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WASHING MACHINE

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Field of the Invention

5 The present invention relates to a washing machine; and, more particularly, to a washing machine capable of drying washer tubs included therein by blowing warm air into the tubs.

10 Background of the Invention

Referring to Fig. 4, there is shown one of conventional washing machines having tubs.

As shown, the washing machine includes top-opened
15 outer washer tub 1 which is suspended within housing 3 via a plurality of suspensions 4 such that vibrations generated during a dewatering process can be absorbed. Installed within outer washer tub 1 is inner washer tub 2 for accepting therein laundry articles. Inner washer tub 2 is
20 rotated about dewatering shaft 5. On an inner bottom surface of inner washer tub 2, there is installed pulsator 6, which rotates about washing shaft 7 to generate a vortex flow for stirring the laundry articles. Further, inner washer tub 2 is provided with a plurality of washing fluid

communication holes (not shown) for use in dewatering the laundries on a side wall and a bottom surface thereof.

Mounted on top of outer washer tub 1 is substantially doughnut-shaped outer tub cover 8 with a through-hole and
5 inner lid 9 mounted on outer tub cover 8 in such a manner as to enable an opening and shutting of the opening of outer tub cover 8. Disposed at the bottom of outer washer tub 1 is electric motor 10, which is connected to pulsator 6 or inner washer tub 2 via clutch assembly 11. Clutch
10 assembly 11 serves to selectively transfer the driving force generated by electric motor 10 to either one of washing shaft 7 and dewatering shaft 5 depending on an operating mode of the washing machine. That is, the driving force from electric motor 10 is transferred to
15 washing shaft 7 to rotate pulsator 6 coupled thereto in a washing mode while it is transferred to dewatering shaft 5 to rotate inner washer tub 2 in a dewatering mode.

Housing cover 12 having an opening is connected to the top of housing 3. Installed at housing cover 12 are
20 outer lid 13 for opening and closing the opening of housing cover 12 and water feed valve 14 for feeding water into inner washer tub 2. Washing fluid is supplied into outer washer tub 1 via water supply hose 15. At the bottom portion of outer washer tub 1, there is prepared drain

valve 16 for draining the washing fluid from outer washer tub 1.

The washing machine having the above-described configuration is operated as follows. First, outer lid 13
5 and inner lid 9 are opened and the laundry articles are placed into inner washer tub 2. If a user starts a washing operation, water feed valve 14 is opened and the washing fluid is fed into inner washer tub 2 through water supply hose 15. If the washing fluid reaches a predetermined
10 water level in inner washer tub 2, water feed valve 14 is closed and electric motor 10 is operated. The driving force generated by electric motor 10 is applied to pulsator 6 via washing shaft 7 by clutch assembly 11, thereby rotating pulsator 6. As pulsator 6 rotates, the laundry
15 articles are made to undergo a vigorous frictional motion and a water flow, experiencing contacts between the laundry articles themselves and between pulsator 6 and inner washer tub 2, and are cleaned thereby.

After the completion of the washing operation as
20 described above, a dewatering operation is initiated. Drain valve 16 is opened, and the washing fluid is drained from inner washer tub 2. Then, clutch assembly 11 is shifted to dewatering shaft 5, which in turn transfers the driving force generated by electric motor 10 to inner

washer tub 2. As a result, the laundry articles are dewatered by the centrifugal force generated by the rotation of inner washer tub 2.

It is impossible, however, to dry the inner washer tub and the outer washer tub according to the structure of the conventional washing machine. Thus, the water used in washing the laundries still remains in the inner washer tub and the outer washer tub even after the washing process is finished, inducing growth of mold and bacteria.

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Summary of the Invention

It is, therefore, an object of the present invention to provide a washing machine capable of drying an inner washer tub and an outer washer tub thereof, thereby preventing growth of mold and bacteria therein.

In accordance with one aspect of the present invention, there is provided a washing machine including: an outer washer tub; an inner washer tub, rotatably installed within the outer washer tub, for accommodating therein laundry articles; a warm air supplying unit for supplying warm air into the inner washer tub; and a controller for controlling a tub drying process for drying the outer washer tub and the inner washer tub, wherein,

during the tub drying process, the controller drives the warm air supplying unit to supply the warm air into the inner washer tub and rotates the inner washer tub to send the warm air to an inter-space between the inner washer tub
5 and the outer washer tub.

In accordance with another aspect of the present invention, there is provided a method for drying an inner washer tub and an outer washer tub of a washing machine, the washing machine having a washing process and a
10 dewatering process of laundry articles, and the inner washer tub accommodating therein the laundry articles during the washing and the dewatering process and rotatably installed within the outer washer tub, the method including the steps of: generating warm air; supplying the warm air
15 into the inner washer tub; and rotating the inner washer tub to send the warm air to an inter-space between the inner washer tub and the outer washer tub.

Brief Description of the Drawings

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The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a washing machine in accordance with a first preferred embodiment of the present invention;

Fig. 2 provides a longitudinal sectional view of a washing machine in accordance with a second preferred embodiment of the present invention;

Fig. 3 illustrates a partially cutaway longitudinal sectional view of a washing machine in accordance with a third preferred embodiment of the present invention; and

Fig. 4 sets forth a longitudinal sectional view of a conventional washing machine.

Detailed Description of Preferred Embodiments

Preferred embodiments of the present invention will now be described in detail with reference to Figs. 1 to 3. Since some parts of a washing machine of the present invention to be described hereinafter are identical or similar to those of the conventional washing machine shown in Fig. 4, the same reference numerals are used to denote and identify corresponding or identical elements, and the detailed description thereof will be omitted.

Referring to Fig. 1, there is provided a washing machine in accordance with a first preferred embodiment of the present invention.

As shown, inner washer tub 17 having a plurality of washing fluid communication holes 18 at its side wall and bottom surface is rotatably installed within top-opened outer washer tub 1. Outer tub cover 19 having an approximate doughnut-shape with a through-hole at its approximately central portion is mounted on top of outer washer tub 1, and inner lid 20 is disposed in such a manner as to open and shut the through-hole of outer tub cover 19. Housing cover 21 is disposed on top of housing 3. Installed at a rear interior portion of housing 3 (i.e., at a right top portion in Fig. 1) is forced warm air unit 26 for drying inner washer tub 17 and outer washer tub 1. Forced warm air unit 26 includes fan 22 and warm air passage 25 incorporating therein heater 24. One side of fan 22 communicates with the outside of housing 3 via air suction filter 23 and the other, with warm air passage 25. Warm air passage 25 is coupled to serpentine hose 27 which is connected to warm air inlet 28 formed at outer tub cover 19, through which the warm air is fed into inner washer tub 17.

At outer tub cover 19, there is also installed warm air outlet 29 for exhausting the warm air which has been supplied into inner washer tub 17 through warm air inlet 28. Prepared adjacent to warm air outlet 29 is support member 30 on which exhaust filter 31 is detachably installed in such a manner as to cover warm air outlet 29.

Washing fluid communication holes 18 define an opening part or a communication part for introducing the warm air, which is fed into inner washer tub 17 by forced warm air unit 26, to inter-space 32 between inner washer tub 17 and outer washer tub 1. Further, circulator 33 for facilitating the circulation of the warm air is prepared at a bottom portion of inter-space 32 between the bottom surfaces of inner washer tub 17 and outer washer tub 1. Circulator 33 is connected to inner washer tub 17 to rotate therewith.

The washing machine further includes controller 34, which controls operations of electric motor 10, water feed valve 14, drain valve 16, and etc., to thereby successively control a series of processes of washing, rinsing and dewatering operation. Further, controller 34 controls a laundry drying operation during which the laundries contained in inner washer tub 17 are dried by the warm air blown thereto by forced warm air unit 26. In addition,

while supplying the warm air into inner washer tub 17 by way of driving forced warm air unit 26, controller 34 concurrently makes inner washer tub 17 rotate to thereby send the warm air therein to inter-space 32, which process
5 is referred to as a tub drying operation.

The washing machine having the above-described configuration is operated as follows. If a user puts the laundry articles into inner washer tub 17 and starts the washing operation, water feed valve 14 is opened and
10 washing fluid is fed into inner washer tub 17 through water supply hose 15 to a predetermined water level. Then, water feed valve 14 is closed and electric motor 10 is activated. The driving force generated by electric motor 10 is applied to pulsator 6 via clutch assembly 11, thereby rotating
15 pulsator 6. The rotation of pulsator 6 causes contact between the laundry articles themselves and between inner washer tub 17 and pulsator 6, which in turn generates a frictional force and a water flow that enable the cleaning of the laundries.

20 During the dewatering process after the completion of the washing operation, drain valve 16 is opened to drain the washing fluid from inner washer tub 17. Then, clutch assembly 11 is shifted to dewatering shaft 5 connected to inner washer tub 17 to rotate inner washer tub 17. The

rotation of inner washer tub 17 then makes the laundry articles contained therein dewatered by the centrifugal force involved.

During the subsequent laundry drying operation, drain
5 valve 16 is closed. Then, clutch assembly 11 is shifted to washing shaft 7 coupled to pulsator 6, which in turn allows electric motor 10 to rotate pulsator 6 in clockwise and counterclockwise direction, thereby agitating the laundry articles. Further, heater 24 and fan 22 are operated by
10 electric current applied thereto, so that the ambient air absorbed by air suction filter 23 is heated and thus obtained warm air is then sent to inner washer tub 17 through warm air inlet 28. The warm air warms up the laundries being agitated, and makes moisture contained in
15 the laundries evaporate. Afterwards, the warm air rises towards the upper portion of inner washer tub 17 to be exhausted through warm air outlet 29.

Next, upon start of the tub drying process, drain valve 16 is opened again and electric motor 10 is operated
20 to rotate pulsator 6. Further, fan 22 and heater 24 are operated by electric current applied thereto to thereby heat the ambient air absorbed by air suction filter 23 and send the thus obtained warm air into inner washer tub 17 through warm air inlet 28 in a direction marked with an

arrow "A". At this time, inner washer tub 17 and pulsator 6 can be rotated so as to improve the efficiency of the tub drying operation.

The warm air introduced into inner washer tub 17
5 diffuses into inter-space 32 through washing fluid communication holes 18 prepared at inner washer tub 17, as illustrated by an arrow B. Thus, as time elapses, inter-space 32 gets filled with the warm air.

As the warm air fills and diffuses throughout inter-
10 space 32, inner washer tub 17 and outer washer tub 1 can be dried effectively.

Herein, since washing fluid communication holes 18 are formed at the side wall and the bottom surface of inner washer tub 17, the warm air fed into inner washer tub 17 is
15 sent to inter-space 32 through these washing fluid communication holes 18 and, then, rises therethrough. Accordingly, inter-space 32 gets filled with the warm air, so that inner washer tub 17 and outer washer tub 1 can be efficiently dried.

20 Further, it is preferable to rotate inner washer tub 17 during the tub drying operation since the rotation of inner washer tub 17 speeds up the warm air flow from inner washer tub 17 to outer washer tub 1. Furthermore, by rotating pulsator 6, fast airflow can be facilitated within

inner washer tub 17, resulting in an improvement in efficiency of the tub drying process.

Moreover, at a time when the warm air within inner washer tub 17 is sent to fill inter-space 32, the warm air
5 around the bottom portion of inter-space 32 gets circulated by circulator 33, which is connected to the bottom of inner washer tub 17 to rotate therewith. Thus, inner washer tub 17 and outer washer tub 1 can be further effectively dried.

In processing the laundry articles in accordance with
10 the first preferred embodiment, the laundry drying operation is performed after a series of processes of a washing operation, a rinsing operation, and a dewatering operation are completed. Since, however, the laundry drying operation need not be always performed, and thus the
15 laundry drying operation can be omitted. Also, the washing machine of the present invention can be designed to only have a washing, a rinsing, a dewatering and a tub drying mode as its operating modes without having the laundry drying mode.

20 Referring to Fig. 2, there is illustrated a washing machine in accordance with a second preferred embodiment of the present invention. As shown, inner washer tub 17a having a plurality of washing fluid communication holes 18 at its side wall is rotatably installed within outer washer

tub 1. Inner washer tub 17a is provided with air guide portions or members 35 serving as air guide means. The air guide portions 35 are outwardly protruded from the periphery of inner washer tub 17a. Each of air guide
5 portions 35 is prepared adjacent to its corresponding one of washing fluid communication hole 18 in order to guide the warm air from the corresponding one of washing fluid communication holes 18 toward the bottom portion of inter-space 32. Since the other parts of the washing machine in
10 the second embodiment are identical to corresponding ones in the first embodiment, the same reference numerals are used thereto and the description thereof will be omitted.

Operation of the washing machine in accordance with the second embodiment will now be described. Since the
15 series of processes from the washing operation to the laundry drying operation are identical to those described in the first embodiment, the explanation thereof will be omitted herein.

When initiating the tub drying process, the warm air
20 supplied into inner washer tub 17a is sent to inter-space 32 between inner washer tub 17a and outer washer tub 1 and fills that area. Thereafter, when inner washer tub 17a rotates, the warm air in inner washer tub 17a is flown out of inner washer tub 17a through washing fluid communication

holes 18 and is guided by air guide portions 35 toward the bottom portions of inter-space 32 in a direction marked as "C" by arrows in Fig. 2. The warm air gathered in the bottom portion of inter-space 32 is effectively spread out
5 throughout inter-space 32, thereby efficiently drying inner washer tub 17a and outer washer tub 1.

Referring to Fig. 3, there is shown a washing machine in accordance with a third preferred embodiment of the present invention. This embodiment is similar to the
10 second one except for air introduction portions 36 formed at outer washer tub 1b which are employed as air guide means instead of air guide portions 35 formed at inner washer tub 17a. Air introduction portions 36 are inwardly protruded from the periphery of outer washer tub 1b in such
15 a manner as to introduce the warm air from washing fluid communication holes 18 toward the bottom portion of inter-space 32.

Like air guide portions 35, air introduction portions 36 help the warm air to be gathered in the bottom portion
20 of inter-space 32, thereby efficiently drying inner washer tub 17a and outer washer tub 1b.

While the invention has been shown and described with respect to the preferred embodiments, it will be understood by those skilled in the art that various changes and

modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

CLAIMS

1. A washing machine comprising:
 - an outer washer tub;
 - 5 an inner washer tub, rotatably installed within the outer washer tub, for accommodating therein laundry articles;
 - a warm air supplying unit for supplying warm air into the inner washer tub; and
 - 10 controller for controlling a tub drying process for drying the outer washer tub and the inner washer tub,
 - wherein, during the tub drying process, the controller drives the warm air supplying unit to supply the warm air into the inner washer tub and rotates the inner
 - 15 washer tub to send the warm air to an inter-space between the inner washer tub and the outer washer tub.
2. The washing machine of claim 1, wherein the inner washer tub is provided with at least one hole permitting
- 20 the warm air in the inner washer tub to flow into the inter-space.
3. The washing machine of claim 1, further comprising a circulator, installed between a bottom portion of the inner

washer tub and that of the outer washer tub, for circulating the warm air in the inter-space.

4. The washing machine of claim 1, further comprising a pulsator rotatably mounted on an inner bottom surface of the inner washer tub, wherein the pulsator is driven during the tub drying process.

5. The washing machine of claim 4, wherein the controller rotates the pulsator and the inner washer tub simultaneously during the tub drying process.

6. The washing machine of claim 1, further comprising a guide member for guiding a flow of the warm air in the inter-space.

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7. The washing machine of claim 6, wherein the guide member is formed at an outer surface of the inner washer tub, the guide member guiding the flow of the warm air toward a bottom portion of the inter-space.

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8. The washing machine of claim 6, wherein the guide member is formed at an inner surface of the outer washer tub, the guide member guiding the flow of the warm air toward a bottom portion of the inter-space.

9. A method for drying an inner washer tub and an outer washer tub of a washing machine, the washing machine having a washing process and a dewatering process of laundry articles, and the inner washer tub accommodating therein the laundry articles during the washing and the dewatering process and rotatably installed within the outer washer tub, the method comprising the steps of:

generating warm air;
10 supplying the warm air into the inner washer tub; and
rotating the inner washer tub to send the warm air to an inter-space between the inner washer tub and the outer washer tub.

15 10. The method of claim 9, further comprising the step of rotating a pulsator rotatably mounted on an inner bottom surface of the inner washer tub.

11. The method of claim 10, wherein the inner washer tub
20 and the pulsator rotate at the same time.