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(54) **MULTI-DRUM WASHING MACHINE WATER-DRAINING METHOD**

(57) A drainage control method for multi-drum washing machine, the multi-drum washing machine comprises at least two washing devices and a drainage pump communicating with the outside. Between each washing device and the drainage pump is respectively provided with a drainage valve. Each washing device of the multi-drum washing machine drains water sequentially. When a washing device completes the drainage, first, the drainage valve of the washing machine is closed, and then the drainage pump is turned off. It is detected whether or not other washing device requires drainage, and if yes, first the drainage valve of the washing device requiring drainage is opened, and then the drainage pump is turned on for the washing device draining water, and if no, the drainage of the multi-drum washing machine ends. The disclosure controls sequential drainage of each washing device, reducing vibration of a washing machine in the drainage process. Moreover, by controlling and determining an operating time sequence of a drainage pump, the disclosure thoroughly drains water in a multi-drum washing machine, extending washing machine service life. The disclosure has a simple structure, low costs, and is suitable for production and promotion.

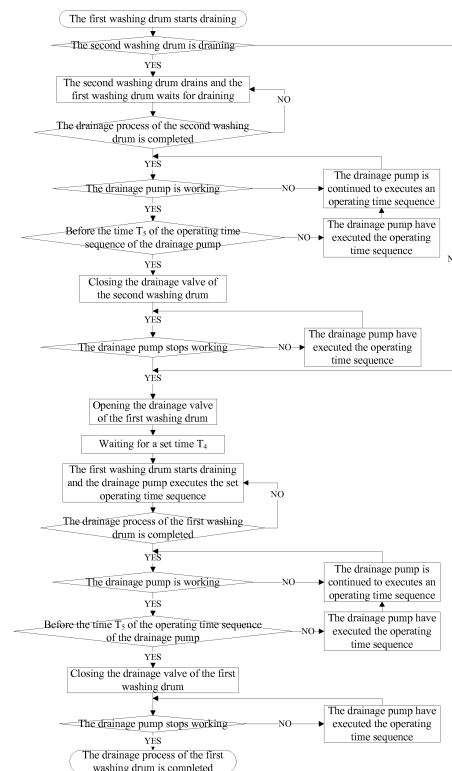


Fig.4

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a field of washing machine, specifically, to a drainage control method of a multi-drum washing machine.

BACKGROUND

[0002] At present, most of the drum washing machines on sale in the market have only one washing drum. With the strengthening of people's health awareness, more and more users need to separate the different types of clothes to wash or to wash a smaller amount of clothes in a timely manner.

[0003] With the improvement of people's quality of life, people's health awareness has gradually increased, especially in the family clothes washing, more and more people wash clothes separately. If using the existing washing machine to take multiple laundries, the laundry time is difficult to meet the requirements. If buying two or more washing machines to wash the clothes separately at the same time, it will not only bring a great waste of energy and water resources, but also take up a large space, which is not suitable for home use. Therefore, using the multi-drum washing machine can meet the above needs and solve the problem of energy, water and space waste.

[0004] A patent No.201010117002.0 discloses a control method of a washing machine which comprises a first washing drum and a second washing drum. The method comprises steps: receiving a first operation instruction for requiring a water supply or a drainage process to be executed in the first washing machine; determining whether or not a same operation instruction is being executed in the second washing machine. When a same operation instruction is being executed in the second washing machine, it is determined that the first operation instruction cannot be executed. When the same operation instructions for requiring a water supply or a drainage process are input to the first washing machine and the second washing machine at the same, it is determined which one of the first washing machine and the second washing machine has a shorter remaining laundry time. And the water supply or the drainage process is preferably executed in the washing drum having a relatively shorter remaining washing time.

[0005] The double-drum washing machine has a high center of gravity, which is unstable, so it has a higher requirement for vibration. However, the larger the overall weight of the washing machine, the smaller the vibration. Setting multiple drainage pumps or multiple washing devices to drain water at the same time will cause greater vibration and noise of the drum with higher center of gravity, which brings unnecessary troubles to the daily life. At the same time, in order to guarantee the service life of the washing machine, it should make sure that the

washing water in the washing machine is thoroughly expelled.

[0006] In the view of foregoing, the present disclosure is proposed.

SUMMARY

[0007] An object of the present disclosure is to overcome the shortcomings of the prior art, and provide a drainage control method for multi-drum washing machine. The multi-drum washing machine is provided with a plurality of washing devices and a drainage pump communicating with the outside. By the determination process, it controls sequential drainage of each washing device, reducing vibration of a washing machine. Moreover, by controlling and determining an operating time sequence of a drainage pump, it realizes thoroughly draining-water in a multi-drum washing machine, extending washing machine service life.

[0008] In order to achieve such object, the technical scheme of a drainage control method of a multi-drum washing machine is adopted by the present disclosure as follows: the multi-drum washing machine comprises at least two washing devices and a drainage pump communicating with the outside. Between each washing device and the drainage pump is respectively provided with a drainage valve. Each washing device of the multi-drum washing machine drains water sequentially. When a washing device completes the drainage, the drainage valve of the washing machine is closed, then the drainage pump is turned off.

[0009] It is detected whether or not other washing devices require to drainage. If yes, first, the drainage valve of the washing device which requires drainage is opened, and then the drainage pump is turned on for the washing device to drain water. If no, the drainage of the multi-drum washing machine is completed.

[0010] Further, after the completion of the drainage of the washing device, it is required to determine whether or not the drainage pump is in the working progress. If no, the drainage pump continues to execute another operating time sequence, and then the determination is performed again. If yes, it is continued to determine a time of the drainage pump in the working process.

[0011] Further, the operating time sequence of the drainage pump is a single cycle time sequence for the drainage pump to execute a whole working progress and stopping progress. A working progress time is set to be T_1 , and a stopping time is set to be T_2 , and a total time of the operating time sequence of the drainage pump is $T_3 = T_1 + T_2$.

[0012] Further, if a working time of the drainage pump is within the first 1/3 of the total time of the working progress, and the drainage valve of the washing device is closed.

[0013] If no, after the completion of the operating time sequence executed by the drainage pump, the drainage pump continues to execute another operating time se-

quence. Then it is determined whether or not the drainage pump is in the working progress.

[0014] Further, after a drainage process of the washing device is started, it is determined whether or not other washing device performs the drainage progress. If yes, waiting until the completion of the drainage of other washing device, and then stating the drainage process. If no, directly starting the drainage process.

[0015] Further, after the completion of the drainage of the washing device, first, the drainage valve of the washing device is closed, and then it is determined whether or not the drainage pump stops working. If no, the drainage pump continues executing the operating time sequence till the end, and then the determination is performed again. If yes, the drainage valve of another washing device is opened, or the drainage of the multi-drum washing machine is completed.

[0016] Further, after the drainage valve of the washing device is opened, and over a set waiting time T_4 , and then the drainage pump is turned on to drain the water in the washing device.

[0017] Further, the waiting time T_4 is set based on relevant parameters such as the drainage rate, the length of the pipeline between the drainage valve and the drainage pump of the multi-drum washing machine. Preferably, the waiting time satisfies $3s \leq T_4 \leq 6s$.

[0018] Further, during the drainage of the washing device, it is required to determine whether or not the washing device completes the drainage. If yes, it is determined whether or not the drainage pump is in the working progress. If no, the drainage pump continues to execute the drainage.

[0019] By adopting the technical scheme of the present disclosure, it brings the following benefits:

1. The present disclosure increases the determination process of sequential drainage, and reasonably arranges the working process of multiple washing drums to realize the vibration reduction effect to the maximum extent. In the present disclosure, when one washing drum of the washing machine reaches the drainage process and if another washing drum is draining water or will drain water in a certain time, the first washing drum will not drain water to increase the weight of the washing machine. It plays a role in increasing the counterweight to achieve absorption effect when the second washing drum is draining water.

2. In the present disclosure, the washing machine comprises at least two washing devices and a drainage pump communicating with the outside. Between each washing device and the drainage pump is respectively provided with a drainage pump, thus, it improves the drainage effect of the washing machine, and simplifies the space setting of the washing machine and reducing the production cost.

3. The present disclosure determines the progress of the operating time sequence of the drainage pump. After the completion of the drainage of the washing device and if the drainage pump is in the working progress and the working progress time thereof is before a certain set time, the drainage pump is turned off after the execution of the operating time sequence by the drainage pump is completed. If no, after the execution of the operating time sequence by the drainage pump is completed, the drainage pump continues to execute an operating time sequence, and then the drainage pump is turned off. It further ensures that the water in the washing machine is thoroughly drained by the drainage pump, avoiding the washing water accumulating between various components of the washing machine and extending the washing machine service life.

[0020] The following is further described in details with embodiments of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

Fig.1: A structural diagram of a multi-drum washing machine of the present disclosure;

Fig.2: A drainage structural diagram of the multi-drum washing machine of the present disclosure;

Fig.3: A drainage structural diagram of a multi-drum washing machine of another embodiment in the present disclosure;

Fig.4: A flow chart of a control method of the present disclosure;

Fig.5: A flow chart of a control method of an embodiment of the present disclosure;

Fig.6: A flow chart of a control method of another embodiment of the present disclosure;

Fig.7: A flow chart of a control method of another embodiment of the present disclosure;

[0022] Wherein: 1. a first washing drum, 2. a second washing drum.

DETAILED DESCRIPTION

[0023] To make the above purposes, features and advantages are more clearly understood, specific embodiments of the present disclosure are further described below in detail with reference to the accompanying drawings.

Embodiment 1

[0024] As shown in Fig.1, a multi-drum washing machine is provided with multiple washing devices. Each independent washing device can respectively and independently execute a water supply process, a washing process, a drainage process, a rinse process and a dehydration process for fulfilling the purpose of washing clothes. In the present embodiment, the multi-drum washing machine is a double-drum washing machine structure, and the washing devices are respectively a first washing drum 1 and a second washing drum 2 which are capable of independently performing preferable washing process in turn. The first washing drum and the second washing drum may also be respectively provided with a drying device for executing a drying process after the dehydration process is completed to achieve the purpose of drying the clothes in the first washing drum and/or the second washing drum. Preferably, the washing machine may also perform a heat treatment to the washing water. The first washing drum is provided with a first heater for heating the washing water therein, and the second washing drum is provided with a second heater for heating the washing water therein. Thus, during the execution of the washing process, the washing water in the corresponding washing drum is subjected to the heat treatment to control the water temperature during the washing process, and the washing effect is improved.

[0025] In the present disclosure, the first washing drum is communicated with the second washing drum. The water in the first washing drum can be drained into the second washing drum for reuse under a certain condition, and the water in the second washing drum can be drained into the first washing drum for reuse under a certain condition. If the water doesn't meet the condition for reuse, it is directly drained away through a drainage pipe. Thus, it improves the water utilization and avoids the water waste. At the same time, it adds a control process to ensure that the water is only be used when the water is relatively clean, and the washing effect can be guaranteed.

Embodiment 2

[0026] As shown in Fig.2 and Fig.3, in the present embodiment, the multi-drum washing machine is a double-drum washing machine structure. The double-drum washing machine has two washing devices, namely a first washing device and a second device respectively. The multi-drum washing machine is the double-drum washing machine and the washing device is a washing drum. The bottoms of the first and second washing device are respectively connected with one end of a drainage pipe, and the other ends of the two drainage pipe are respectively connected with a drainage main pipe communicating with the outside. The middle part of the drainage pipe is provided with a drainage valve, and the first washing device is connected with a drainage valve A and

the second washing device is connected with a drainage valve B, and the drainage main pipe is provided with a drainage pump P. The washing water in the first and second washing drums of the multi-drum washing machine are drained to the outside via the drainage pipe of the corresponding washing drum and the drainage main pipe. In order to make sure that the washing water in the drainage pipe of the washing machine is entirely drained to the outside, the drainage pump adopts the method of extra executing a set operating time sequence to ensure that all remaining washing water in the drainage pipe and inside washing machine is entirely drained. In the present embodiment, the drainage valve A, drainage valve B and the drainage pump are all connected with a control chip of the washing machine, and the control chip of the washing machine controls each washing drum to drain in order, reducing the vibration and noise of the washing machine. The drainage structure of the multi-drum washing machine improves the drainage efficiency of multiple washing drums of the multi-drum washing machine, and simplifies the interior space setting of the washing machine and reduces the production cost of the washing machine at the same time.

[0027] In the present embodiment, the water outlet of the drainage main pipe is arranged at the middle or the bottom part of the washing machine according to different usage environments, further ensuring the use convenience of users.

Embodiment 3

[0028] As shown in Fig.4, the drainage control method for multi-drum washing machine is provided in the present embodiment. The multi-drum washing machine comprises at least two washing devices and a drainage pump communicating with the outside. Between each washing device and the drainage pump is respectively provided with a drainage valve. Each washing device of the multi-drum washing machine drains water sequentially. When a washing device completes the drainage, first, the drainage valve of the washing device is closed, and then the drainage pump is turned off.

[0029] It is detected whether or not other washing device requires drainage. If yes, first, the drainage valve of the washing device which requires drainage is opened, and then the drainage pump is turned on for the washing device draining water. If no, the drainage of the multi-drum washing machine ends. When a washing device is draining water and another washing device is in the process of waiting for draining, the water and clothes in the other washing device plays a role as a counterweight which increases the overall weight of the washing machine to achieve the effect of vibration absorption. In particular, the effect of vibration absorption is best when the washing device is in the drainage course of the dehydration process.

[0030] After the completion of the drainage of the washing device, it is required to determine whether or

not the drainage pump is in the working progress. If no, the drainage pump continues to execute an operating time sequence again, and then the determination is performed again. If yes, it is continued to determine a time of the drainage pump in the working progress. The washing drum determines whether or not the water thereof is drained by detecting the water level or by calculating the amount of water intake and the amount of drainage by the control chip. However, there still some washing water remains in the washing device of the washing machine, or some washing water is not drained from the drainage pipeline. By determining the period of the operating time sequence of the drainage pump, it makes ensure that the drainage pump continues operating for a set time after detecting that the washing water in the multi-drum washing machine is drained, thus it achieves the effect that the washing water in the multi-drum washing machine is thoroughly drained.

[0031] An operating time sequence of the drainage pump is a single cycle time sequence for the drainage pump to execute a whole working progress and stopping process. A working progress time is set to be T_1 , and a stopping time is set to be T_2 and a total time of the operating time sequence of the drainage pump is $T_3 = T_1 + T_2$. The operating time sequence of the drainage pump comprises the working progress and the stopping progress. In the stopping progress, the multi-drum washing machine accumulates a certain amount of washing water, and then the drainage pump starts to drain the washing water out, which reduces the no-load running of the drainage pump and extends the service life of the drainage pump. Moreover, it reduces the excessive noise of the washing machine generated by the no-load running of the drainage pump and affects the using satisfaction of the user.

[0032] If a working time of the drainage pump is within the first 1/3 of the total time of the working progress, the drainage valve of the washing device is closed.

[0033] If no, after the completion of the operating time sequence executed by the drainage pump, the drainage pump continues to execute another operating time sequence, and then it is determined whether or not the drainage pump is in the working progress. When the time of the stopping progress and the working progress of the operating time sequence of the drainage pump is relatively short, and it is determined the water in the washing device is drained and the drainage pump is in the last stage of the working time, it is still cannot be assured that the residual washing water in the drainage pipeline or the washing device is thoroughly drained. In order to make sure that all washing machine is thoroughly drained, it should guarantee that the working time of the drainage pump after the completion of the drainage of the washing device is larger than 2/3 of the total time of the working process of the drainage pump, to thoroughly drain the washing water in the washing machine.

[0034] After the drainage process of the washing device is started, it is determined whether or not another washing device performs the drainage process. If yes,

waiting until the completion of the drainage of other washing device, and then the drainage process is started. If no, the drainage process is directly started. It realizes the sequentially drainage of the washing devices of the multi-drum washing machine and makes sure that plurality of washing devices of the multi-drum washing machine will not drain water at the same time, thereby improving the drainage efficiency of the multi-drum washing machine.

[0035] After the completion of the drainage of the washing device, first the drainage valve of the washing device is closed. Then it is determined whether or not the drainage pump stops working. If no, the drainage pump executes the operating time sequence till the end, and then the determination is performed again. If yes, the drainage valve of another washing device is opened, or the drainage of the multi-drum washing machine ends. It further ensures that the washing water in the drainage pipeline is thoroughly drained, preventing a large number of the washing water from depositing in the drainage pipeline to cause bearing burden of the drainage pipeline, and preventing a lot of bacteria from breeding by the long-term residual washing water in the drainage pipeline to contaminate the interior of the washing machine, and even the clothes, which can improve the using cleanness of the washing machine and extend the service life of the washing machine.

[0036] After opening the drainage valve of the washing device, then the drainage pump is turned on to drain the water in the washing device over a set waiting time T_4 .

[0037] The waiting time T_4 is set based on relevant parameters such as the drainage rate and the length of the pipeline between the drainage valve and the drainage pump of the multi-drum washing machine. Preferably, the waiting time is $3s \leq T_4 \leq 6s$. After the drainage valve of the washing machine is opened, the washing water cannot instantly reach the position of the drainage pump. Therefore, it waits for a set time to allow the washing water to be drained after the washing water reaches the drainage pump, avoiding a lot of noise caused by the no-load running of the drainage pump, and further ensuring the service life of the drainage pump.

[0038] During the drainage of the washing device, it is required to determine whether or not the washing device completes the drainage. If yes, it is determined whether or not the drainage pump is in the working process. If no, the drainage pump continues to execute the drainage.

[0039] As shown in Fig.4, the multi-drum washing machine of the present embodiment is a double-drum washing machine. The washing device of the double-drum washing machine is a first washing drum and a second washing drum, respectively. There is no difference between the first washing drum and the second washing drum, just to distinguish multiple washing devices of the washing machine. The drainage control method of the multi-drum washing machine of the present embodiment is as follows:

1) The first washing drum reaches the drainage process;

2) It is determined whether or not the second washing drum is draining, if yes, executing step 3), if no, executing step 9);

3) The second washing drum drains and the first washing drum waits for draining;

4) It is determined whether or not the drainage process of the second washing drum is completed, if yes, executing step 5), if no, executing step 3);

5) It is determined whether or not the drainage pump is working, if yes, executing step 6), if no, the drainage pump executes an operating time sequence again, then executing step 5);

6) It is determined whether or not the working time of the drainage pump is before a time T_5 of this working process, if yes, executing step 7), if no, the drainage pump executes an operating time sequence again after the completion of the execution of this operating time sequence, and then executing step 5);

7) The drainage pump of the second washing drum is turned off;

8) It is determined whether or not the drainage pump stops working, if yes, executing step 9); if no, after the completion of the execution of operating time sequence of the drainage pump, executing step 8);

9) The drainage valve of the first washing drum is opened;

10) Waiting for a set time T_4 ;

11) The drainage pump is turned on and executes the set operating time sequence, and the first washing drum starting draining water;

12) It is determined whether or not the drainage of the first washing drum is completed, if yes, executing step 13), if no, executing step 11);

13) It is determined whether or not the drainage pump is working, if yes, executing step 14), if no, the drainage pump executes an operating time sequence again, and then executing step 13);

14) It is determined whether or not a working time of the drainage pump is within the first 1/3 of the total time of the working progress, if yes, executing step 15), if no, the drainage pump executes an operating time sequence again after the completion of the ex-

ecution of this operating time sequence, then step 13) is executed;

15) The drainage valve of the first washing drum is closed;

16) It is determined whether or not the drainage pump is working, if yes, executing step 17), if no, after the execution of the operating time sequence by the drainage pump is completed, and then step 17) is executed;

17) The drainage of the first washing drum is completed.

[0040] The time point T_5 which is mentioned in step 6 for determining whether or not the working time of the drainage pump is before the time T_5 of the working progress is the time point of 1/3 of the total time of this working progress. Therefore, determining whether or not the working time of the drainage pump is before the time point T_5 of this working progress is to determine whether or not the working time of the drainage pump is within 1/3 of the total time of this working progress.

[0041] As shown in Fig.5, the present embodiment is provided with an implementation solution. When the second washing drum reaches the drainage process, it is required to determine whether or not the first washing drum is draining. The steps of drainage method is as follows:

1) The second washing drum reaches the drainage process;

2) It is determined whether or not the first washing drum is draining, if yes, executing step 3), if no, executing step 9);

3) The first washing drum drains and the second washing drum waits for draining;

4) It is determined whether or not the drainage process of the first washing drum is completed, if yes, executing step 5), if no, executing step 3);

5) It is determined whether or not the drainage pump is working, if yes, executing step 6), if no, the drainage pump executes an operating time sequence again, then step 5) is executed;

6) It is determined whether or not the working time of the drainage pump is before a time T_5 of this working process, if yes, executing step 7), if no, the drainage pump executes an operating time sequence again after the completion of the execution of this operating time sequence, and then step 5) is executed;

7) The drainage pump of the first washing drum is turned off;

8) It is determined whether or not the drainage pump stops working, if yes, executing step 9); if no, after the completion of the execution of operating time sequence of the drainage pump, step 8) is executed;

9) The drainage valve of the second washing drum is opened;

10) Waiting for a set time T_4 ;

11) The drainage pump is turned on and executes the set operating time sequence, and the second washing drum starting draining water;

12) It is determined whether or not the drainage of the second washing drum is completed, if yes, executing step 13), if no, executing step 11);

13) It is determined whether or not the drainage pump is working, if yes, executing step 14), if no, the drainage pump executes an operating time sequence again, and then executing step 13);

14) It is determined whether or not a working time of the drainage pump is within the first 1/3 of the total time of the working progress, if yes, executing step 15), if no, the drainage pump executes an operating time sequence again after the completion of the execution of this operating time sequence, then step 13) is executed;

15) The drainage valve of the second washing drum is closed;

16) It is determined whether or not the drainage pump is working, if yes, executing step 17), if no, after the execution of the operating time sequence by the drainage pump is completed, and then step 17) is executed

17) The drainage of the second washing drum is completed.

Embodiment 4

[0042] In the present embodiment, the water in the washing drum of the multi-drum washing machine is reused. If it is determined the first washing drum waits until the completion of the drainage process of the second washing drum, and it is determined whether or not the second washing drum needs to supply water after the completion of the dehydration process. If the water supply is not required, the water in the first washing drum is drained directly. If the water supply is required, it is determined whether or not the water in the first washing

drum can be reused. If it can be reused, the water in the first washing drum is drained into the second washing drum.

[0043] When the first washing drum reaches the drainage process and if the second washing drum is supplying water, it is determined whether or not the water in the first washing drum can be reused. If it can be reused, the water in the first washing drum is drained into the second washing drum.

[0044] The water in the first washing drum cannot be reused, if the first washing drum is in a washing state when it drains and the second washing drum is in a rinse state when it supplies water; or if the first and second washing drum are both in the washing state when the first washing drum drains and the second washing drum supplies water and the washing times of the first washing drum is less than that of the second washing drum; or if the first and second washing drum are both in the rinse state when the first washing drum drains and the second washing drum supplies water and the rinsing times of the first washing drum is less than that of the second washing drum; or if a turbidity of the first washing drum exceeds a set value.

[0045] When it is determined whether or not the water in the first washing drum can be reused, the turbidity value or the foam concentration value of the water in the first washing drum is detected. If the turbidity value or the foam concentration value is smaller than the set value, the water in the first washing drum can be reused. Otherwise, the water in the first washing drum cannot be reused and is drained directly.

[0046] When the first washing drum reaches the drainage process, it is determined whether or not the process of which the second washing drum is in progress or is about to be performed is a water supply for last rinse. If yes, the water in the first washing drum is drained directly. If no, it is continued to determine whether or not the water in the first washing drum can be reused.

[0047] When the first washing drum reaches the drainage process, it is determined whether or not the drainage of the first washing drum is for the last rinse. If the drainage is for the last rinse, the water in the first washing drum is drained directly. If the drainage is not for the last rinse, it is determined whether or not the water in the first washing drum can be reused. It is because that the softener or the antivirus agent may be added to the last rinse, and the second washing drum may not need this process, it can avoid the clothes in the second washing drum being affected. If the drainage of the second washing drum is for the last rinse, the water in the first washing drum is drained directly.

[0048] The numeration of the first washing drum and the second washing drum are only for sake of convenience of the description, regardless of the order relationship. It is also possible to determine whether or not the first washing drum is draining at this time when the second washing drum is draining. If the first washing drum is draining, the second washing drum waits until the com-

pletion of the drainage process of the first washing drum, and then drains. The water in the second washing drum plays role as a counterweight, which can increase the weight of the washing machine to achieve the effect of vibration absorption.

[0049] In the present embodiment, when the washing drum of the multi-drum washing machine is in a dehydration process, because the washing machine generates greater vibration in the dehydration process, in order to achieve better effect of vibration absorption, if the first washing drum is not draining or dehydrating at this time, it is determined whether or not the second washing drum waits until the completion of the dehydration process of the first washing drum and then drains. It can avoid the scenario that the first washing drum starts to dehydrate as soon as the second washing drum just finished draining water. Under that scenario the water in the second washing drum cannot reach the effect of vibration absorption, resulting in a waste.

[0050] As shown in Fig.6, another drainage method of multi-drum washing machine of the present embodiment is as follows:

- 1) The first washing drum reaches the drainage process;
- 2) It is determined whether or not the second washing drum is draining, if yes, executing step 3), if no, executing step 12);
- 3) The second washing drum drains and the first washing drum waits for draining;
- 4) It is determined whether or not the drainage process of the second washing drum is completed, if yes, executing step 5), if no, executing step 4);
- 5) It is determined whether or not the drainage pump is working, if yes, executing step 6), if no, the drainage pump executes another operating time sequence, then executing step 5);
- 6) It is determined whether or not the working time of the drainage pump is before a time T_5 of this working progress, if yes, executing step 7), if no, the drainage pump executes another operating time sequence after the completion of the execution of this operating time sequence, then executing step 5);
- 7) The drainage pump of the second washing drum is turned off;
- 8) It is determined whether or not the drainage pump stops working, if yes, executing step 9); if no, after the completion of the execution of operating time sequence of the drainage pump, executing step 8);
- 9) The first washing drum prepares to drain;

10) It is determined whether or not the second washing drum supplies water, if yes, executing step 11), if no, executing step 12);

11) It is determined whether or not the water in the first washing drum can be reused, if yes, the water in the first washing drum is drained into the second washing drum, if no, executing step 12);

12) The water in the first washing drum is discharged from the washing machine.

Embodiment 5

[0051] A control method of water reuse of a multi-drum washing machine of the present embodiment is provided. The multi-drum washing machine at least comprises a first washing drum and a second washing drum. When the first washing drum and the second washing drum are both in the working state at the same time and the first washing drum reaches the drainage process, it is compared a time T_{12} for reaching a water supply process of a second washing drum and a time T_{11} for reaching a next drainage process of the first washing drum. If $T_{12} < T_{11}$, the first washing drum waits for the water supply process of the second washing drum. if $T_{12} \geq T_{11}$, the water in the first washing drum is drained directly.

[0052] It is determined whether or not the water in the first washing drum can be reused before comparing the time T_{12} for reaching the water supply process of the second washing drum and the time T_{11} for reaching the next drainage process of the first washing drum. If no, the water in the first washing drum is drained directly. If yes, it is compared the time T_{12} for reaching the water supply process of the second washing drum and the time T_{11} for reaching the next drainage process of the first washing drum.

[0053] Or, it is determined whether or not the water in the first washing drum can be reused when the first washing drum waits until the start of the water supply process of the second washing drum. If no, the water in the first washing drum is drained directly. If yes, the water in the first washing drum is drained into the second washing drum for reuse.

[0054] As shown in Fig.7, in the present embodiment, the waiting time of the water supply is adopted as the determination criterion to determine whether or not to reuse the water. According to the waiting time of the water supply, it is determined whether or not to reuse the water drained from the other washing drum when one washing drum reaches the water supply process. The method has a simple judgment and control logic, and the control stability is high in the actual washing process. At the same time, it achieves a full reuse of water, and the practical value is high, which is more effective to promote and apply.

[0055] When the first washing drum and the second washing drum are both in the working state at the same

time, the control method of water reuse is as follows:

A control method of water reuse of a multi-drum washing machine is provided, and the multi-drum washing machine at least comprises a first washing drum and a second washing drum. When the first washing drum and the second washing drum are both in the working state, the control method of water reuse is as follows: when the first washing machine reaches the water supply process, it is compared a time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. If $T_{22} \geq T_{21}$, the first washing drum supplies clean water directly. If $T_{22} < T_{21}$, the first washing drum waits for the drainage process of the second washing drum.

[0056] It is determined whether or not the water in the second washing drum can be reused before comparing the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. If no, the first washing drum supplies clean water directly. If yes, it is compared the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. Or, it is determined whether or not the water in the second washing drum can be reused when the first washing drum waits until the start of the drainage process of the second washing drum. If no, the first washing drum supplies clean water directly. If yes, the water in the second washing drum is drained into the first washing drum for reuse.

[0057] Specific: step 1: when the first washing drum reaches the water supply process, it is compared the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. If $T_{22} \geq T_{21}$, the first washing drum supplies clean water directly. If $T_{22} < T_{21}$, the first washing drum waits for the drainage process of the second washing drum, then executes step 2.

[0058] Step 2: it is determined whether or not the water in the second washing drum can be reused. If yes, the water in the second washing drum is drained into the first washing drum for reuse. If no, the first washing drum supplies clean water directly. By adding the process of determination of whether or not to wait, to a large extent it increase the water reuse probability of the second washing drum, and more water can be reused.

[0059] In step 1, if the second washing drum is draining when the first washing drum reaches the water supply process, the time T_{22} for reaching the drainage process of the second washing drum is 0, and no need to wait, and step 2 is executed directly. It can also possible to first determine whether or not the second washing drum is currently executing the drainage process before comparing the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. If the second washing drum is not subjected to the drain-

age process, then it is compared the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum.

[0060] In step 1, an allowable waiting time T_{20} is set, which $T_{20} < T_{21}$. If $T_{22} < T_{20}$, the first washing drum waits for the drainage process of the second washing drum, then executes step 2. If $T_{22} \geq T_{20}$, the first washing drum supplies clean water directly. This step avoids the first washing drum waiting too long and reasonably arrange the water reuse on the premise of guaranteeing the washing time of the first washing drum. It will not waste too much time of the first washing drum because of only considering the water reuse. If the washing machine determines that the waiting time is too long and exceeds the set allowable waiting time, the first washing drum will not reuse the water in the second washing drum. This determination makes the water reuse more reasonable, to the greatest extend coordinating the relationship between the waiting time and the water reuse.

[0061] In step 2, the turbidity value or the foam concentration value in the second washing drum is detected. If the turbidity value or the foam concentration value is smaller than the set value, the water in the second washing drum can be reused. Otherwise the water in the second washing drum cannot be reused. Water can only be reused when the turbidity value or the foam concentration value is within the set range.

[0062] In step 2, it is determined whether or not the drainage of the second washing drum is for the last rinse. If the drainage is for the last rinse, the water in the second washing drum is drained directly. If the drainage is not for the last rinse, it is determined whether or not the water in the second washing drum can be reused. It is because that the softener or the antivirus agent may be added to the last rinse, and the first washing drum may not need this process, it can avoid the clothes in the first washing drum being affected. If the drainage of the second washing drum is for the last rinse, the water in the second washing drum is drained directly and the first washing drum supplies clean water directly.

[0063] In step 1, when the first washing drum reaches the water supply process, it is determined whether or not the water supply process being executed is a water supply for the last rinse. If yes, the first washing drum supplies clean water directly. If no, it is continued to compare the time T_{22} for reaching the drainage process of the second washing drum and a time T_{21} for reaching the next water supply process of the first washing drum. Thus it is ensured that the water supplied-in in the last rinse process is clean water, which ensures the effect of washing clothes after washing.

[0064] In step 2, when the water in the second washing drum is drained into the first washing drum, it is determined whether or not the first washing drum executes the water supply process for washing. If yes, the first washing drum first supplies water for flushing the detergent box. After the completion of the water supply for

flushing the detergent box of the first washing drum, the water in the second washing drum is drained into the first washing drum. If no, the water in the second washing drum is drained into the first washing drum directly.

[0065] In step 2, when the water in the second washing drum is drained into the first washing drum, the height of the water level of the first washing drum is detected. If the water level in the first washing drum reaches the set water level value, there remains some water in the second washing drum, then the remaining water in the second washing drum is drained directly. If when the water in the second washing drum is thoroughly drained into the first washing drum, the water level of the first washing drum doesn't reach the set water level value, then the first washing drum supplies clean water.

[0066] When the water in the second washing drum is drained directly, it is determined whether or not the first washing drum is executing the drainage process or the dehydration process at this moment. If yes, the second washing drum waits for the completion of the drainage of the first washing drum and then drains. If no, it is determined that a time for reaching the dehydration process of the first washing drum is T_{41} , a time taken for the first washing drum to drain is T_{42} , a time taken for the first washing drum to dehydrate is T_{43} , and an allowable waiting time T_{40} is set. If $T_{41}+T_{42}+T_{43}<T_{40}$, the second washing drum waits for the completion of the drainage process of the first washing drum and then drains. Otherwise, the water in the second washing drum is drained directly.

[0067] It is also possible to determine whether or not the water in the first washing drum can be reused by determining the washing state and the washing times. In step 2, the water in the first washing drum cannot be reused, if the second washing drum is in a washing state when it drains and the first washing drum is in a rinsing state when it supplies water; or if the first and second washing drum are both in the washing state when the second washing drum drains and the first washing drum supplies water and the washing times of the second washing drum is less than that of the first washing drum; or if the first and second washing drum are both in the rinsing state when the second washing drum drains and the first washing drum supplies water and the washing times of the second washing drum is less than that of the first washing drum.

[0068] When the second washing drum reaches the water supply process, it is compared the time for reaching the drainage process of the first washing drum and the time for reaching the next water supply process of the second washing drum, it is determined whether or not the second washing drum waits until the first washing drum drains.

[0069] The drainage outlet of the second washing drum is communicated with the first washing drum, and the water in the second washing drum can be drained into the first washing drum for reuse. The drainage outlet of the second washing drum is provide with a holding valve, the water in the second washing drum can flow into the

first washing drum through the holding valve. The first washing drum is provided with a water inlet valve and the external clean water can flow into the first washing drum through the water inlet valve. The control method is as follows:

1) The first washing drum reaches the water supply process;

2) It is determined whether or not the water in the second washing drum can be reused, if yes, executing step 3), if no, executing step 6);

3) It is determined that a time for reaching the next water supply water process of the first washing drum is T_{21} , a time for reaching the drainage process of the second washing drum is T_{22} , if $T_{22}<T_{21}$, executing step 4), if $T_{22}\geq T_{21}$, executing step 6);

4) The first washing drum waits for the second washing drum to drain, executing step 5);

5) The water in the second washing drum is drained into the first washing drum;

6) The first washing drum supplies clean water directly and the water in the second washing drum drains directly.

[0070] The control method can also add a process of determining whether or not the second washing drum is draining before comparing the time T_{22} for reaching the drainage process of the second washing drum and the time T_{21} for reaching the next water supply process of the first washing drum. The control method is as follows:

1) The first washing drum reaches the water supply process;

2) It is determined whether or not the water in the second washing drum can be reused, if yes, executing step 3), if no, executing step 7);

3) It is determined whether or not the second washing drum is executing the drainage process, if no, executing step 4), if yes, step 6);

4) It is determined that a time for reaching the next water supply water process of the first washing drum is T_{21} , a time for reaching the drainage process of the second washing drum is T_{22} , if $T_{22}<T_{21}$, executing step 5), if $T_{22}\geq T_{21}$, executing step 7);

5) The first washing drum waits for the second washing drum to drain, executing step 6);

6) The water in the second washing drum is drained into the first washing drum;

7) The first washing drum supplies clean water directly and the water in the second washing drum drains directly.

[0071] The control method can also include a determination of whether or not the first washing drum has enough time to wait the second washing drum draining. The control method is as follows:

- 1) The first washing drum reaches the water supply process; 10
- 2) It is determined whether or not the water in the second washing drum can be reused, if yes, executing step 3), if no, executing step 8); 15
- 3) It is determined whether or not the second washing drum is executing the drainage process, if no, executing step 4), if yes, step 7); 20
- 4) It is determined that a time for reaching the next water supply water process of the first washing drum is T_{21} , a time for reaching the drainage process of the second washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 8); 25
- 5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 8);
- 6) The first washing drum waits for the second washing drum to drain, executing step 7); 30
- 7) The water in the second washing drum is drained into the first washing drum; 35
- 8) The first washing drum supplies clean water directly and the water in the second washing drum drains directly.

[0072] If the water in the second washing drum is too dirty or the water is from the water supply process of the first washing drum is for the last rinse, the water in the second washing drum cannot be reused. The control method is as follows:

- 1) The first washing drum reaches the water supply process; 40
- 2) It is determined whether or not the first washing drum only has a water supply for the last rinse left, if no, executing step 3), if yes, executing step 9); 45
- 3) It is determined whether or not the second washing drum is executing the drainage process, if no, executing step 4), if yes, executing step 7); 50
- 4) It is determined that a time for reaching the next water supply water process of the first washing drum

is T_{21} , a time for reaching the drainage process of the second washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 9);

- 5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 9);
- 6) The first washing drum waits for the second washing drum to drain, executing step 7);
- 7) The turbidity value or the foam concentration value of the water in the second washing drum is detected to determine whether or not the turbidity value or the foam concentration value is smaller than the set value, if yes, executing step 8), if no, executing step 9); it is determined whether or not the second washing drum drains for the last rinse, if no, executing step 8), if yes, executing step 9);
- 8) The water in the second washing drum is drained into the first washing drum;
- 9) The first washing drum supplies clean water directly and the water in the second washing drum is drained directly.

[0073] When the water in the second washing drum is drained into the first washing drum and if the water supply of the first washing drum is for washing, the detergent box need to be flushed and the water level need to be detected. The control method is as follows:

- 1) The first washing drum reaches the water supply process;
- 2) It is determined whether or not the first washing drum only has a water supply for the last rinse left, if no, executing step 3), if yes, executing step 12);
- 3) It is determined whether or not the second washing drum is executing the drainage process, if no, executing step 4), if yes, executing step 7);
- 4) It is determined that a time for reaching the next water supply water process of the first washing drum is T_{21} , a time for reaching the drainage process of the second washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 12);
- 5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 12);
- 6) The first washing drum waits for the second washing drum to drain, executing step 7);
- 7) The turbidity value or the foam concentration value of the water in the second washing drum is detected to determine whether or not the turbidity value or

the foam concentration value is smaller than the set value, if yes, executing step 8), if no, executing step 12);

8) It is determined whether or not the first washing drum is executing the water supply process for washing, if yes, executing step 9), if no, executing step 10);

9) The first washing drum first supplies water for flushing the detergent box, after the completion of water supply for flushing the detergent box of the first washing drum, executing step 10);

10) The water in the second washing drum is drained into the first washing drum;

11) It is detected the height of the water level in the first washing drum. When the water level in the first washing drum reaches the set water level value, if there remains some water in the second washing drum, the remaining water is drained directly; if the water level in the first washing drum still not reaches the set water level value after all water in the second washing drum is entirely drained into the first washing drum, the water from outside is flooded into the first washing drum through the water inlet;

12) The first washing drum supplies water directly and the water in the second washing drum is drained directly.

[0074] The numeration of the first washing drum and the second washing drum of the present embodiment is only for the sake of convenience of the description, regardless of the order relationship. It is also possible to reuse the water in the first washing drum. The water inlet of the second washing drum is communicated with the drainage outlet of the first washing drum, and the water in the first washing drum can be drained into the second washing drum for reuse. The drainage outlet of the first washing drum is provided with a holding valve, and the water in the first washing drum can flow into the second washing drum through the holding valve. The second washing drum is provided with a water inlet valve, the external clean water can flow into the second washing drum through the water inlet valve. When one washing drum reaches the water supply process, it is determined whether or not the water in the other washing drum is drained into the washing drum for reuse. And when the other washing drum reaches the water supply process, it doesn't need to consider the water reuse of the washing drum. It avoids both drums waiting to cause an infinite loop.

[0075] The control method is as follows:

1) The second washing drum reaches the water supply process;

2) It is determined whether or not the water in the first washing drum can be reused, if yes, executing step 3), if no, executing step 6);

3) It is determined that a time for reaching the next water supply water process of the second washing drum is T_{21} , a time for reaching the drainage process of the first washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 4), if $T_{22} \geq T_{21}$, executing step 6);

4) The second washing drum waits for the first washing drum to drain, executing step 5);

5) The water in the first washing drum is drained into the second washing drum;

6) The second washing drum supplies clean water directly and the water in the first washing drum drains directly.

[0076] The control method can also add a process of determining whether or not the first washing drum is draining before comparing the time T_{22} for reaching the drainage process of the first washing drum and the time T_{21} for reaching the next water supply process of the second washing drum. The control method is as follows:

1) The second washing drum reaches the water supply process;

2) It is determined whether or not the water in the first washing drum can be reused, if yes, executing step 3), if no, executing step 7);

3) It is determined whether or not the first washing drum is executing the drainage process, if no, executing step 4), if yes, step 6);

4) It is determined that a time for reaching the next water supply water process of the second washing drum is T_{21} , a time for reaching the drainage process of the first washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 7);

5) The second washing drum waits for the first washing drum to drain, executing step 6);

6) The water in the first washing drum is drained into the second washing drum;

7) The second washing drum supplies clean water directly and the water in the first washing drum drains directly.

[0077] The control method can also include a determination of whether or not the second washing drum has enough time to wait the first washing drum draining. The control method is as follows:

1) The second washing drum reaches the water supply process;

2) It is determined whether or not the water in the first washing drum can be reused, if yes, executing step 3), if no, executing step 8); 5

3) It is determined whether or not the first washing drum is executing the drainage process, if no, executing step 4), if yes, executing step 7); 10

4) It is determined that a time for reaching the next water supply water process of the second washing drum is T_{21} , a time for reaching the drainage process of the first washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 8); 15

5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 8); 20

6) The second washing drum waits for the first washing drum to drain, executing step 7);

7) The water in the first washing drum is drained into the second washing drum; 25

8) The second washing drum supplies clean water directly and the water in the first washing drum drains directly. 30

[0078] If the water in the first washing drum is too dirty or the water supply process of the second washing drum is for the last rinse, the water in the first washing drum cannot be reused. The control method is as follows:

1) The second washing drum reaches the water supply process;

2) It is determined whether or not the second washing drum only has a water supply for the last rinse left, if no, executing step 3), if yes, executing step 9); 40

3) It is determined whether or not the first washing drum is executing the drainage process, if no, executing step 4), if yes, executing step 7); 45

4) It is determined that a time for reaching the next water supply water process of the second washing drum is T_{21} , a time for reaching the drainage process of the first washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 9); 50

5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 9); 55

6) The second washing drum waits for the first washing drum to drain, executing step 7);

7) The turbidity value or the foam concentration value of the water in the first washing drum is detected to determine whether or not the turbidity value or the foam concentration value is smaller than the set value, if yes, executing step 8), if no, executing step 9); it is determined whether or not the first washing drum drains for the last rinse, if no, executing step 8), if yes, executing step 9);

8) The water in the first washing drum is drained into the second washing drum;

9) The second washing drum supplies clean water directly and the water in the first washing drum is drained directly.

[0079] When the water in the first washing drum is drained into the second washing drum and if the water supply of the second washing drum is for washing, the detergent box need to be flushed and the water level need to be detected. The control method is as follows:

1) The second washing drum reaches the water supply process;

2) It is determined whether or not the second washing drum only has a water supply for the last rinse left, if no, executing step 3), if yes, executing step 12);

3) It is determined whether or not the first washing drum is executing the drainage process, if no, executing step 4), if yes, executing step 7);

4) It is determined that a time for reaching the next water supply water process of the second washing drum is T_{21} , a time for reaching the drainage process of the first washing drum is T_{22} , if $T_{22} < T_{21}$, executing step 5), if $T_{22} \geq T_{21}$, executing step 12);

5) An allowable waiting time T_{20} is set, if $T_{22} < T_{20}$, executing step 6), if $T_{22} \geq T_{20}$, executing step 12);

6) The second washing drum waits for the first washing drum to drain, executing step 7);

7) The turbidity value or the foam concentration value of the water in the first washing drum is detected to determine whether or not the turbidity value or the foam concentration value is smaller than the set value, if yes, executing step 8), if no, executing step 12);

8) It is determined whether or not the second washing drum is executing the water supply process for washing, if yes, executing step 9), if no, executing step 10);

9) The second washing drum first supplies water for flushing the detergent box, after the completion of water supply for flushing the detergent box of the

second washing drum, executing step 10);

10) The water in the first washing drum is drained into the second washing drum;

11) It is detected the height of the water level in the second washing drum. When the water level in the second washing drum reaches the set water level value, if there remains some water in the first washing drum, the remaining water is drained directly; if the water level in the second washing drum still not reaches the set water level value after all water in the first washing drum is entirely drained into the second washing drum, the water from outside is flooded into the second washing drum through the water inlet;

12) The second washing drum supplies water directly and the water in the first washing drum is drained directly.

[0080] While there has been shown several and alternate embodiments of the present disclosure, it is to be understood that various of variants and improvement can be made as would be known to one skilled in the art without departing from the underlying scope of the present disclosure as is discussed and set forth above and below including claims.

Claims

1. A drainage control method for multi-drum washing machine, which comprises at least two washing devices, a drainage pump communicating with outside, and a drainage valve respectively provided between each washing device and the drainage pump, comprising, each washing device of the multi-drum washing machine draining water sequentially, after a drainage of a first washing device is completed, first the drainage valve of the washing device being closed, then the drainage pump being turned off, and detecting whether or not another washing device requires drainage, if yes, first the drainage valve of the other washing device that requires drainage being opened, and then the drainage pump is turned on for the other washing device to drain water, and if no, a drainage of the multi-drum washing machine being completed.
2. The drainage control method for multi-drum washing machine according to claim 1, wherein after a completion of the drainage of the washing device, it is determined whether or not the drainage pump is in a working progress, if no, the drainage pump continues to execute another operating time sequence, then a determination is performed again; if yes, it is continued to determine a working time for the drainage pump being in the working process.
3. The drainage control method for multi-drum washing machine according to claim 2, wherein the operating time sequence of the drainage pump is a single cycle time sequence for the drainage pump to execute a whole working progress and a stopping progress, and a working progress time is set to be T_1 , and a stopping time is set to be and a total time of the operating time sequence of the drainage pump is $T_3 = T_1 + T_2$.
4. The drainage control method for multi-drum washing machine according to claim 2, wherein if the working time of the drainage pump is within a first 1/3 of a total time of the working progress, the drainage valve of the washing device is closed, and if no, after a completion of the operating time sequence executed by the drainage pump, the drainage pump continues to execute another operating time sequence, and then it is determined whether or not the drainage pump is in the working progress.
5. The drainage control method for multi-drum washing machine according to any of claims from 1 to 4, wherein after a drainage process of the washing device is started, it is determined whether or not another washing device performs the drainage progress, if yes, waiting until the completion of the drainage of another washing device, and then stating the drainage process, if no, directly starting the drainage process.
6. The drainage control method for multi-drum washing machine according to any of claims from 1 to 5, wherein after the completion of the drainage of the washing device, first the drainage valve of the washing device is closed, and then it is determined whether or not the drainage pump stops working, if no, the drainage pump executes the operating time sequence till an end, and then the determination is performed again; if yes, the drainage valve of the other washing device is opened, or the drainage of the multi-drum washing machine is completed.
7. The drainage control method for multi-drum washing machine according to any of claims from 1 to 6, wherein after the drainage pump of the washing device is opened, and then the drainage pump is turned on to drain water for the washing device over a set waiting time T_4 .
8. The drainage control method for multi-drum washing

machine according to claim 7, wherein the waiting time T_4 is set based on relevant parameters such as a drainage rate and a length of a pipeline between the drainage valve and the drainage pump of the multi-drum washing machine,
and preferably, the waiting time is $3s \leq T_4 \leq 6s$.

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9. The drainage control method for multi-drum washing machine according to claim 7, wherein during the drainage of the washing device, it is determined whether or not the drainage of the washing device is completed,
if yes, it is determined whether or not the drainage pump is in the working progress,
if no, the drainage pump continues executing the drainage.

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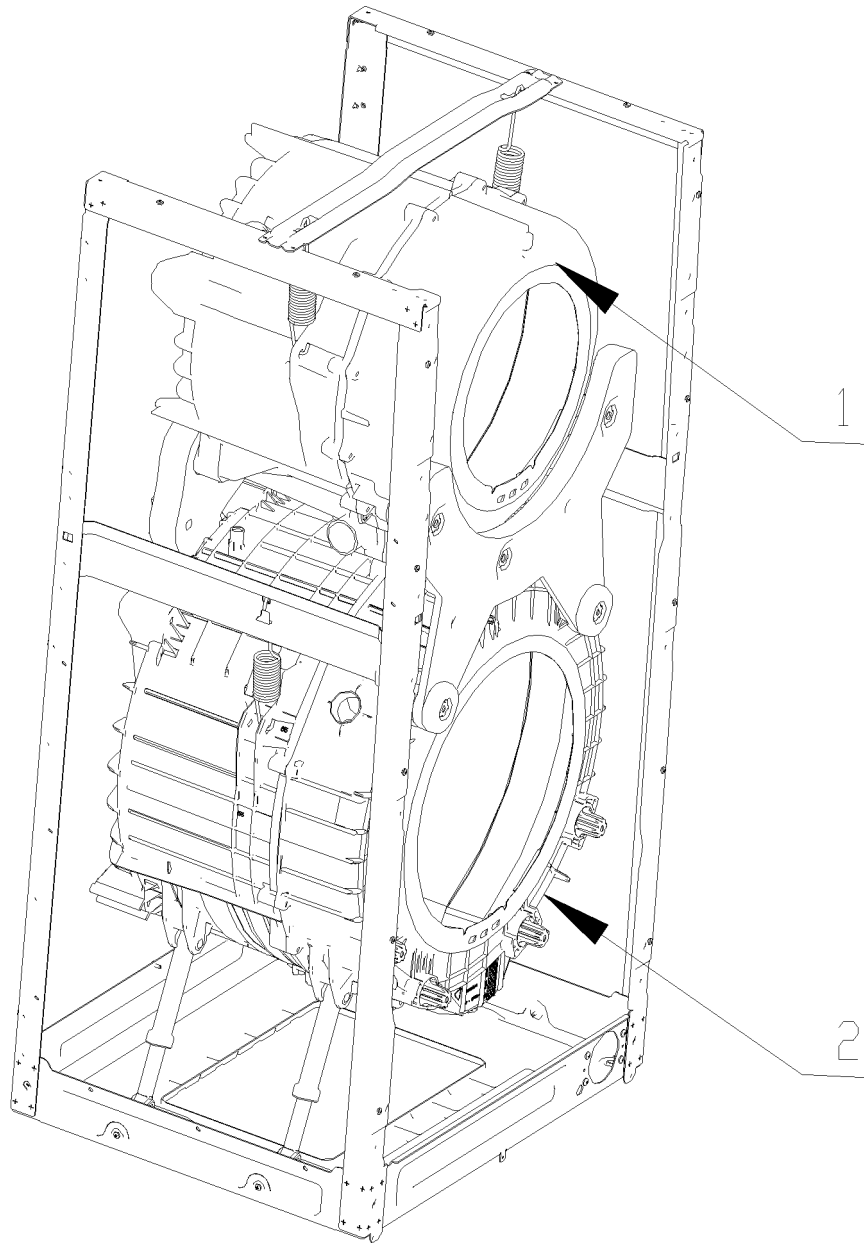


Fig.1

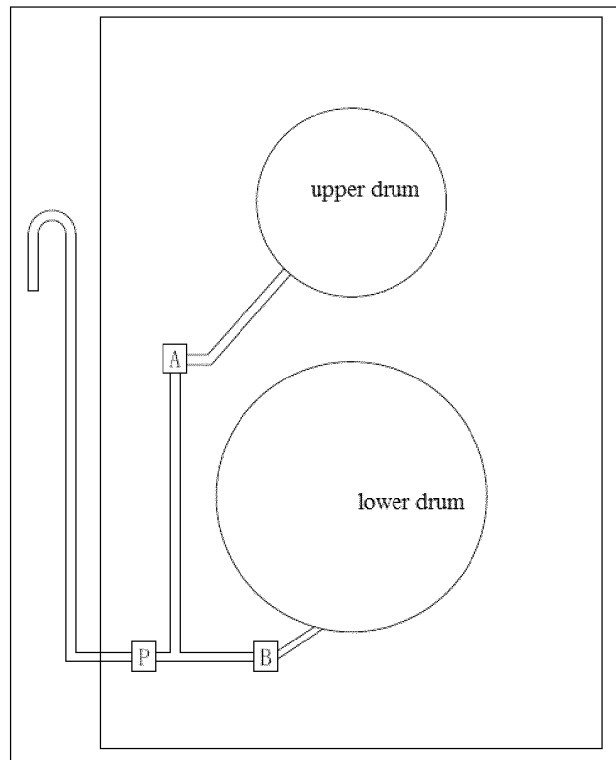


Fig.2

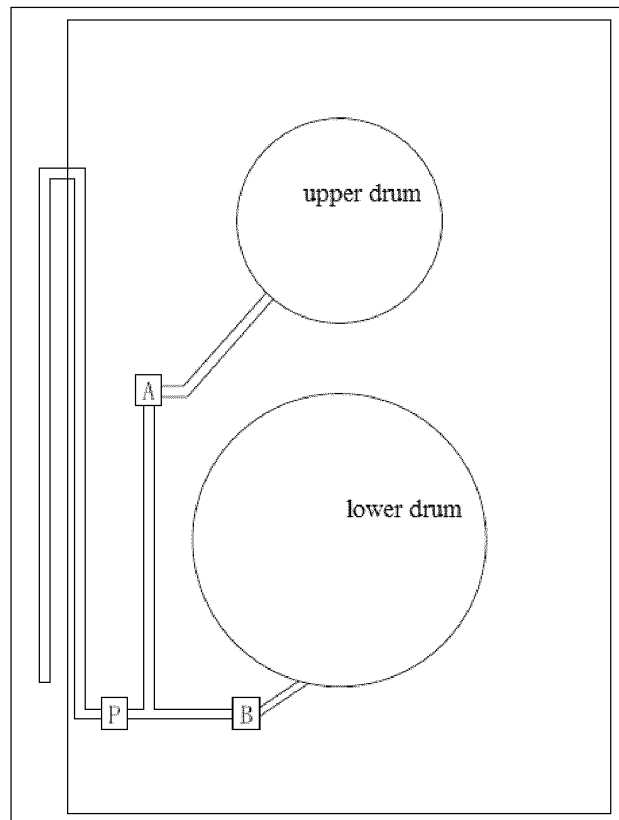


Fig.3

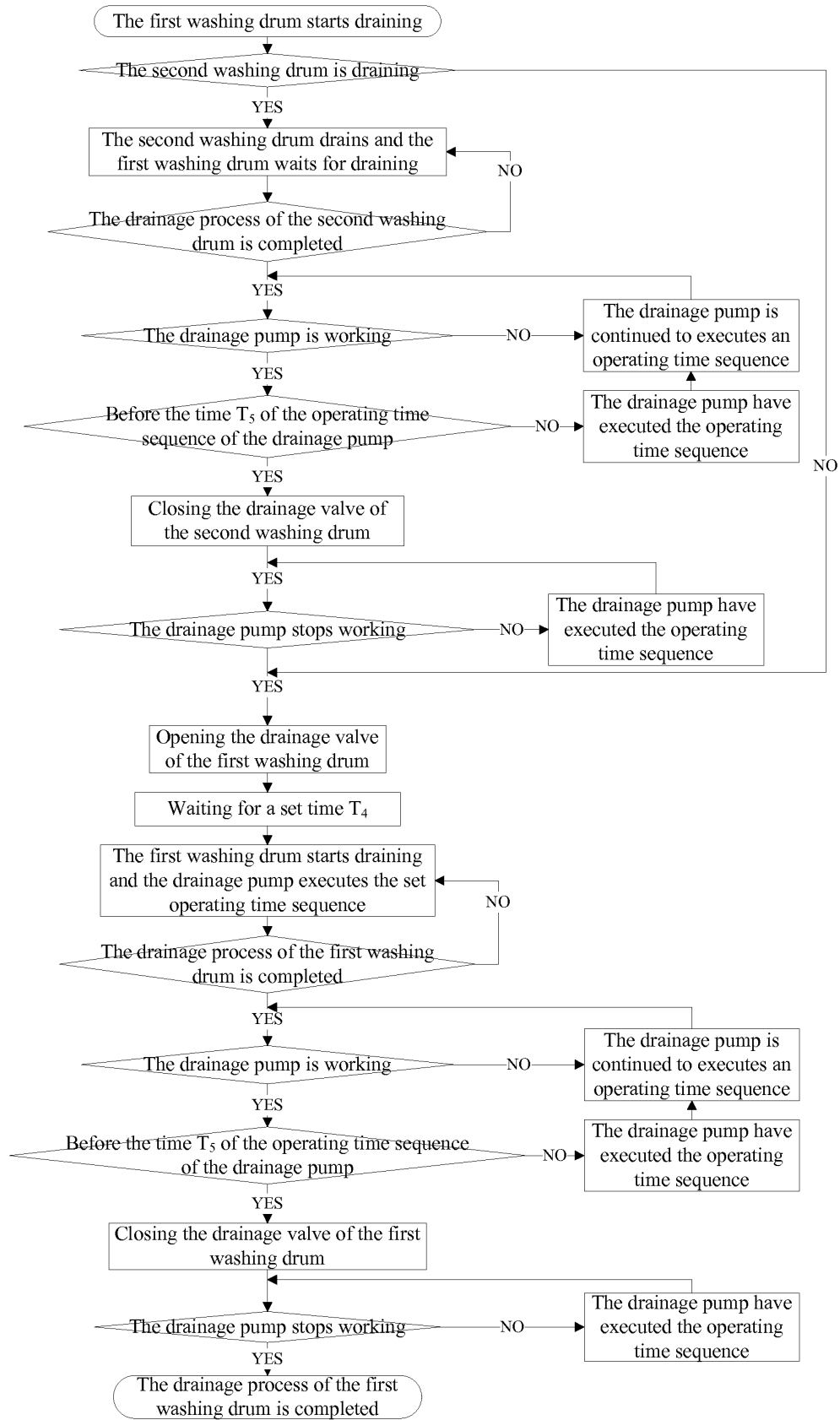


Fig.4

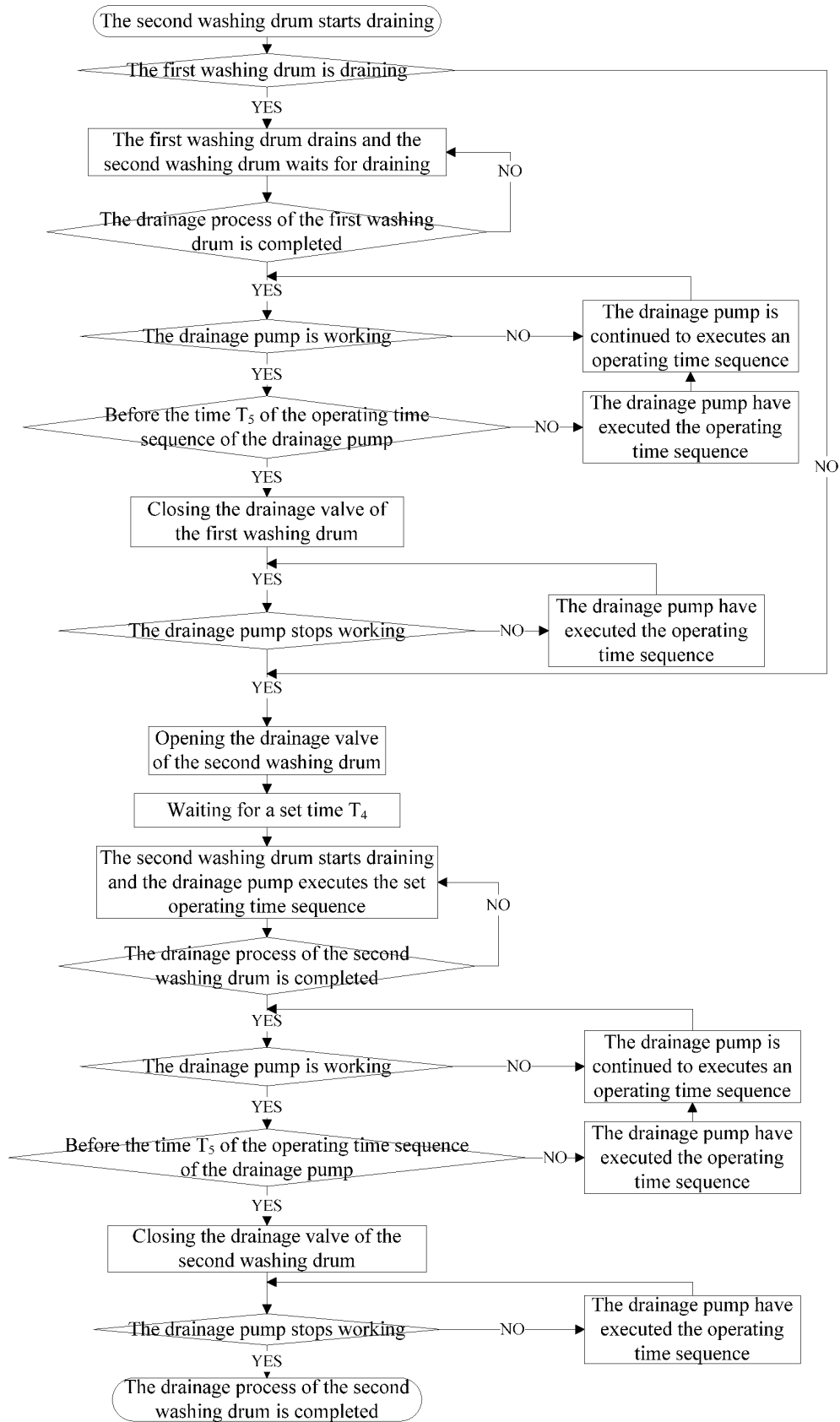


Fig.5

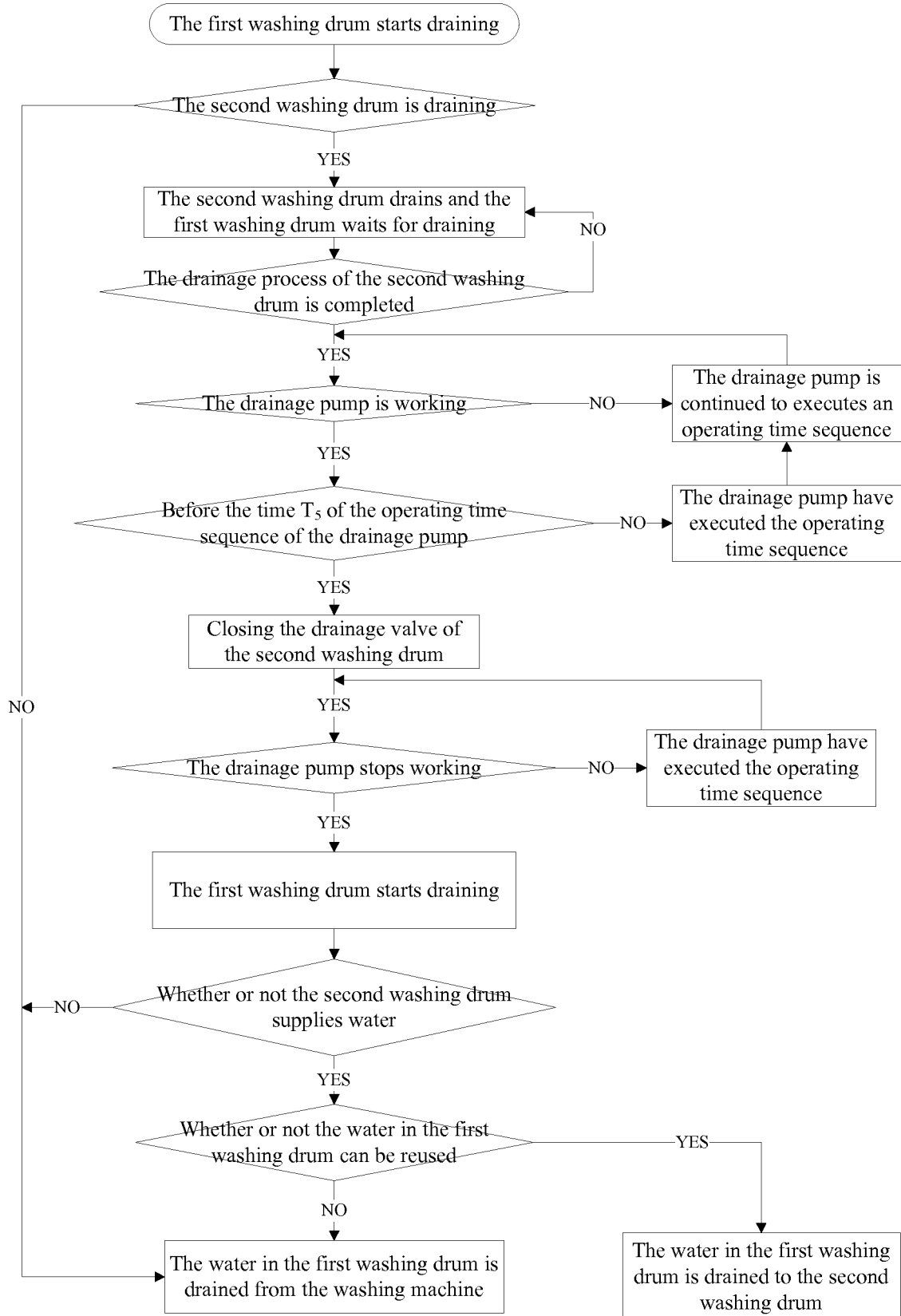


Fig.6

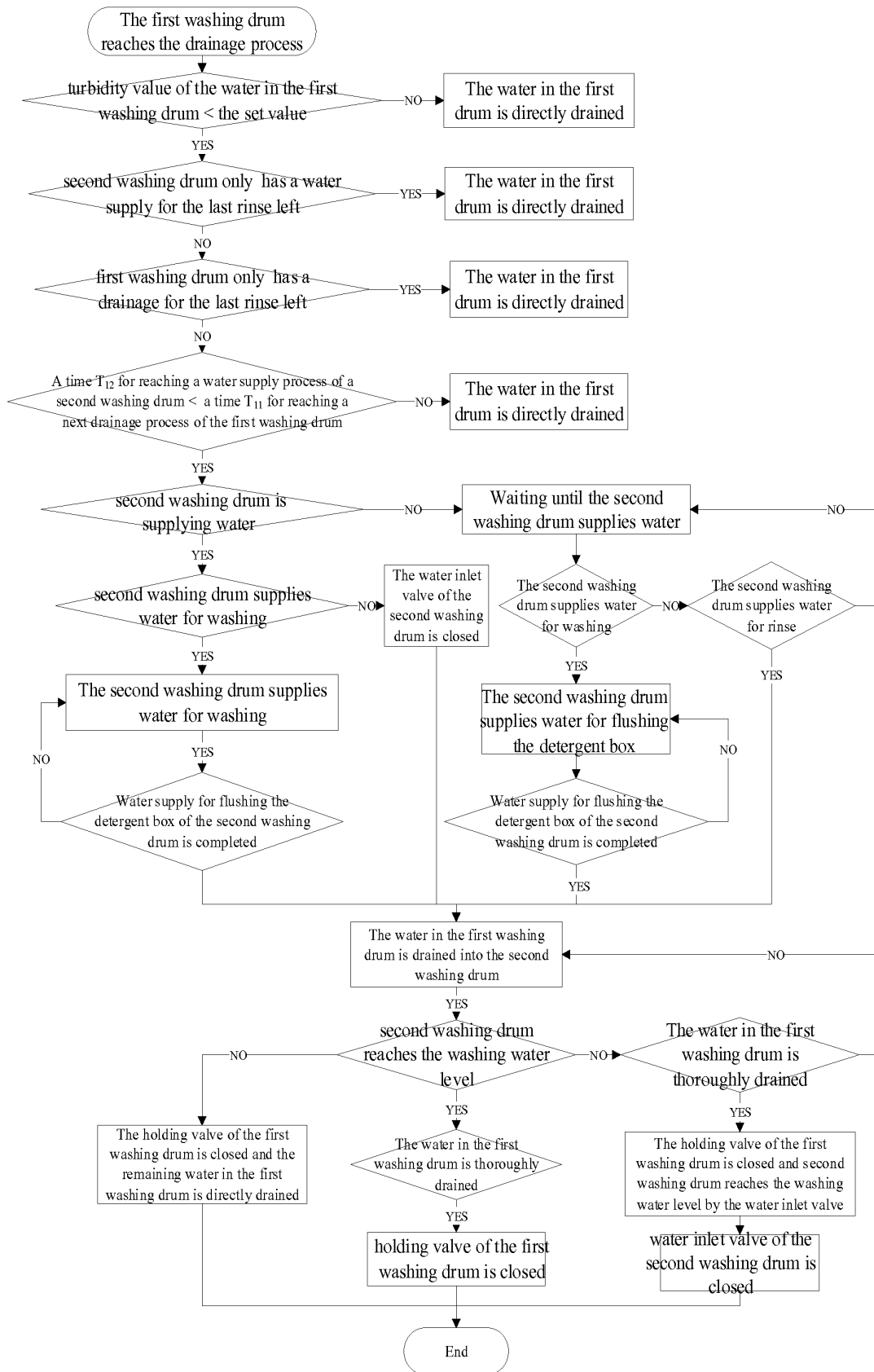


Fig.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2016/099027

A. CLASSIFICATION OF SUBJECT MATTER

D06F 33/02 (2006.01) i; D06F 39/08 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

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

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

CNABS; CNTXT; EPODOC; WPI: second+, ssistant, auxiliary+, small+, multipl+, multipl+, two, double, supplement, twin, tub+, bucket+, roller+, barrel+, drum+, cylinder+, drain+, discharg+, unwater+, dewater+, valve, motor, pump, electromotor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 101876137 A (SAMSUNG ELECTRONICS CO., LTD.) 03 November 2010 (03.11.2010) description, paragraphs [0049]-[0081], and figures 1-3	1-9
A	CN 103924417 A (HEFEI ROYALSTAR SANYO ELECTRIC APPLIANCE CO., LTD.) 16 July 2014 (16.07.2014) the whole document	1-9
A	CN 103924416 A (HEFEI ROYALSTAR SANYO ELECTRIC APPLIANCE CO., LTD.) 16 July 2014 (16.07.2014) the whole document	1-9
A	KR 20130127046 A (SOHN SEO GON) 22 November 2013 (22.11.2013) the whole document	1-9
A	CN 101886320 A (SAMSUNG ELECTRONICS CO., LTD.) 17 November 2010 (17.11.2010) the whole document	1-9

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"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	"&" document member of the same patent family

Date of the actual completion of the international search 12 December 2016	Date of mailing of the international search report 21 December 2016
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHANG, Zhen Telephone No. (86-10) 62084588

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/CN2016/099027

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 101876137 A	03 November 2010	US 2010275386 A1	04 November 2010
		KR 20100119451 A	09 November 2010
CN 103924417 A	16 July 2014	CN 103924417 B	20 January 2016
CN 103924416 A	16 July 2014	CN 103924416 B	20 January 2016
KR 20130127046 A	22 November 2013	None	
CN 101886320 A	17 November 2010	KR 20100122275 A	22 November 2010
		CN 101886320 B	17 December 2014
		US 2010287712 A1	18 November 2010
		KR 101599854 B1	08 March 2016

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 201010117002 A [0004]