, since the operations of the drum washing machine in different process stages are different, in order to better remove the foam, the process stage of the drum washing machine is obtained, and different defoaming operations are performed according to the process stages of the drum washing machine.

**[0030]** The process stage can include other stages such as water injection stage, washing stage, draining stage, spinning stage, rinsing stage, etc.; or the drum washing machine has a drying function, and the process stage can also include a drying stage. Of course, the

process stage is not limited to the stages listed above, but can also be a standby stage or another stage. In the following, the defoaming method of the present disclosure will be further described by using the washing stage and the rinsing stage as examples.

**[0031]** Further, as shown in FIG. 2, the defoaming method of the present disclosure further includes:

**[0032]** S500: if the foam height is smaller than the first preset alert height, then not performing the defoaming operation, and continuing to execute the set programs; and

**[0033]** S600: if the foam height is larger than the second preset alert height, then controlling the washing cylinder to stop rotating.

**[0034]** In step S500, if the foam height is smaller than the first preset alert height (for example, the first preset alert height is 200mm, and the detected foam height is 180mm, which is smaller than the first preset alert height), it means that the foam height detected this time is low and does not reach the first preset alert height, which will not affect the normal operation of the drum washing machine. In this case, it is required to perform the defoaming operation, and execution of the set programs can be continued.

**[0035]** In step S600, if the foam height is larger than the second preset alert height (for example, the second preset alert height is 400mm, and the detected foam height is 405mm, which is larger than the second preset alert height), it means that the foam height detected this time is very high, which has exceeded the second preset alert height. If the foam in the washing cylinder continues to increase and rise, it may block the vent pipe, thus affecting the normal operation of the drum washing machine. In order to avoid such a situation, the washing cylinder is controlled to stop rotating, so that the washing water in the washing cylinder tends to be still, thus removing the foam in a static manner. The generation of foam can be completely inhibited, and the foam height is continuously detected. When the foam height detected again is smaller than the first preset alert height, execution of the remaining set programs is continued.

**[0036]** It should be noted that the first preset alert height and the second preset alert height listed above are only illustrative, not restrictive, and those skilled in the art can flexibly adjust and set the first preset alert height and the second preset alert height according to information such as the model of the drum washing machine and the arrangement position of the vent pipe in practical applications. For example, the first preset alert height is 260mm, and the second preset alert height is 480mm, etc. The first preset alert height and the second preset alert height can be adjusted and set in any way, as long as whether the defoaming operation needs to be performed can be judged.

**[0037]** It should be further noted that in the above process, step S300, step S500 and step S600 are not executed in sequence, but in parallel. They are only related to the comparison result between the foam height and

the first preset alert height and the second preset alert height respectively. The corresponding steps can be executed according to different comparison results.

**[0038]** Referring to FIGS. 3 to 5, the defoaming method of the present disclosure when the drum washing machine is in the washing stage will be described below. FIG. 3 is a first flowchart of the defoaming method of the present disclosure when the drum washing machine is in the washing stage, FIG. 4 is a second flowchart of the defoaming method of the present disclosure when the drum washing machine is in the washing stage, and FIG. 5 is a third flowchart of the defoaming method of the present disclosure when the drum washing machine is in the washing stage.

**[0039]** As shown in FIG. 3, in step S400, the step of "performing different defoaming operations according to the process stage" specifically includes:

S411: if the drum washing machine is in a washing stage, then reducing a rotation/stop ratio of the washing cylinder to a first rotation/stop ratio, and canceling an agitating operation;

S412: obtaining the foam height in the washing cylinder again after a first preset time;

S413: comparing the foam height obtained again with the first preset alert height and a first preset height respectively; and

S414: selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result.

**[0040]** The first preset height is larger than the first preset alert height but smaller than the second preset alert height, and the first preset height is larger than or equal to the foam height obtained last time.

**[0041]** The foam height obtained last time refers to the foam height obtained in step S100, and the foam height meets the condition for judging the execution of step S300, that is, the foam height meets the condition that it is larger than the first preset alert height but smaller than the second preset alert height; for example, the detected foam height listed in step S300 is 210mm.

**[0042]** In step S411, when the drum washing machine is in the washing stage, generally, in order to improve the washing effect, an agitating operation is set and the rotation/stop ratio of the washing cylinder is set higher to improve the intensity of water flow. Therefore, the intensity of water flow can be reduced by reducing the rotation/stop ratio, canceling the agitating operation, etc., so as to effectively inhibit the generation of foam and achieve the purpose of defoaming.

**[0043]** For example, if the current rotation/stop ratio of the washing cylinder is 30/20, the rotation time of the inner cylinder is reduced, so that the rotation/stop ratio is reduced to 20/20 (i.e., the first rotation/stop ratio), or the stop time of the inner cylinder is increased, so that the rotation/stop ratio is reduced to 30/30, or the rotation

time of the inner cylinder is reduced and the stop time of the inner cylinder is increased, so that the rotation/stop ratio is reduced to 25/25. The rotation/stop ratio of the washing cylinder is reduced through the above methods, thus reducing the intensity of washing water flow of the drum washing machine, which can effectively remove the foam.

**[0044]** Of course, the defoaming method in step S411 is not limited to the methods listed above. It is also possible to only reduce the rotation/stop ratio of the washing cylinder to the first rotation/stop ratio, or only cancel the agitating operation. Those skilled in the art can flexibly adjust and set a combination of the defoaming methods in step S411 based on actual defoaming needs and defoaming effects, etc.

**[0045]** In step S412, only after the first preset time (such as 5min), the foam height in the washing cylinder is detected again through the foam detection member, so as to ensure that there can be enough time for the drum washing machine to remove the foam in the washing cylinder after the drum washing machine performs the defoaming operations such as reducing the rotation/stop ratio and canceling the agitating operation; and according to the comparison result between the foam height obtained again and the first preset alert height and the first preset height respectively, the drum washing machine is selectively controlled to execute the remaining set programs or continue to perform the defoaming operation, which avoids execution of the remaining set programs when the defoaming effect does not reach the preset effect, thus preventing the foam in the washing cylinder from continuing to rise to the second preset alert height. As such, the purpose of providing the most reasonable defoaming method for the drum washing machine is achieved, thus further improving the user experience.

**[0046]** It should be noted that the current rotation/stop ratio, the first rotation/stop ratio and the first preset time listed above are only illustrative, not restrictive, and those skilled in the art can flexibly adjust and set the current rotation/stop ratio, the first rotation/stop ratio and the first preset time according to the foam height, the defoaming needs, the defoaming effects and the like in practical applications.

**[0047]** As shown in FIG. 4, in step S414, the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically includes:

**[0048]** S421: if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the first preset height, then controlling the washing cylinder to continue to operate according to the first rotation/stop ratio;

**[0049]** S422: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of washing to a first preset emptying water level, and controlling the drum

washing machine to perform a rotational draining operation when the drum washing machine performs the draining operation; and

**[0050]** S423: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a first preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a first preset speed.

**[0051]** The emptying water level refers to a water level set for starting a drainage pump of the drum washing machine in the draining stage. As long as the water level of the drainage pump reaches the emptying water level, the drainage pump starts draining.

**[0052]** The spinning acceleration is an acceleration set for increasing the spinning speed of the inner cylinder to a set maximum spinning speed in the spinning stage; preferably, the spinning speed is increased stepwise.

**[0053]** In step S421, if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the first preset height (for example, the first preset alert height is 200mm, the first preset height is 220mm, and the foam height detected again is 205mm), although the foam height detected again is still larger than the first preset alert height, it is already smaller than the first preset height, and is smaller than the foam height detected last time (such as 210mm), which means that the foam is being removed gradually, the foam height is gradually decreasing, and a certain defoaming effect is achieved. The defoaming method adopted in step S411 is effective, so execution of the defoaming operation is continued, that is, the washing cylinder is controlled to continue to operate according to the first rotation/stop ratio.

**[0054]** Alternatively, the first preset alert height is 200mm, the first preset height is 220mm, and the foam height detected again is 215mm; the foam height detected again is still larger than the first preset alert height, and is larger than the foam height detected last time (such as 210mm), but the foam height detected again is smaller than the first preset height, which means that the foam is not yet well removed, and the foam height is slightly increased. However, the rise of foam is not large, and is within a controllable range. This may be caused by detection error or by a short defoaming time, and does not mean that the defoaming method adopted in step S411 is ineffective. Therefore, execution of the defoaming method adopted in step S411 can be continued, that is, the washing cylinder is controlled to continue to operate according to the first rotation/stop ratio.

**[0055]** In step S422, the emptying water level of the drainage pump when the drum washing machine subsequently performs the draining operation after completion of washing is reduced to the first preset emptying water level. For example, if the current emptying water level of the drainage pump is 14mm, the emptying water level is reduced to 12mm (i.e., the first preset emptying water level). Once the water level of the drainage pump reaches

12mm, the drainage pump starts draining, thus shortening the time interval between two adjacent starts of the drainage pump, and increasing a draining frequency of the drainage pump, so that the washing water can be discharged in time, and a beating action exerted by the inner cylinder during rotation is avoided, thus avoiding the generation of foam.

**[0056]** Further, the drum washing machine is controlled to perform the rotational draining operation when the drum washing machine performs the draining operation. During the rotation of the inner cylinder, the clothing in the inner cylinder can be driven to rotate, so that the foam filling up the inner cylinder can be driven away or removed. Under a joint action of lowering the emptying water level and rotational draining, the foam can be better removed, thus further improving the defoaming effect.

**[0057]** In step S423, the spinning acceleration of the washing cylinder when the drum washing machine subsequently performs the spinning operation after completion of draining is reduced to the first preset acceleration. For example, if the current spinning acceleration of the inner cylinder is 25r/s, the spinning acceleration is reduced to 20r/s (i.e., the first preset acceleration). The spinning acceleration is reduced, so that the time for the spinning speed of the inner cylinder to rise to the maximum spinning speed is extended, which prolongs the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, prevents the centrifugal force generated in the spinning process from rapidly rising to the maximum centrifugal force, and shortens an action time during which the clothing is squeezed by the maximum centrifugal force, thus reducing the amount of foam generated by the clothing under the action of the maximum centrifugal force, and further improving the defoaming effect.

**[0058]** Moreover, due to the prolonging of the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, the centrifugal force on the clothing at the same time point is reduced, thereby reducing the amount of washing water spun out. Moreover, since the emptying water level is reduced to the first preset emptying water level in step S422, even if the amount of washing water spun out is reduced, the washing water spun out can still be discharged in a timely manner, thus avoiding the beating action exerted by the inner cylinder during rotation, and avoiding the generation of foam.

**[0059]** Further, the maximum spinning speed of the washing cylinder is reduced to the first preset speed. For example, if the current maximum spinning speed of the inner cylinder is 1400r/min, the maximum spinning speed is reduced to 1200r/min (i.e., the first preset speed). The maximum spinning speed is reduced, so that the maximum centrifugal force generated in the spinning process is reduced, thus reducing the amount of foam generated by the clothing when squeezed by the maximum centrifugal force, and further improving the defoaming effect.

**[0060]** Of course, the defoaming method in step S423

is not limited to the methods listed above. It is also possible to only reduce the spinning acceleration of the washing cylinder to the first preset acceleration, or only reduce the maximum spinning speed of the washing cylinder to the first preset speed. Those skilled in the art can flexibly adjust and set a combination of the defoaming methods in step S423 based on actual defoaming needs and defoaming effects, etc.

**[0061]** After step S423, the drum washing machine is controlled to execute the remaining set programs; for example, the drum washing machine is controlled to execute the rinsing program, etc.

**[0062]** It should be noted that the first preset alert height, the first preset height, the current emptying water level, the first preset emptying water level, the current spinning acceleration, the first preset acceleration, the current maximum spinning speed and the first preset speed listed above are only illustrative, not restrictive. Those skilled in the art can flexibly adjust and set the first preset alert height, the first preset height, the current emptying water level, the first preset emptying water level, the current spinning acceleration, the first preset acceleration, the current maximum spinning speed and the first preset speed based on the foam height, defoaming needs, defoaming effects and the like in practical applications.

**[0063]** As shown in FIG. 5, in step S414, the step of "selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes:

S431: if the foam height obtained again is larger than the first preset height, then reducing the rotation/stop ratio of the drum washing machine to a second rotation/stop ratio, in which the second rotation/stop ratio is smaller than the first rotation/stop ratio;

S432: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of washing to a second preset emptying water level, and controlling the drum washing machine to perform a rotational draining operation when the drum washing machine performs the draining operation;

S433: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a second preset acceleration, and reducing a maximum spinning speed of the washing cylinder to a second preset speed;

S434: obtaining a set number of rinsing times of the drum washing machine after completion of spinning of the drum washing machine;

S435: judging whether the set number of rinsing times is smaller than a first preset number of times;

S436: increasing the number of rinsing times if the set number of rinsing times is smaller than the first preset number of times; and

S437: not adjusting the number of rinsing times if the set number of rinsing times is larger than or equal to the first preset number of times.

**[0064]** In step S431, if the foam height obtained again is larger than the first preset height (for example, the first preset height is 220mm, and the foam height detected again is 225mm, which is larger than the first preset height), since the first preset height is larger than the foam height detected last time (such as 210mm), it means that the foam is not well removed, but is increased significantly. It indicates that the defoaming method adopted in step S411 cannot effectively remove the foam, and the foam will not be removed if execution of the defoaming method adopted in step S411 continues. In order to remove the foam, the rotation/stop ratio of the washing cylinder is further reduced, so that the intensity of washing water flow of the drum washing machine is further reduced, thus effectively inhibiting the generation of foam and achieving the purpose of defoaming.

**[0065]** For example, if the first rotation/stop ratio of the washing cylinder is 20/20, the rotation time of the inner cylinder is reduced, so that the rotation/stop ratio is reduced to 10/20 (i.e., the second rotation/stop ratio), or the stop time of the inner cylinder is increased, so that the rotation/stop ratio is reduced to 20/30, or the rotation time of the inner cylinder is reduced and the stop time of the inner cylinder is increased, so that the rotation/stop ratio is reduced to 15/25. The rotation/stop ratio of the washing cylinder is further reduced through the above methods, thus further reducing the intensity of washing water flow of the drum washing machine, which can effectively remove the foam.

**[0066]** In step S432, the emptying water level when the drum washing machine subsequently performs the draining operation after completion of washing is reduced to the second preset emptying water level. For example, the current emptying water level of the drainage pump is 14mm, and the emptying water level is reduced to 10mm (i.e., the second preset emptying water level). Once the water level of the drainage pump reaches 10mm, the drainage pump starts draining, thus shortening the time interval between two adjacent starts of the drainage pump, and increasing a draining frequency of the drainage pump, so that the washing water can be discharged in time, and a beating action exerted by the inner cylinder during rotation is avoided, thus avoiding the generation of foam.

**[0067]** Further, the drum washing machine is controlled to perform the rotational draining operation when the drum washing machine performs the draining operation. During the rotation of the inner cylinder, the clothing in the inner cylinder can be driven to rotate, so that the foam filling up the inner cylinder can be driven away or removed. Under a joint action of lowering the emptying water level and rotational draining, the foam can be better removed, thus further improving the defoaming effect.

**[0068]** In step S433, the spinning acceleration of the

washing cylinder when the drum washing machine subsequently performs the spinning operation after completion of draining is reduced to the second preset acceleration. For example, if the current spinning acceleration of the inner cylinder is 25r/s, the spinning acceleration is reduced to 10r/s (i.e., the second preset acceleration). The spinning acceleration is reduced, so that the time for the spinning speed of the inner cylinder to rise to the maximum spinning speed is extended, which prolongs the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, prevents the centrifugal force generated in the spinning process from rapidly rising to the maximum centrifugal force, and shortens an action time during which the clothing is squeezed by the maximum centrifugal force, thus reducing the amount of foam generated by the clothing under the action of the maximum centrifugal force, and further improving the defoaming effect.

**[0069]** Moreover, due to the prolonging of the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, the centrifugal force on the clothing at the same time point is reduced, thereby reducing the amount of washing water spun out. Moreover, since the emptying water level is reduced to the second preset emptying water level in step S432, even if the amount of washing water spun out is reduced, the washing water spun out can still be discharged in a timely manner, thus avoiding the beating action exerted by the inner cylinder during rotation, and avoiding the generation of foam.

**[0070]** Further, the maximum spinning speed of the washing cylinder is reduced to the second preset speed. For example, the current maximum spinning speed of the inner cylinder is 1400r/min, and the maximum spinning speed is reduced to 1000r/min (i.e., the second preset speed). The maximum spinning speed is reduced, so that the maximum centrifugal force generated in the spinning process is reduced, thus reducing the amount of foam generated by the clothing when squeezed by the maximum centrifugal force, and further improving the defoaming effect.

**[0071]** Of course, the defoaming method in step S433 is not limited to the methods listed above. It is also possible to only reduce the spinning acceleration of the washing cylinder to the second preset acceleration, or only reduce the maximum spinning speed of the washing cylinder to the second preset speed. Those skilled in the art can flexibly adjust and set a combination of the defoaming methods in step S433 based on actual defoaming needs and defoaming effects, etc.

**[0072]** In step S434, since the foam height obtained again in step S431 is larger than the first preset height, it means that there is too much foam in the washing cylinder. Even if defoaming treatment is carried out, there may be problems such as incomplete rinsing, foam residue, etc. In order to avoid such situations, it may take more times of rinsing to rinse the clothing clean. However, the user may already know that excessive detergent has

been dispensed, and has set a larger number of rinsing times than a normal number of rinsing times. In order to avoid resource waste, a set number of rinsing times of the drum washing machine is obtained, and it is judged whether to increase the number of rinsing times based on the already set number of rinsing times.

**[0073]** In step S436, if the set number of rinsing times is smaller than the first preset number of times (for example, the first preset number of times is 5, and the set number of rinsing times is 3, which is smaller than the first preset number of times), it means that the set number of rinsing times is small, and it is difficult to rinse the clothing clean. In order to avoid foam residue on the clothing, the number of rinsing times is increased, for example by 1 or 2, and the number of rinsing times after increasing should not be larger than the first preset number of times.

**[0074]** In step S437, if the set number of rinsing times is larger than or equal to the first preset number of times (for example, the first preset number of times is 5, and the set number of rinsing times is 6, which is larger than the first preset number of times), it means that the set number of rinsing times is very large, and the clothing can be rinsed clean. Therefore, there is no need to adjust the number of rinsing times.

**[0075]** It should be noted that the first preset height, the first rotation/stop ratio, the second rotation/stop ratio, the current emptying water level, the second preset emptying water level, the current spinning acceleration, the second preset acceleration, the current maximum spinning speed, the second preset speed and the first preset number of times listed above are only illustrative, not restrictive. Those skilled in the art can flexibly adjust and set the first preset height, the first rotation/stop ratio, the second rotation/stop ratio, the current emptying water level, the second preset emptying water level, the current spinning acceleration, the second preset acceleration, the current maximum spinning speed, the second preset speed and the first preset number of times based on the foam height, defoaming needs, defoaming effects and the like in practical applications.

**[0076]** It should be further noted that in the above process, steps S436 and S437 are not executed in sequence, but in parallel. They are only related to the judgment result of whether the set number of rinsing times is smaller than the first preset number of times. The corresponding steps can be executed according to different judgment results.

**[0077]** Although not shown in the figure, in step S414, the step of "selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes:

**[0078]** S441: if the foam height obtained again is smaller than the first preset alert height, then controlling the drum washing machine to execute the remaining set programs.

**[0079]** In step S441, if the foam height obtained again is smaller than the first preset alert height (for example, the first preset alert height is 200mm, and the foam height

detected again is 190mm, which is smaller than the first preset alert height), it means that the foam height at this time has been reduced below the first preset alert height. The alert is removed, and the drum washing machine can operate normally. Therefore, the drum washing machine is controlled to execute the remaining set programs.

**[0080]** It should be noted that in the above process, step S421, step S431 and step S441 are not executed in sequence, but in parallel. They are only related to the comparison result between the foam height obtained again and the first preset alert height and the first preset height respectively. The corresponding steps can be executed according to different comparison results.

**[0081]** Referring to FIGS. 6 to 8, the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage will be described below. FIG. 6 is a first flowchart of the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage, FIG. 7 is a second flowchart of the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage, and FIG. 8 is a third flowchart of the defoaming method of the present disclosure when the drum washing machine is in the rinsing stage.

**[0082]** As shown in FIG. 6, in step S400, the step of "performing different defoaming operations according to the process stage" further includes:

S451: if the drum washing machine is in a rinsing stage, then reducing a rotation frequency of the washing cylinder to a preset rotation frequency;

S452: obtaining the foam height in the washing cylinder again after a second preset time;

S453: comparing the foam height obtained again with the first preset alert height and a second preset height respectively; and

S454: selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result.

**[0083]** The second preset height is larger than the first preset alert height but smaller than the second preset alert height, and the second preset height is larger than or equal to the foam height obtained last time.

**[0084]** The foam height obtained last time refers to the foam height obtained in step S100, and the foam height meets the condition for judging the execution of step S300, that is, the foam height meets the condition that it is larger than the first preset alert height but smaller than the second preset alert height; for example, the detected foam height listed in step S300 is 210mm.

**[0085]** In step S451, when the drum washing machine is in the rinsing stage, generally, in order to improve the rinsing effect, the rotation frequency of the washing cylinder is set higher to improve the intensity of water flow. Therefore, the intensity of water flow can be reduced by

reducing the rotation frequency, etc., so as to effectively inhibit the generation of foam and achieve the purpose of defoaming.

**[0086]** For example, if the current rotation frequency of the washing cylinder is rotating for 10s every 30s, the rotation frequency is reduced to rotating for 5s every 30s (i.e., the preset rotation frequency), or the rotation frequency is reduced to rotating for 10s every 40s, or the rotation frequency is reduced to rotating for 8s every 28s. By reducing the rotation frequency of the washing cylinder in the above way, the intensity of rinsing water flow of the drum washing machine can be reduced, which can effectively remove the foam.

**[0087]** In step S452, only after the second preset time (such as 5min), the foam height in the washing cylinder is detected again through the foam detection member, so as to ensure that there can be enough time for the drum washing machine to remove the foam in the washing cylinder after the drum washing machine performs the defoaming operations such as reducing the rotation frequency; and according to the comparison result between the foam height obtained again and the first preset alert height and the second preset height respectively, the drum washing machine is selectively controlled to execute the remaining set programs or continue to perform the defoaming operation, which avoids execution of the remaining set programs when the defoaming effect does not reach the preset effect, thus preventing the foam in the washing cylinder from continuing to rise to the second preset alert height. As such, the purpose of providing the most reasonable defoaming method for the drum washing machine is achieved, thus further improving the user experience.

**[0088]** Although the second preset time listed above is the same as the first preset time, this is only illustrative and not restrictive. In practical applications, those skilled in the art can also set the second preset time to be different from the first preset time; for example, the first preset time is 4min, and the second preset time is 6min. The present disclosure does not impose any restriction on this.

**[0089]** It should be noted that the current rotation frequency, the preset rotation frequency and the second preset time listed above are only illustrative, not restrictive. Those skilled in the art can flexibly adjust and set the current rotation frequency, the preset rotation frequency and the second preset time according to the foam height, the defoaming needs, the defoaming effects and the like in practical applications.

**[0090]** As shown in FIG. 7, in step S454, the step of "selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically includes:

S461: if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the second preset height, then con-

trolling the washing cylinder to continue to operate according to the preset rotation frequency;

S462: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of rinsing to a third preset emptying water level;

S463: after the drum washing machine completes draining, controlling the drum washing machine to perform a spray-rinsing operation, and controlling the drum washing machine to perform a rotational draining operation;

S464: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a third preset acceleration, and reducing a maximum spinning speed of the washing cylinder to a third preset speed;

S465: after the drum washing machine completes spinning, controlling the drum washing machine to perform the spray-rinsing operation again;

S466: after the drum washing machine completes spray-rinsing again, obtaining the number of remaining rinsing times of the drum washing machine;

S467: judging whether the number of remaining rinsing times is larger than or equal to a second preset number of times;

if yes, executing step S468;

if not, executing step S469;

S468: controlling the drum washing machine to continue to perform the rinsing operation; and

S469: controlling the drum washing machine to end operation.

**[0091]** The emptying water level refers to a water level set for starting the drainage pump of the drum washing machine in the draining stage. As long as the water level of the drainage pump reaches the emptying water level, the drainage pump starts draining.

**[0092]** The spinning acceleration is an acceleration set for increasing the spinning speed of the inner cylinder to a set maximum spinning speed in the spinning stage; preferably, the spinning speed is increased stepwise.

**[0093]** In step S461, if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the second preset height (for example, the first preset alert height is 200mm, the second preset height is 225mm, and the foam height detected again is 205mm), although the foam height detected again is still larger than the first preset alert height, it is already smaller than the second preset height, and is smaller than the foam height detected last time (such as 210mm), which means that the foam is being removed gradually, the foam height is gradually decreasing, and a certain defoaming effect is achieved. The defoaming method adopted in step S451 is effective, so execution of the defoaming operation is continued, that is, the washing cylinder is controlled to continue to operate according to the preset rotation frequency.

**[0094]** Alternatively, the first preset alert height is 200mm, the second preset height is 225mm, and the foam height detected again is 215mm; the foam height detected again is still larger than the first preset alert height, and is larger than the foam height detected last time (such as 210mm), but the foam height detected again is smaller than the second preset height, which means that the foam is not yet well removed, and the foam height is slightly increased. However, the rise of foam is not large, and is within a controllable range. This may be caused by detection error or by a short defoaming time, and does not mean that the defoaming method adopted in step S451 is ineffective. Therefore, execution of the defoaming method adopted in step S451 can be continued, that is, the washing cylinder is controlled to continue to operate according to the preset rotation frequency.

**[0095]** Although the second preset height listed above is different from the first preset height, this is only illustrative and not restrictive. In practical applications, those skilled in the art can also set the second preset height to be equal to the first preset height; for example, the first preset height is 222mm, and the second preset height is also 222mm. The present disclosure does not impose any restriction on this.

**[0096]** In step S462, the emptying water level of the drainage pump when the drum washing machine subsequently performs the draining operation after completion of rinsing is reduced to the third preset emptying water level. For example, if the current emptying water level of the drainage pump is 14mm, the emptying water level is reduced to 8mm (i.e., the third preset emptying water level). Once the water level of the drainage pump reaches 8mm, the drainage pump starts draining, thus shortening the time interval between two adjacent starts of the drainage pump, and increasing a draining frequency of the drainage pump, so that the washing water can be discharged in time, and a beating action exerted by the inner cylinder during rotation is avoided, thus avoiding the generation of foam.

**[0097]** In step S463, after the drum washing machine completes draining, the drum washing machine is controlled to perform the spray-rinsing operation, such as spray-rinsing for 20s, and the drum washing machine is controlled to execute the rotational draining operation, so that the clothing in the inner cylinder is rotated to the front of the inner cylinder (that is, close to a window gasket), and that all the sprayed washing water can be sprayed onto the clothing, which can effectively remove the foam and further improve the defoaming effect.

**[0098]** In step S464, the spinning acceleration of the washing cylinder when the drum washing machine subsequently performs the spinning operation after completion of draining is reduced to the third preset acceleration. For example, if the current spinning acceleration of the inner cylinder is 25r/s, the spinning acceleration is reduced to 5r/s (i.e., the third preset acceleration). The spinning acceleration is reduced, so that the time for the spin-

ning speed of the inner cylinder to rise to the maximum spinning speed is extended, which prolongs the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, prevents the centrifugal force generated in the spinning process from rapidly rising to the maximum centrifugal force, and shortens an action time during which the clothing is squeezed by the maximum centrifugal force, thus reducing the amount of foam generated by the clothing under the action of the maximum centrifugal force, and further improving the defoaming effect.

**[0099]** Moreover, due to the prolonging of the time for the centrifugal force generated in the spinning process to rapidly rise to the maximum centrifugal force, the centrifugal force on the clothing at the same time point is reduced, thereby reducing the amount of washing water spun out. Moreover, since the emptying water level is reduced to the third preset emptying water level in step S462, even if the amount of washing water spun out is reduced, the washing water spun out can still be discharged in a timely manner, thus avoiding the beating action exerted by the inner cylinder during rotation, and avoiding the generation of foam.

**[0100]** Further, the maximum spinning speed of the washing cylinder is reduced to the third preset speed. For example, if the current maximum spinning speed of the inner cylinder is 1400r/min, the maximum spinning speed is reduced to 800r/min (i.e., the third preset speed). The maximum spinning speed is reduced, so that the maximum centrifugal force generated in the spinning process is reduced, thus reducing the amount of foam generated by the clothing when squeezed by the maximum centrifugal force, and further improving the defoaming effect.

**[0101]** Of course, the defoaming method in step S464 is not limited to the methods listed above. It is also possible to only reduce the spinning acceleration of the washing cylinder to the third preset acceleration, or only reduce the maximum spinning speed of the washing cylinder to the third preset speed. Those skilled in the art can flexibly adjust and set a combination of the defoaming methods in step S464 based on actual defoaming needs and defoaming effects, etc.

**[0102]** In step S465, after the drum washing machine completes spinning, the drum washing machine is controlled to perform the spray-rinsing operation again, such as spray-rinsing for 25s, so as to further remove the foam and reduce the residual amount of foam on the clothing.

**[0103]** In step S466, since it is uncertain whether the current rinsing stage (i.e., the rinsing stage determined in step S451) is the last time of rinsing of the drum washing machine, the number of remaining rinsing times of the drum washing machine is obtained after the defoaming in step S465 is completed, and it is judged whether to end operation or continue the rinsing operation based on the number of remaining rinsing times.

**[0104]** In step S468, if the number of remaining rinsing times is larger than or equal to the second preset number

of times (for example, the second preset number of times is 1, and the number of remaining rinsing times is 2, which is larger than the second preset number of times), it means that the current rinsing stage is not the last time of rinsing of the drum washing machine, and there are still two times of rinsing not yet executed, so the drum washing machine is controlled to continue the rinsing operation.

**[0105]** In step S469, if the number of remaining rinsing times is smaller than the second preset number of times (for example, the second preset number of times is 1, and the number of remaining rinsing times is 0, which is smaller than the second preset number of times), it means that the current rinsing stage is the last time of rinsing of the drum washing machine, so the drum washing machine is controlled to end operation after the drum washing machine completes spinning.

**[0106]** It should be noted that the first preset alert height, the second preset height, the current emptying water level, the third preset emptying water level, the spray-rinsing time, the current spinning acceleration, the third preset acceleration, the current maximum spinning speed, the third preset speed and the second preset number of times listed above are only illustrative, not restrictive. Those skilled in the art can flexibly adjust and set the first preset alert height, the second preset height, the current emptying water level, the third preset emptying water level, the spray-rinsing time, the current spinning acceleration, the third preset acceleration, the current maximum spinning speed, the third preset speed and the second preset number of times according to the foam height, the defoaming needs, the defoaming effects and the like in practical applications.

**[0107]** It should be further noted that in the above process, step S468 and step S469 are not executed in sequence, but in parallel. They are only related to the judgment result of whether the number of remaining rinsing times is larger than or equal to the second preset number of times. The corresponding steps can be executed according to different judgment results.

**[0108]** As shown in FIG. 8, in step S454, the step of "selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes:

S471: if the foam height obtained again is larger than the second preset height, then controlling the washing cylinder to stop rotating and making the drum washing machine perform a draining operation;

S472: controlling the drum washing machine to perform a spinning operation after the drum washing machine completes draining;

S473: obtaining the number of remaining rinsing times of the drum washing machine after the drum washing machine completes spinning;

S474: judging whether the number of remaining rinsing times is smaller than a third preset number of

times;

if not, executing step S475;

if yes, executing step S476;

S475: controlling the drum washing machine to continue to perform the rinsing operation;

S476: obtaining a set number of rinsing times of the drum washing machine;

S477: judging whether the set number of rinsing times is smaller than a fourth preset number of times;

if yes, executing step S478;

if not, executing step S479;

S478: increasing the number of rinsing times; and  
S479: controlling the drum washing machine to end operation.

**[0109]** In step S471, if the foam height obtained again is larger than the second preset height (for example, the second preset height is 225mm, and the foam height detected again is 230mm, which is larger than the second preset height), since the second preset height is larger than the foam height detected last time (such as 210mm), it means that the foam is not well removed, but is increased significantly. It indicates that the defoaming method adopted in step S451 cannot effectively remove the foam, and the foam will not be removed if execution of the defoaming method adopted in step S451 continues. Therefore, the washing cylinder is controlled to stop rotating, and the drum washing machine performs the draining operation to reduce the water level and prevent the foam from blocking the vent pipe.

**[0110]** In step S473, since it is uncertain whether the current rinsing stage (i.e., the rinsing stage determined in step S451) is the last time of rinsing of the drum washing machine, the number of remaining rinsing times of the drum washing machine is obtained after the spinning in step S472 is completed, and it is judged whether to end operation or continue the rinsing operation based on the number of remaining rinsing times.

**[0111]** In step S475, if the number of remaining rinsing times is larger than or equal to the third preset number of times (for example, the third preset number of times is 1, and the number of remaining rinsing times is 3, which is larger than the third preset number of times), it means that the current rinsing stage is not the last time of rinsing of the drum washing machine, and there are still three times of rinsing not yet executed, so the drum washing machine is controlled to continue the rinsing operation.

**[0112]** In step S476, if the number of remaining rinsing times is smaller than the third preset number of times (for example, the third preset number of times is 1, and the number of remaining rinsing times is 0, which is smaller than the third preset number of times), it means that the current rinsing stage is the last time of rinsing of the drum washing machine. However, the foam height obtained again in step S471 is larger than the second preset height, and there is still too much foam in the washing cylinder; the clothing is not yet rinsed clean, and more times of rinsing are needed to rinse the clothing clean.

In order to determine whether to increase the number of rinsing times, the set number of rinsing times of the drum washing machine is obtained, and it is determined whether to increase the number of rinsing times based on the set number of rinsing times.

**[0113]** In step S478, if the set number of rinsing times is smaller than the fourth preset number of times (for example, the fourth preset number of times is 5, and the set number of rinsing times is 3, which is smaller than the fourth preset number of times), it means that the set number of rinsing times is small. In order to rinse the clothing clean, the number of rinsing times can be increased, for example by 1 or 2, and the number of rinsing times after increasing should not be larger than the fourth preset number of times.

**[0114]** In step S479, if the set number of rinsing times is larger than or equal to the fourth preset number of times (for example, the fourth preset number of times is 5, and the set number of rinsing times is 6, which is larger than the fourth preset number of times), it means that the set number of rinsing times is very large. During the last time of rinsing, the detected foam height is still larger than the first preset alert height, the foam height detected again after defoaming treatment is larger than the second preset height, and the foam still cannot be removed, which may be caused by failure of the detection member, or caused by too much detergent dispensed. Whatever the reason is, the rinsing operation is not suitable for being executed any longer, and the drum washing machine is controlled to end operation.

**[0115]** It should be noted that in the above process, steps S475 and S476 are not executed in sequence, but in parallel. They are only related to the judgment result of whether the number of remaining rinsing times is smaller than the third preset number of times. The corresponding steps can be executed according to different judgment results. Steps S478 and S479 are not executed in sequence, but in parallel. They are only related to the judgment result of whether the set number of rinsing times is smaller than the fourth preset number of times. The corresponding steps can be executed according to different judgment results.

**[0116]** Although not shown in the figure, in step S454, the step of "selectively controlling the drum washing machine to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further includes:

S481: if the foam height obtained again is smaller than the first preset alert height, then controlling the drum washing machine to execute the remaining set programs.

**[0117]** In step S481, if the foam height obtained again is smaller than the first preset alert height (for example, the first preset alert height is 200mm, and the foam height detected again is 185mm, which is smaller than the first preset alert height), it means that the foam height at this time has been reduced below the first preset alert height. The alert is removed, and the drum washing machine can operate normally. Therefore, the drum washing ma-

chine is controlled to execute the remaining set programs.

**[0118]** It should be noted that in the above process, step S461, step S471 and step S481 are not executed in sequence, but in parallel. They are only related to the comparison result between the foam height obtained again and the first preset alert height and the first preset height respectively. The corresponding steps can be executed according to different comparison results.

**[0119]** In addition, it should also be noted that although the first preset emptying water level, the second preset emptying water level and the third preset emptying water level listed above are different from each other, the first preset acceleration, the second preset acceleration and the third preset acceleration are different from each other, and the second preset speed, the first preset speed and the third preset speed are different from each other, this is only illustrative, not restrictive. In practical applications, those skilled in the art can also set any two or all of the first preset emptying water level, the second preset emptying water level and the third preset emptying water level to be the same, or set any two or all of the first preset acceleration, the second preset acceleration and the third preset acceleration to be the same, or set any two or all of the second preset speed, the first preset speed and the third preset speed to be the same. The present disclosure does not impose any restriction on this.

**[0120]** Referring to FIGS. 9 and 10, a possible control process of the present disclosure will be introduced below. FIG. 9 is a first logic diagram of the defoaming method of the present disclosure, and FIG. 10 is a second logic diagram of the defoaming method of the present disclosure.

**[0121]** As shown in FIG. 9, a possible complete process of the defoaming method of the present disclosure is:

S701: obtaining a foam height  $h_1$  in the washing cylinder during operation of the drum washing machine;  
 S702: comparing  $h_1$  with a first preset alert height  $h_{01}$  and a second preset alert height  $h_{02}$  respectively;  
 if  $h_1 < h_{01}$ , executing step S703;  
 if  $h_1 > h_{02}$ , executing step S704;  
 if  $h_{01} \leq h_1 \leq h_{02}$ , executing step S705;

S703: not performing the defoaming operation, and proceeding to step S719;

S704: controlling the washing cylinder to stop rotating, and continuously detecting the foam height; when the foam height detected again is smaller than the first preset alert height, executing step S719;

S705: obtaining the current process stage of the drum washing machine;

if the drum washing machine is in the washing stage, executing step S706;

S706: reducing a rotation/stop ratio of the washing cylinder to a first rotation/stop ratio, and canceling an agitating operation;

S707: obtaining the foam height  $h_2$  in the washing cylinder again after 5min;

S708: comparing  $h_2$  with the first preset alert height  $h_{01}$  and a first preset height  $h_{11}$  respectively;  
 if  $h_{01} \leq h_2 \leq h_{11}$ , executing step S709;  
 if  $h_2 > h_{11}$ , executing step S712;  
 if  $h_2 < h_{01}$ , executing step S719;  
 S709: controlling the washing cylinder to continue to operate according to the first rotation/stop ratio;  
 S710: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of washing to a first preset emptying water level, and controlling the drum washing machine to perform a rotational draining operation when the washing apparatus performs the draining operation;  
 S711: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a first preset acceleration, and reducing a maximum spinning speed of the washing cylinder to a first preset speed;  
 after step S711, executing step S719;  
 S712: reducing the rotation/stop ratio of the drum washing machine to a second rotation/stop ratio, in which the second rotation/stop ratio is smaller than the first rotation/stop ratio;  
 S713: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of washing to a second preset emptying water level, and controlling the drum washing machine to perform a rotational draining operation when the drum washing machine performs the draining operation;  
 S714: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a second preset acceleration, and reducing a maximum spinning speed of the washing cylinder to a second preset speed;  
 S715: obtaining a set number of rinsing times  $C_1$  of the drum washing machine after completion of spinning of the drum washing machine;  
 S716: judging whether  $C_1$  is smaller than 5 (i.e., the first preset number of times); if yes, executing step S717; if not, executing step S718;  
 S717: increasing the number of rinsing times;  
 S718: not adjusting the number of rinsing times;  
 S719: controlling the drum washing machine to execute the remaining set programs;  
if the drum washing machine is in the rinsing stage,  
executing step S720;  
 S720: reducing a rotation frequency of the washing cylinder to a preset rotation frequency;  
 S721: obtaining the foam height  $h_3$  in the washing cylinder again after 5min;  
 S722: comparing  $h_3$  with the first preset alert height  $h_{01}$  and a second preset height  $h_{12}$  respectively;  
 if  $h_3 < h_{01}$ , executing step S723;  
 if  $h_{01} \leq h_3 \leq h_{12}$ , executing step S724;

if  $h_3 > h_{12}$ , executing step S732;  
 S723: controlling the drum washing machine to execute the remaining set programs;  
 S724: controlling the washing cylinder to continue to operate according to the preset rotation frequency;  
 S725: reducing an emptying water level when the drum washing machine subsequently performs a draining operation after completion of rinsing to a third preset emptying water level;  
 S726: after the drum washing machine completes draining, controlling the drum washing machine to perform a spray-rinsing operation, and controlling the drum washing machine to perform a rotational draining operation;  
 S727: reducing a spinning acceleration of the washing cylinder when the drum washing machine subsequently performs a spinning operation after completion of draining to a third preset acceleration, and reducing a maximum spinning speed of the washing cylinder to a third preset speed;  
 S728: after the drum washing machine completes spinning, controlling the drum washing machine to perform the spray-rinsing operation again;  
 S729: after the drum washing machine completes spray-rinsing again, obtaining the number of remaining rinsing times  $C_2$  of the drum washing machine;  
 S730: judging whether  $C_2$  is larger than or equal to 1 (i.e., the second preset number of times); if yes, executing step S731; if not, executing step S739;  
 S731: controlling the drum washing machine to continue to perform the rinsing operation;  
 S732: controlling the washing cylinder to stop rotating and making the drum washing machine perform the draining operation;  
 S733: controlling the drum washing machine to perform a spinning operation after the drum washing machine completes draining;  
 S734: obtaining the number of remaining rinsing times  $C_3$  of the drum washing machine after the drum washing machine completes spinning;  
 S735: judging whether  $C_3$  is smaller than 1 (i.e., the third preset number of times); if yes, executing step S736; if not, executing step S731;  
 S736: obtaining a set number of rinsing times  $C_4$  of the drum washing machine;  
 S737: judging whether  $C_4$  is smaller than 5 (i.e., the fourth preset number of times); if yes, executing step S738; if not, executing step S731;  
 S738: increasing the number of rinsing times; and  
 S739: controlling the drum washing machine to end operation.

**[0122]** It should be pointed out that the above embodiments are only some preferred embodiments of the present disclosure; they are only used to illustrate the principles of the method of the present disclosure, not to limit the scope of protection of the present disclosure. In practical applications, those skilled in the art can allocate

the above functions to different steps for implementation as needed, that is, to decompose or combine the steps in the embodiments of the present disclosure. For example, the steps of the above embodiments can be combined into one step, or further divided into several sub-steps, so as to complete all or part of the functions described above. The names of the steps involved in the embodiments of the present disclosure are only for the purpose of distinguishing individual steps, and should not be considered as limitations to the present disclosure.

**[0123]** Hitherto, the technical solutions of the present disclosure have been described in connection with the preferred embodiments shown in the accompanying drawings, but it is easily understood by those skilled in the art that the scope of protection of the present disclosure is obviously not limited to these specific embodiments. Without departing from the principles of the present disclosure, those skilled in the art can make equivalent changes or replacements to relevant technical features, and all the technical solutions after these changes or replacements will fall within the scope of protection of the present disclosure.

**Claims**

1. A defoaming method for a washing apparatus, wherein the washing apparatus comprises a washing cylinder, and the defoaming method comprises the following steps:

obtaining a foam height in the washing cylinder during operation of the washing apparatus;  
 comparing the foam height with a first preset alert height and a second preset alert height respectively;  
 if the foam height is larger than the first preset alert height but smaller than the second preset alert height, then obtaining the current process stage of the washing apparatus; and  
 performing different defoaming operations according to the process stage;  
 wherein the first preset alert height is smaller than the second preset alert height.

2. The defoaming method according to claim 1, wherein the step of "performing different defoaming operations according to the process stage" specifically comprises:

if the washing apparatus is in a washing stage, then reducing a rotation/stop ratio of the washing cylinder to a first rotation/stop ratio, and/or canceling an agitating operation;  
 obtaining the foam height in the washing cylinder again after a first preset time;  
 comparing the foam height obtained again with the first preset alert height and a first preset

height respectively;  
 selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result;  
 wherein the first preset height is larger than the first preset alert height but smaller than the second preset alert height, and the first preset height is larger than or equal to the foam height obtained last time.

3. The defoaming method according to claim 2, wherein the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically comprises:

if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the first preset height, then controlling the washing cylinder to continue to operate according to the first rotation/stop ratio; reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of washing to a first preset emptying water level, and controlling the washing apparatus to perform a rotational draining operation when the washing apparatus performs the draining operation; and reducing a spinning acceleration of the washing cylinder when the washing apparatus subsequently performs a spinning operation after completion of draining to a first preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a first preset speed.

4. The defoaming method according to claim 2, wherein the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further comprises:

if the foam height obtained again is larger than the first preset height, then reducing the rotation/stop ratio of the washing apparatus to a second rotation/stop ratio, wherein the second rotation/stop ratio is smaller than the first rotation/stop ratio;  
 reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of washing to a second preset emptying water level, and controlling the washing apparatus to perform a rotational draining operation when the washing apparatus performs the draining operation;  
 reducing a spinning acceleration of the washing cylinder when the washing apparatus subse-

quently performs a spinning operation after completion of draining to a second preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a second preset speed; 5  
 obtaining a set number of rinsing times of the washing apparatus after completion of spinning of the washing apparatus;  
 judging whether the set number of rinsing times is smaller than a first preset number of times; 10  
 increasing the number of rinsing times if the set number of rinsing times is smaller than the first preset number of times; and/or  
 not adjusting the number of rinsing times if the set number of rinsing times is larger than or equal to the first preset number of times. 15

- 5. The defoaming method according to claim 1, wherein the step of "performing different defoaming operations according to the process stage" further comprises: 20

if the washing apparatus is in a rinsing stage, then reducing a rotation frequency of the washing cylinder to a preset rotation frequency; 25  
 obtaining the foam height in the washing cylinder again after a second preset time;  
 comparing the foam height obtained again with the first preset alert height and a second preset height respectively; and  
 selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result; 30  
 wherein the second preset height is larger than the first preset alert height but smaller than the second preset alert height, and the second preset height is larger than or equal to the foam height obtained last time. 35

- 6. The defoaming method according to claim 5, wherein the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" specifically comprises: 40

if the foam height obtained again is larger than or equal to the first preset alert height but smaller than or equal to the second preset height, then controlling the washing cylinder to continue to operate according to the preset rotation frequency; 45  
 reducing an emptying water level when the washing apparatus subsequently performs a draining operation after completion of rinsing to a third preset emptying water level; 50  
 after the washing apparatus completes draining, controlling the washing apparatus to perform a

spray-rinsing operation, and controlling the washing apparatus to perform a rotational draining operation;  
 reducing a spinning acceleration of the washing cylinder when the washing apparatus subsequently performs a spinning operation after completion of draining to a third preset acceleration, and/or reducing a maximum spinning speed of the washing cylinder to a third preset speed;  
 after the washing apparatus completes spinning, controlling the washing apparatus to perform the spray-rinsing operation again;  
 after the washing apparatus completes spray-rinsing again, obtaining the number of remaining rinsing times of the washing apparatus;  
 judging whether the number of remaining rinsing times is larger than or equal to a second preset number of times;  
 if the number of remaining rinsing times is larger than or equal to the second preset number of times, then controlling the washing apparatus to continue to perform the rinsing operation; and/or  
 if the number of remaining rinsing times is smaller than the second preset number of times, then controlling the washing apparatus to end operation.

- 7. The defoaming method according to claim 5, wherein the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further comprises:

if the foam height obtained again is larger than the second preset height, then controlling the washing cylinder to stop rotating and making the washing apparatus perform a draining operation;  
 controlling the washing apparatus to perform a spinning operation after the washing apparatus completes draining;  
 obtaining the number of remaining rinsing times of the washing apparatus after the washing apparatus completes spinning; 45  
 judging whether the number of remaining rinsing times is smaller than a third preset number of times;  
 if the number of remaining rinsing times is smaller than the third preset number of times, then obtaining a set number of rinsing times of the washing apparatus;  
 judging whether the set number of rinsing times is smaller than a fourth preset number of times; 50  
 and  
 if the set number of rinsing times is smaller than the fourth preset number of times, then increasing the number of rinsing times.

8. The defoaming method according to claim 7, wherein the step of "selectively controlling the washing apparatus to execute remaining set programs or continue to perform the defoaming operation based on a comparison result" further comprises: 5

if the number of remaining rinsing times is larger than or equal to the third preset number of times, then controlling the washing apparatus to continue to perform the rinsing operation; and/or 10  
 if the set number of rinsing times is larger than or equal to the fourth preset number of times, then controlling the washing apparatus to end operation. 15

9. The defoaming method according to claim 2 or 5, wherein the defoaming method further comprises: if the foam height obtained again is smaller than the first preset alert height, then controlling the washing apparatus to execute the remaining set programs. 20

10. The defoaming method according to claim 1, wherein the defoaming method further comprises:

if the foam height is larger than the second preset alert height, then controlling the washing cylinder to stop rotating; and/or 25  
 if the foam height is smaller than the first preset alert height, then not performing the defoaming operation, and continuing to execute set programs. 30

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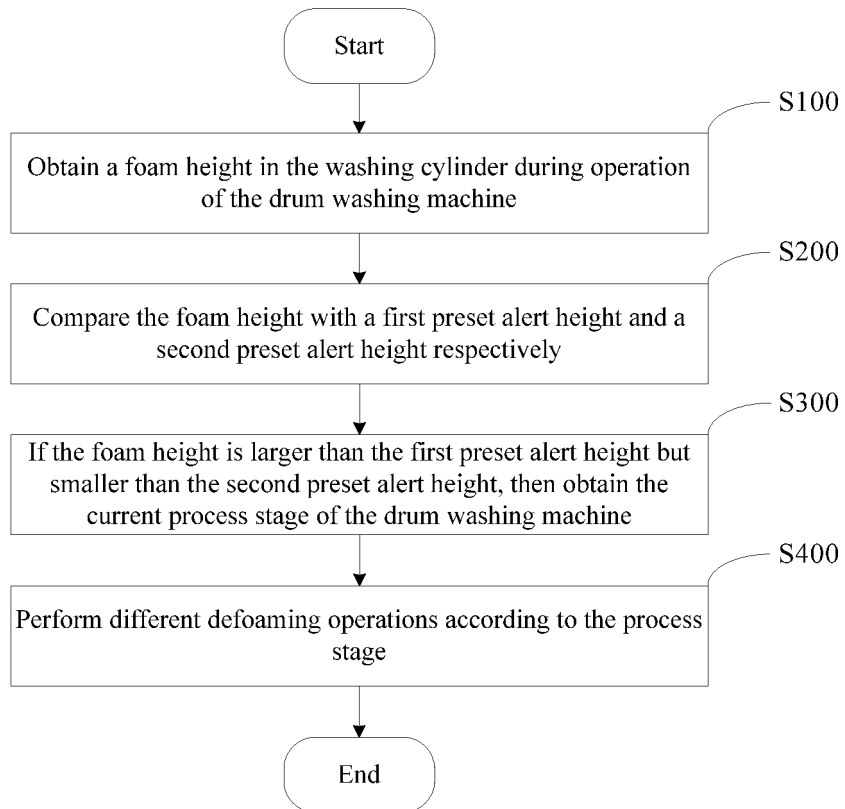


FIG. 1

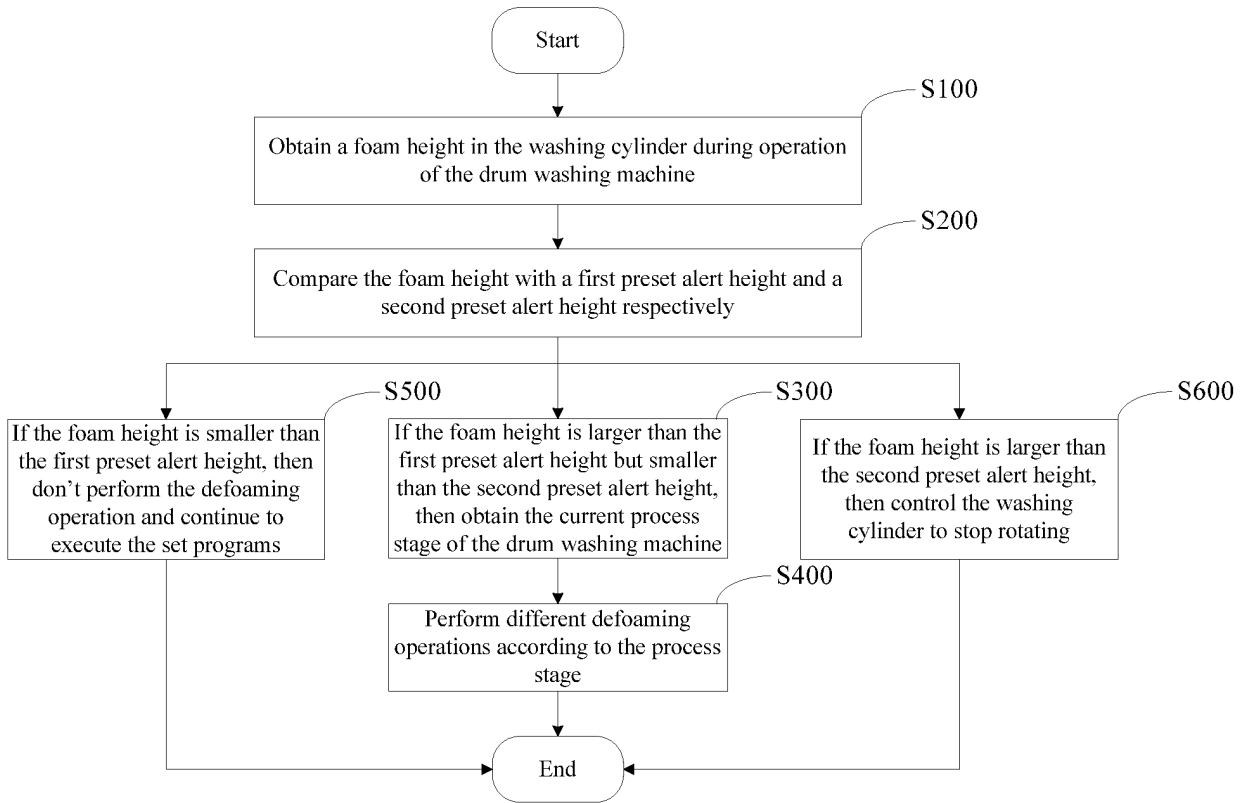


FIG. 2

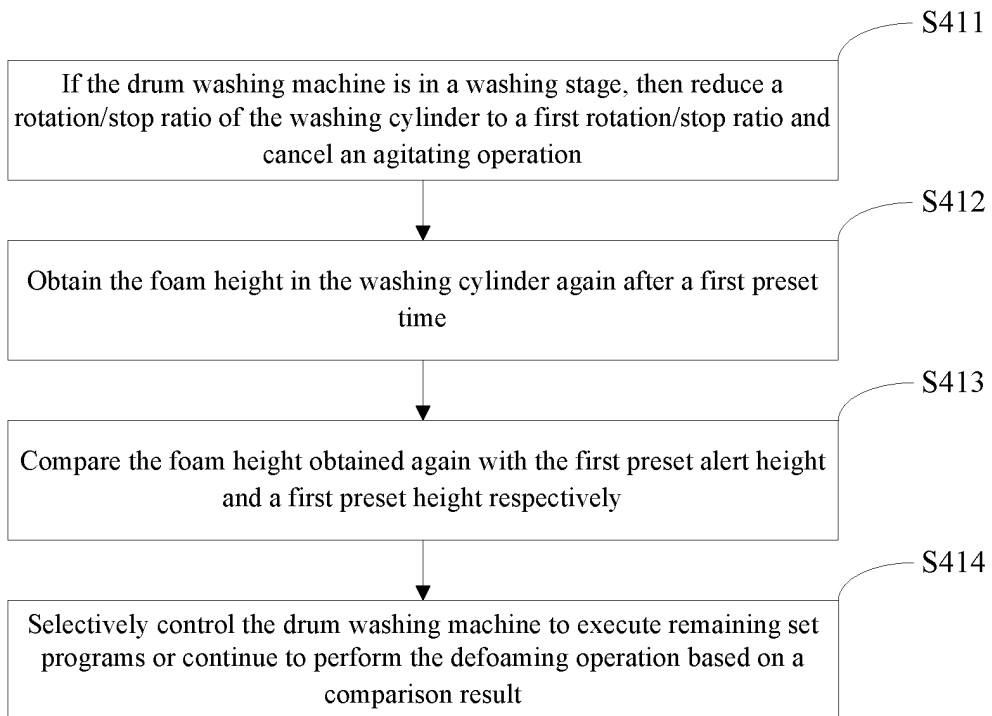


FIG. 3

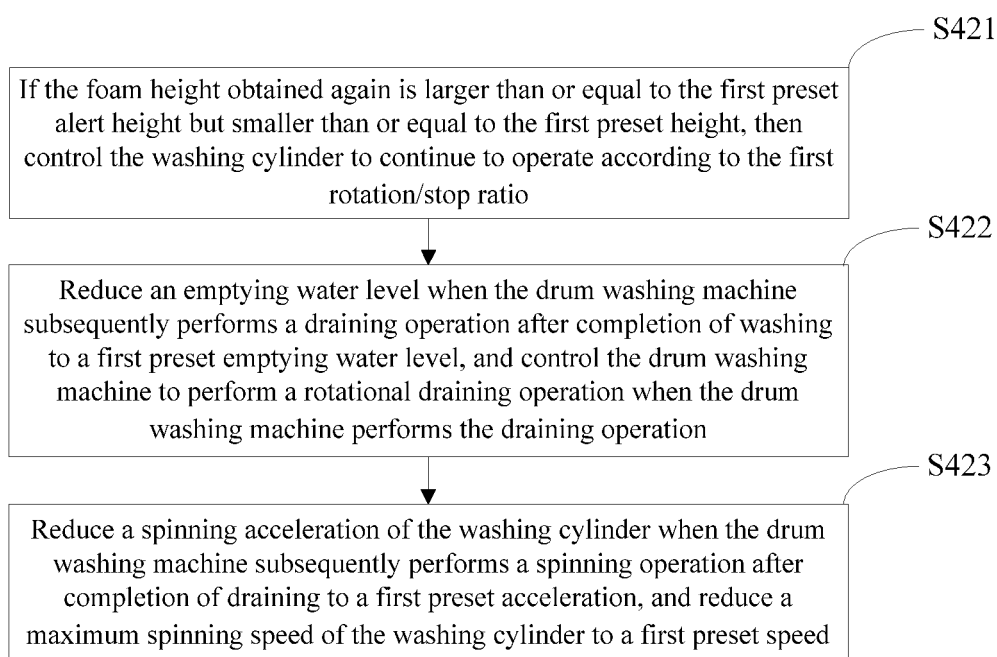


FIG. 4

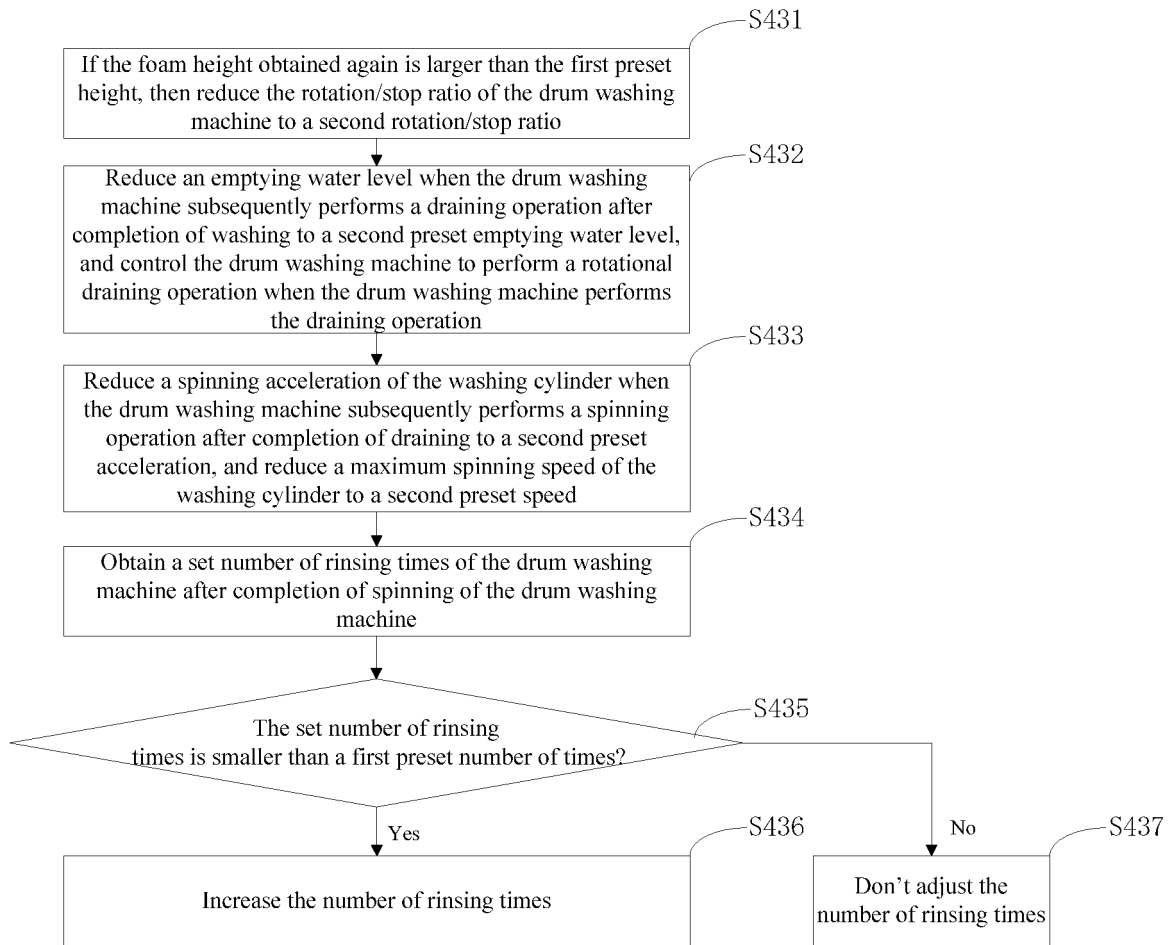


FIG. 5

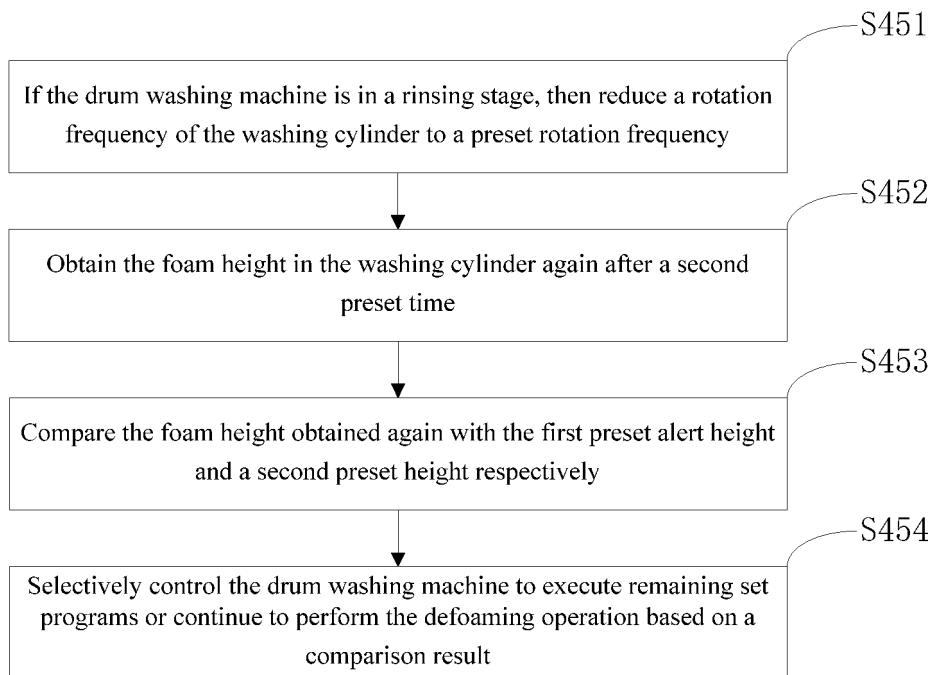


FIG. 6

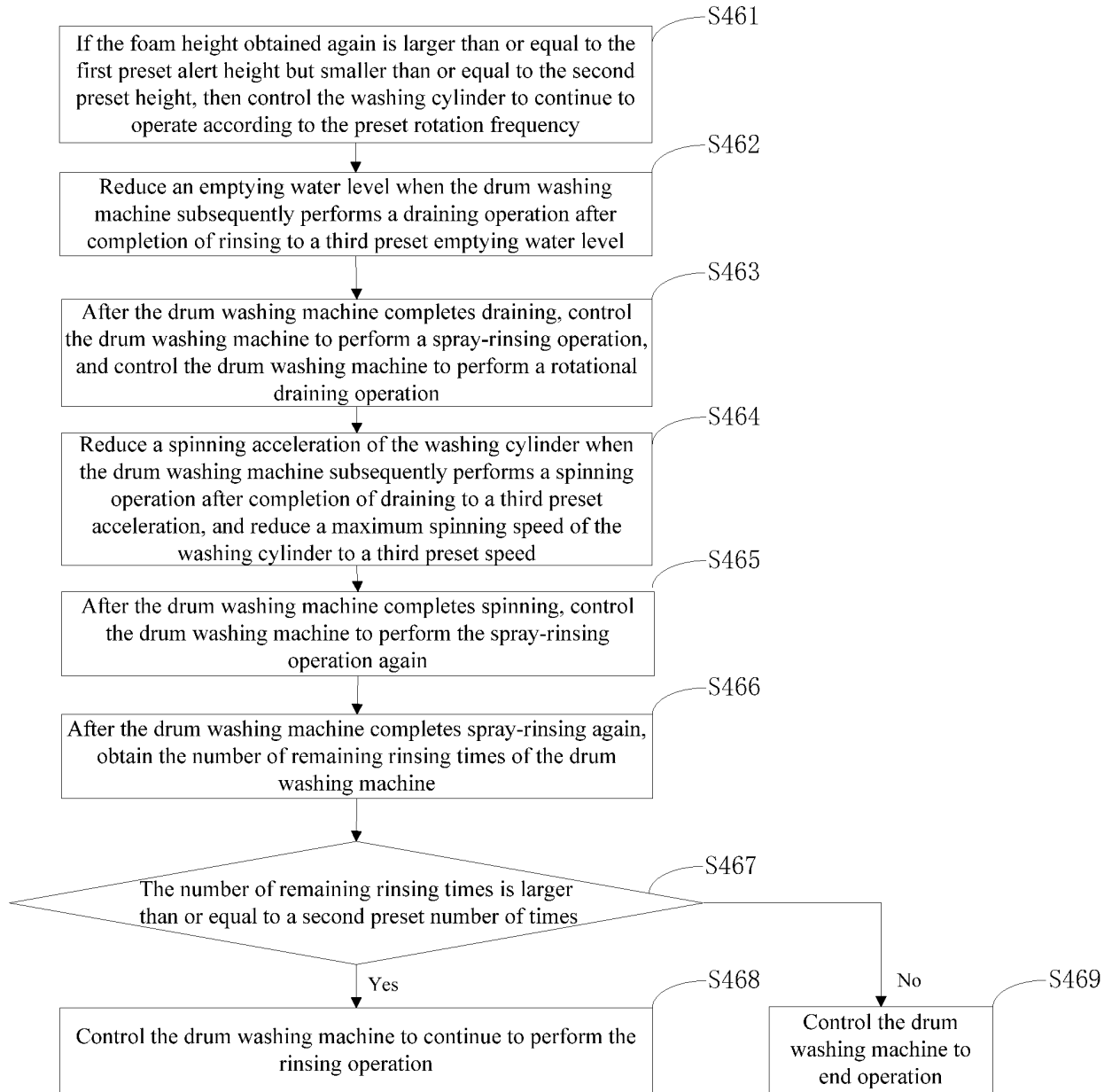


FIG. 7

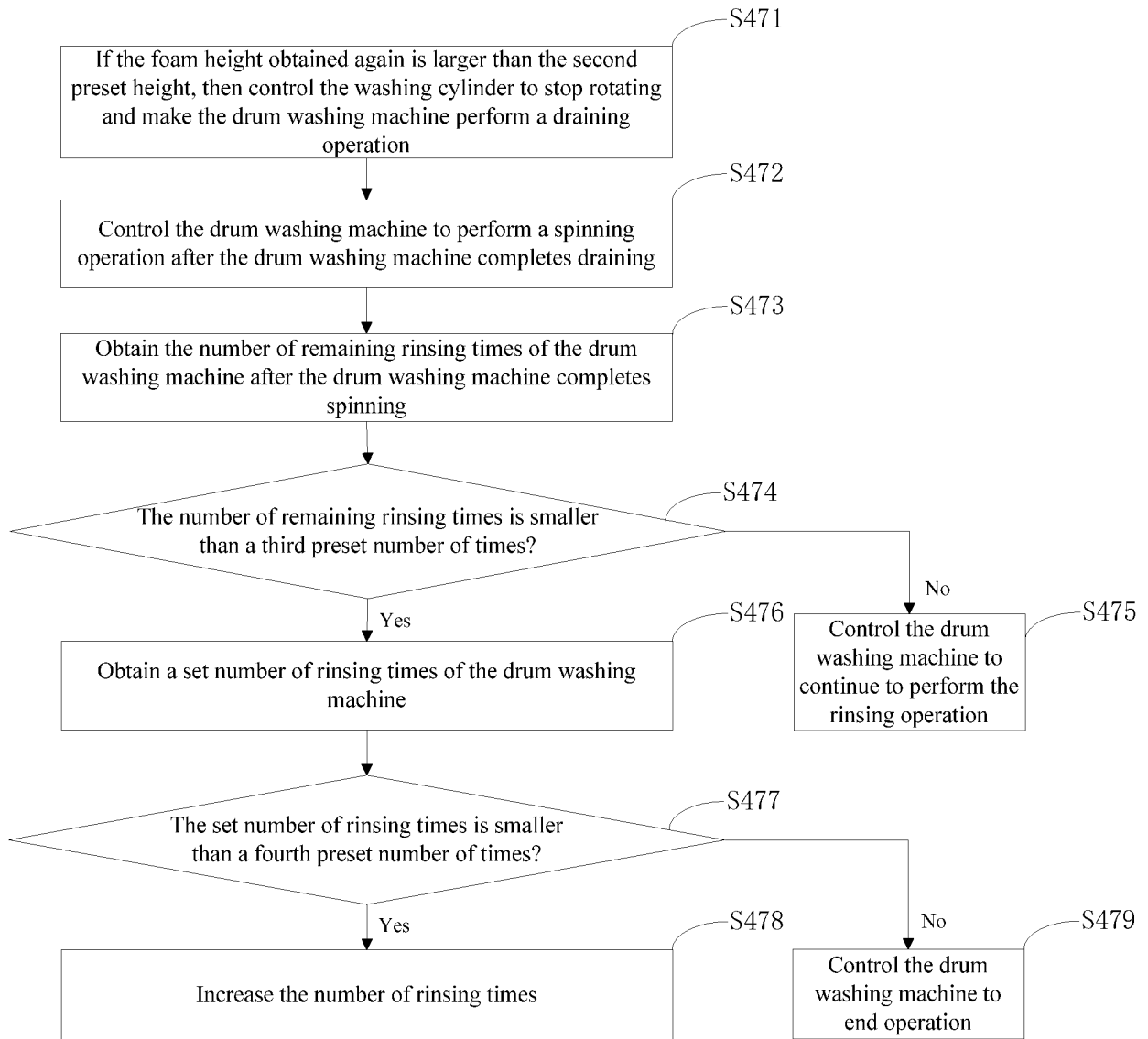


FIG. 8

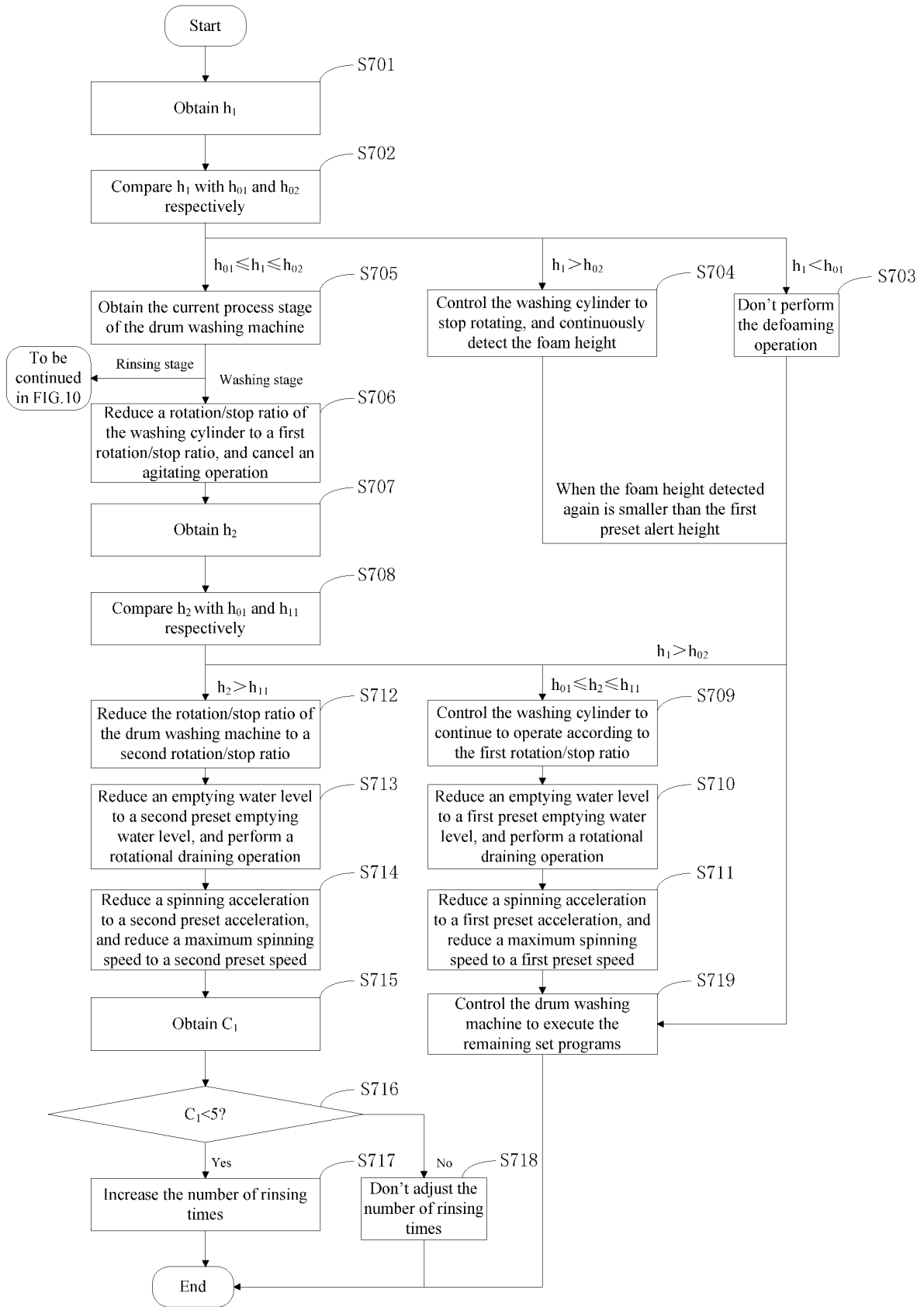


FIG. 9

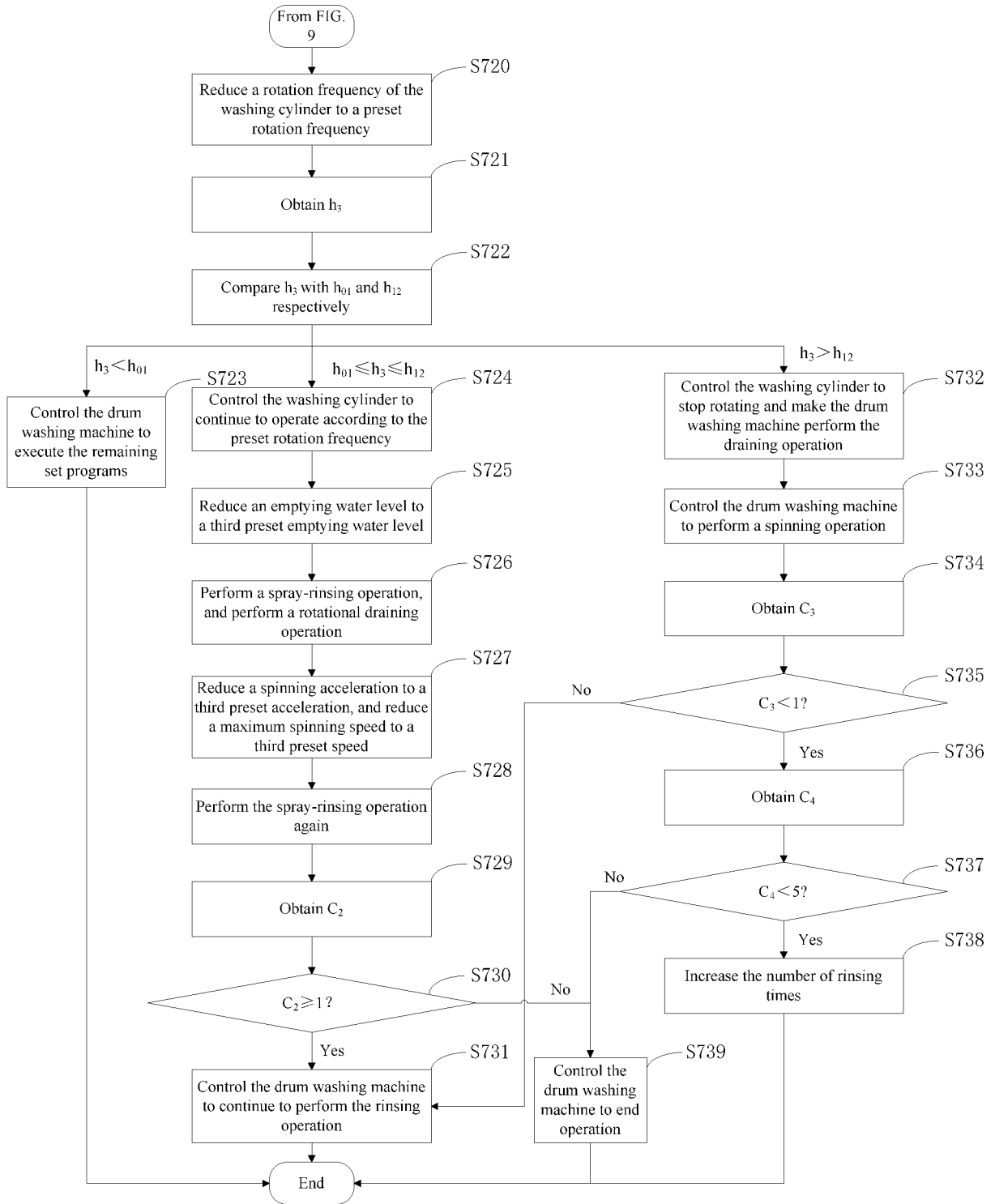


FIG. 10

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/138316

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**A. CLASSIFICATION OF SUBJECT MATTER**

D06F 33/32(2020.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

15

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI, CNPAT, WPI, EPODOC: 海尔, 洗衣机, 洗涤, 泡沫, 消泡, 预设, 阈值, 预警, 高度, washing, froth, foam, bobble, default, presuppose, preset, threshold w value, warning

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 110258080 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 20 September 2019 (2019-09-20) description paragraphs 0054-0071, figures 7-8	1, 10
X	CN 110205775 A (QINGDAO HAIER WASHING MACHINE CO., LTD. et al.) 06 September 2019 (2019-09-06) description, paragraphs 0028-0094, figures 1-2	1, 10
PX	CN 112575507 A (GREE ELECTRIC APPLIANCES, INC. OF ZHUHAI) 30 March 2021 (2021-03-30) description, paragraphs 0033-0054, figures 1-4	1, 10
A	CN 111206366 A (QINGDAO HAIER WASHING MACHINE CO., LTD.) 29 May 2020 (2020-05-29) entire document	1-10
A	JP 2004008467 A (SHARP K. K.) 15 January 2004 (2004-01-15) entire document	1-10
A	CN 109468797 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD.) 15 March 2019 (2019-03-15) entire document	1-10

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 Further documents are listed in the continuation of Box C.
  See patent family annex.

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\* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

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Date of the actual completion of the international search

27 January 2022

Date of mailing of the international search report

01 March 2022

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Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/  
CN)  
No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing  
100088, China

Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No. <b>PCT/CN2021/138316</b>
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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 109468808 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD.) 15 March 2019 (2019-03-15) entire document	1-10

