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DRUM TYPE WASHING AND DRYING MACHINE

Field of the Invention

5 The present invention relates to a drum type washing and drying machine for executing washing, rinsing, water-extracting and drying processes after accommodating laundry articles in a rotary drum rotatably mounted in a water tub.

10 Background of the Invention

 A drum type washing machine performs washing, rinsing and water-extracting processes in order by rotating a rotary drum rotatably mounted in a water tub, to thereby wash
15 laundry articles accommodated in the rotary drum. By adding a drying function to the drum type washing machine, a drum type washing and drying machine capable of drying laundry articles after completion of the water-extracting process can be obtained.

20 The drying function involves a series of steps as follows: exhausting damp air from the water tub; dehumidifying thus exhausted damp air by a dehumidifying element; heating thus dehumidified air by a heating element; and blowing thus heated air into the water tub. However,
25 the drum type washing and drying machine has a drawback in that lint produced from laundry articles during the drying



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process tend to stick to an air outlet duct or the dehumidifying element disposed near the rotary drum. In order to solve the problem, there has been proposed a drum type washing and drying machine capable of washing away the lint by using water during a rinsing process, to thereby prevent the lint from obstructing air circulation (see Japanese Patent Laid-Open Application No. 1999-333185, pp. 3 to 5, Fig. 1).

Specifically, the prior art drum type washing and drying machine includes a rotary drum having a substantially horizontal rotational axis in a water tub. During the drying process, air circulates through the washing machine as follows: air in the water tub is exhausted through an air outlet exposed toward the bottom portion of the water tub, and is recirculated into the water tub through a front opening of the rotary drum after going through a piping with a fan and a heater. In such configuration, the lint accumulated in, e.g., the air outlet duct connected to the air outlet can be removed by way of increasing the amount of water supplied during the rinsing process thereby submerging the air outlet in water. If the air outlet is submerged in water, the water would contact the air outlet duct as well, so that the lint sticking to the air outlet or the air outlet duct is washed away by water currents generated by rotation of the rotary drum during the rinsing process. Further, if the fan is operated at this time, the water

level changes due to a pressure exerted by blown air, resulting in more vigorous water dispersion to the extent that the dispersed water reaches the dehumidifying element connected to the air outlet hose. Accordingly, the lint
5 sticking to the dehumidifying element can be washed away by water.

In order to improve the drying function of the drum type washing and drying machine, it is required to efficiently exhaust damp air from laundry articles
10 accommodated in the rotary drum and to blow warm air all over the laundry articles. For the purpose, it is preferred to configure the drum type washing and drying machine such that damp air exhaustion from the water tub is carried out through an upper portion of the water tub while warm air
15 supplying into the water tub is performed through a lower portion of the water tub. In such configuration, the air outlet is exposed toward the upper portion of the water tub and the dehumidifying element is disposed in a piping connected thereto. Therefore, it becomes impossible to wash
20 away lint sticking to the dehumidifying element by controlling water supply or by controlling air blowing during a rinsing process.

Summary of the Invention

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It is, therefore, an object of the present invention

to provide a drum type washing and drying machine capable of efficiently eliminating lint and the like adhered to a dehumidification unit, to thereby provide a further improved laundry drying function.

5 In accordance with the present invention, there is provided a drum type washing and drying machine including: a water tub; a cylindrical rotary drum for accommodating laundry articles therein and having a number of holes formed at a peripheral surface thereof, the rotary drum being
10 installed in the water tub such that a rotational axis thereof is horizontal or declined toward a rear portion of the washing machine; a motor for rotating the rotary drum; and a dry air circulation path for blowing air exhausted from the water tub into the water tub again via an air flow
15 passage incorporating therein dehumidification unit, a fan and a heater, wherein a dehumidification unit accommodating chamber for accommodating therein the dehumidification unit is disposed near an upper peripheral surface of the water tub, and an air outlet communicated with the
20 dehumidification unit accommodating chamber is installed at a sidewall of the water tub in a direction substantially tangent to a rotational direction of the rotary drum.

 In the configuration, the air outlet communicating with the dehumidification unit accommodating chamber,
25 installed near the upper peripheral surface of the water tub, is opened in the direction substantially tangent to the

rotational direction of the rotary drum. Accordingly, if the rotary drum containing water therein rotates, the water splashed up by the rotation of the rotary drum is mainly scattered toward the direction tangent to the rotational direction of the rotary drum to be introduced into the dehumidification unit accommodating chamber with considerable force. Since lint and the like produced from the laundry articles during a drying process is carried into the dehumidification unit accommodating chamber through the air outlet when air is exhausted from the water tub, there is a high likelihood that the lint sticks to the dehumidification unit or the wall or the surface of the dehumidification unit accommodating chamber. If the lint is accumulated therein, a dehumidifying function or airflow may be deteriorated. However, by providing a structure for flowing water into the dehumidification unit accommodating chamber from the air outlet, lint may be washed away by the water introduced into the dehumidification unit accommodating chamber with the great force.

Further, the dehumidification unit accommodating chamber and the water tub may be fabricated as one body.

Brief Description of the Drawings

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 cross sectional view describing a configuration of main components of a drum type washing and drying machine in accordance with a preferred embodiment of the present invention;

Fig. 2 is a cross sectional view illustrating a drying function provided by the drum type washing and drying machine in accordance with the preferred embodiment of the present invention; and

Fig. 3 presents a transverse sectional view of a water tub and a dehumidification pipe in Fig. 2.

Detailed Description of the Preferred Embodiments

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Referring to Fig. 1, there is described a configuration of main components of drum type washing and drying machine 1 in accordance with a preferred embodiment of the present invention. Water tub 3 is slantingly disposed in housing 6 via a suspension structure (not shown). Rotatably installed in water tub 3 is cylindrical rotary drum 2 having a base. Rotary drum 2 is driven by drum driving motor 7, and a rotational speed and a rotational direction thereof can be varied. Further, rotary drum 2 is disposed such that a rotational axis thereof is declined toward the rear portion of housing 6, as shown in Fig. 1,

and door 9 is installed through inclined surface 6a formed at the front portion of housing 6. Therefore, by opening door 9, loading and unloading of laundry articles can be performed without a user having to bend down, and the
5 installation of drum type washing and drying machine 1 in a small space can also be facilitated, because having clearance space in front of washing and drying machine 1 is not needed.

Further included in housing 6 are water supply unit 12
10 for feeding water into water tub 3, water drain unit 13 for draining water from water tub 3, and so forth. Moreover, as shown in Fig. 2, a dry air circulation channel for a drying process for laundry articles accommodated in rotary drum 2 is installed. Specifically, the air exhausted from water
15 tub 3 through air outlet 21 is dehumidified by running through dehumidification pipe (dehumidification unit accommodating chamber) 16, lint trap filter 17, and dehumidified air flow piping 18, subsequently and is also fed to water tub 3.

20 Drum type washing and drying machine 1 configured as described above executes washing, rinsing, water-extracting and drying (if required) processes under the control of a controller (not shown).

Specifically after opening door 9, laundry articles
25 are loaded into rotary drum 2 and a specific amount of detergent is added into a detergent dispenser installed in

water supply unit 12. Then, if the operation of drum type washing and drying machine 1 is initiated by using a console provided on the surface of housing 6, a specific amount of water corresponding to the amount of laundry articles is fed
5 into water tub 3 from water supply unit 12, and rotary drum 2 is driven to rotate by drum driving motor 7, to thereby start a washing process. Upon completion of the washing process, soiled wash water is drained from the water drain unit 13, and the laundry articles are water-extracted by
10 rotating rotary drum 2 at a high rotational speed. Thereafter, fresh water is fed into water tub 3 from water supply unit 12 and a rinsing process is started. After the rinsing process, a water-extracting process for extracting water from the laundry articles is performed by rotating
15 rotary drum 2 at a high rotational speed. When the current operation course requires a drying process after the water-extraction process, the drying process is conducted so that the air in water tub 3 is exhausted so that it is dehumidified and heated, and then the dry warm air is
20 recirculated into water tub 3.

As shown in Fig. 2, by the rotation of fan 15, the air in rotary drum 2 is exhausted into water tub 3 through drum perforations 8 formed on the peripheral surface thereof and then is introduced into dehumidification pipe 16 via air
25 outlet 21. Disposed in dehumidification pipe 16 is dehumidification unit 38 including heat exchanger 51 and

water supply nozzle 52. When water supply valve 53 is opened, water is sprayed onto heat exchanger 51 via water supply nozzle 52, whereby the damp air traveling through dehumidification pipe 16 is cooled and dehumidified. Then, thus dehumidified air is directed to a rear portion of water tub 3 through lint trap filter 17 and air flow piping 18, respectively, and is heated by heater 20 while passing through air heating piping 19 installed on the rear portion of water tub 3. Thus heated air is blown into water tub 3 from air inlet 22 and is introduced into rotary drum 2 through air circulation hole 39 formed at the rear side of rotary drum 2 and drum perforations 8. As a result, the residual moisture in the laundry articles is evaporated by the dehumidified warm air, and drying of all the laundry articles is facilitated because of agitation of the laundry articles generated by the rotation of rotary drum 2. Such air circulation is repeated for a predetermined period of time, whereby the laundry articles are dried.

As shown in Fig. 3, dehumidification pipe 16 and air flow piping 18 are simultaneously made by, e.g., a resin molding to be formed as one body with water tub 3 made by a resin molding. Dehumidification pipe 16 is installed near the peripheral surface of water tub 3, and air outlet 21 opened toward dehumidification pipe 16 is formed by opening a part of the sidewall of cylindrical water tub 3. Air outlet 21 is opened in a direction substantially tangent to

the rotational direction of rotary drum 2.

As the drying process proceeds, it is highly likely that lint and the like, produced from the laundry articles, is carried into dehumidification pipe 16 via air outlet 21 (as marked by an arrow A). Though lint trap filter 17 installed at a gate of air flow piping 18 serves to prevent lint in the air from entering air flow piping 18 and air heating piping 19, it frequently happens that lint would stick to heat exchanger 51 or the inner wall of dehumidification pipe 16 before it reaches lint trap filter 17. Since the dehumidification function or airflow is deteriorated with increased lint build up sticking to dehumidification pipe 16, the lint sticking therein should be eliminated.

In the preferred embodiment of the present invention, the lint can be removed from dehumidification pipe 16 by way of rotating rotary drum 2 at a predetermined rotational speed in the rinsing process to thereby cause to flow the water splashed up in the rotational direction (arrow B) of rotary drum 2 into dehumidification pipe 16 via air outlet 21 with considerable force (as shown by an arrow C), thereby allowing the lint sticking to heat exchanger 51 or the wall of piping 16 to be carried away by the water. The predetermined rotational speed of rotary drum 2 is determined within a range allowing the water to be splashed upward by a centrifugal force generated by the rotation of

rotary drum 2 and to be rotated along the inner wall of water tub 3 (for example, 150 rpm when the diameter of rotary drum is about 500 ± 50 mm).

Since air outlet 21 is opened in the direction substantially tangent to the rotational direction of rotary drum 2 as described, the water splashed up from the lower portion of water drum during the rinsing process is mainly dispersed in a direction tangent to the rotational direction of rotary drum to be forcefully introduced into dehumidification pipe 16 via air outlet 21. As such movement of water is repeated during the rinsing operation, the lint in dehumidification pipe 16 is washed away. Since dehumidification pipe 16 incorporates a drain passageway for water flow, produced from the dehumidification process or supplied from water supply nozzle 52, into water tub 3 and then exhausting the water to the outside from drain unit 13, the lint carried out from dehumidification pipe 16 is also exhausted to the outside when the water is drained.

Though the preferred embodiment of the present invention has been described for the case where rotary drum 2 is slantingly disposed, the present invention can also be applied to the case where rotary drum 2 is horizontally installed.

As described above, though lint or the like generated from the laundry articles during a drying process clings to the wall or the surface of the dehumidification unit, they

can be washed away by the water splashed upward by the rotation of the rotary drum during the washing or the rinsing process. Therefore, the present invention can provide a drum type washing and drying machine which does
5 not have a deterioration of dehumidification and airflow by way of solving the problem of lint sticking to the dehumidification unit.

While the invention has been shown and described with respect to the preferred embodiment, it will be understood
10 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.

What is claimed is:

1. A drum type washing and drying machine comprising:
a water tub;

5 a cylindrical rotary drum for accommodating laundry articles therein and having a number of holes formed on the peripheral surface of the rotary drum, the rotary drum being installed in the water tub such that a rotational axis thereof is substantially horizontal or declined toward a
10 rear portion of the washing machine;

a motor for rotating the rotary drum; and

a dry air circulation path for blowing air exhausted from the water tub into the water tub again via an air flow passage incorporating therein a dehumidification unit, a fan
15 and a heater,

wherein a dehumidification unit accommodating chamber for accommodating therein the dehumidification unit is disposed near an upper peripheral surface of the water tub, and an air outlet communicated with the dehumidification
20 unit accommodating chamber is installed on the sidewall of the water tub in a direction substantially tangent to a rotational direction of the rotary drum.

2. The machine of claim 1, wherein the dehumidification unit
25 accommodating chamber and the water tub are formed as one body.

3. The machine of claim 1 or 2, wherein a controller for controlling each component of the washing machine in a washing, a rinsing, a water-extracting and a drying process controls the rotary drum containing therein a specific
5 amount of water to rotate at a predetermined rotational speed at least in the rinsing process.