

APPARATUS FOR WASHING ARTICLES AND DRYING MODULE THEREFOR

Field of the Invention

5

The invention relates to an apparatus for washing articles such as dishes, cutlery, etc. and to a drying module for use with such an apparatus.

Background

10

The washing of high volumes of consumer items, particularly those that require regular washing, for example dishes and cutlery from food centres and airline catering, are conventionally washed by hand involving a highly labour intensive batch or continuous process. Such processes typically involve inefficient use of water with water consumption relatively high and on a per article basis extremely high. Despite this excessive water consumption, the inefficient water use may also lead to cross contamination, where food particles of a previous batch are insufficiently disposed of prior to the cleaning of the batch. It follows this represents a significant health risk.

20 More recently, automated processes have been adopted so as to solve the labour intensive aspect. In such industrial washing systems, the articles are loaded into crates or baskets and passed through various stations via a conveyor belt, so as to systematically undergo rinsing, detergent washing and drying. Such an approach is also less water intensive with water management more controllable than the former manual method.

25 The present invention seeks to provide an improved industrial washing apparatus, or at least to provide a useful alternative.

Summary of Invention

5 In a first aspect the invention provides an apparatus for washing articles, the apparatus comprising:

at least one washing module; and

a drying module configured to receive washed articles from the at least one washing module and to dry the washed articles;

10 wherein the drying module comprises a conveyor which is configured to move the washed articles along a transport path having a first substantially helical section to transport the washed articles from a first height to a second height.

In a second aspect there is provided a drying module for an industrial washing apparatus comprising at least one washing module, the drying module being configured to receive
15 washed articles from the at least one washing module and to dry the washed articles; the drying module comprising: a conveyor which is configured to move the washed articles along a transport path comprising a first substantially helical section to transport the washed articles from a first height to a second height.

20 In a third aspect, the present invention provides a method of drying washed articles, the method comprising: conveying the washed articles along a transport path having at least one substantially helical section.

25 By moving the washed articles along a substantially helical path, it is possible to reduce the footprint of the drying module whilst maintaining sufficient residence time of articles within the module to achieve effective drying.

The transport path may comprise a second substantially helical section configured to transport the washed articles from the second height to the first height. There may be a
30 continuous transition section at the second height between an exit of the first substantially helical section and an entry of the second substantially helical section.

Brief Description of Drawings

Embodiments of the invention will now be described, by way of non-limiting example only, with reference to the accompanying drawings in which:

5

Figure 1 is a schematic top view of an apparatus for washing articles according to embodiments of the present invention;

Figure 2 is a side view of the apparatus of Figure 1;

Figure 3 is a schematic top view of an apparatus for washing articles according to alternative embodiments of the present invention; and

10

Figure 4 is a side view of the apparatus of Figure 3.

Detailed Description

15 Figures 1 and 2 show a washing device 10 for continuous automated washing of dishes and cutlery. The device 10 has a plurality of washing modules, including a first pre-wash module in the form of a high pressure spray module 40, a second pre-wash module in the form of an ultrasonic washing module 45, and a washing module 60. Device 10 comprises a loading section 55 for loading dishes 12 from the pre-wash modules 40 and
20 45 into the washing module 60. Following washing in the washing module 60, the dishes are unloaded by unloading conveyor 120 into a drying module 130.

In addition to the pre-wash modules 40 and 45, the device 10 may also include a soaking module (not shown) arranged at the input to the first pre-wash module 40, for
25 soaking dishes so as to assist in reducing adhesion of encrusted food particles to the dishes prior to passing them to subsequent wash modules. Suitable soaking modules include those described in PCT publication no. WO/2013/191650, the contents of which are incorporated herein by reference.

30 The high pressure spray module 40 may receive crates of dirty dishes and/or cutlery, or individual articles to be washed. In some embodiments the high pressure spray module may include a mechanism for unloading articles from a crate presented to it, for

example one or more robotic arms for grasping articles within the crate and depositing them on a support surface for direct application of a high pressure spray in order to remove food particles from the dishes.

- 5 As a final pre-wash stage, the dishes (or other articles) may be passed through one or more ultrasonic baths 85 of an ultrasonic wash module 45, so as to be immersed in the ultrasonic bath 85. The bath, or baths, includes ultrasonic transducers therein so as to apply ultrasonic waves to said articles as a final quality check that all food particles have been removed.

10

- The articles are then loaded onto a wash conveyor 90 from the ultrasonic conveyor 50. In the present embodiment each of the sections 40 and 45 have separate conveyors so that any food particles adhered to the conveyor are not then transferred to the downstream sections. The conveyor 50 from the ultrasonic bath does not transfer any
15 pre-wash carriers such as crates or baskets (not shown) to the washing module 60. Thus, a source of cross-contamination is removed. It will be appreciated that the pre-wash section and wash section are physically separated through the transfer of dishes from one conveyor 50 to the wash conveyor 90. Thus, whilst in this embodiment each pre-wash section has a distinct conveyor system, it is sufficient that the conveyors of the
20 pre-wash section are distinct from the conveyor of the wash section.

- In the washing module 60, the washing device may be adapted for the complete washing of plates including the removal of food particles. However, when coupled with the pre-wash modules 40 and/or 45, the washing device may be made simpler in
25 construction, since dishes reaching the washing module 60 will already have food particles removed.

- Alternatively, the apparatus 10 may include a washing module which is specifically adapted for the removal of grease, oil and fat from the dishes and so more efficiently
30 designed given that food particles are assured to have been removed in the upstream portions of the device.

In the present embodiment, the washing module 60 moves the dishes from the loading conveyor 90 to a spray rinse section 95 followed by a final rinse section 100 prior to a sterilizing spray section 105. This series of rinse stations may be useful to ensure that any moisture lost during the transfer from the pre-wash section to the wash section is replaced during the rinse. The rinse stations are designed to ensure the removal of grease, oil and fat from the dishes so as to provide a continuous flow of clean dishes to the drying module 130.

The drying module 130 comprises a spiral conveyor, generally indicated at 140, mounted to a support 132. Typically, the drying module 130 will comprise a drying chamber (not shown) which encloses the spiral conveyor 140. The spiral conveyor 140 comprises an endless belt 134 which passes around rollers 136a, 136b, 136c and 136d, and through a channel of a helical section 142 of the conveyor. The conveyor 140 is configured to receive washed articles 12 from the unloading section 120 of the washing apparatus 10 (for example, through an entry aperture of the drying chamber), at a receiving section 141, at a first height 154. The conveyor 140 then transports the articles along the helical path defined by helical section 142 from the first height 154 to a second (in this case, greater) height 156. When articles exit the helical section 142 they reach an unloading section 146 of the conveyor 140 where they can be retrieved (for example, via an exit aperture of the drying chamber).

Advantageously, the use of a spiral conveyor may minimize the footprint of the drying module, whilst maximizing the residence time of articles within the drying module such that they can be thoroughly dried.

25

The drying module 130 comprises a plurality of temperature zones (not shown) which are arranged between the first height and the second height in order of increasing temperature. Thus, as moisture-carrying articles are conveyed along the helical path between the first height and the second height, they pass through temperature zones of successively higher temperature. The temperature zones may be implemented in a number of ways, for example by providing a plurality of heating elements each coupled to a blower such that each blower provides hot air at a different temperature.

30

In certain embodiments, the drying module 130 may comprise or be coupled to an air blower, which is coupled to one or more heating elements such that the air blower can fill the drying chamber with hot air in order to accelerate the drying process. The air blower may be coupled to an opening in the drying chamber housing, for example. The heating elements may be configured to heat air to a desired temperature prior to being forced into the chamber by the air blower. In some embodiments, the heating elements may be omitted such that air at ambient temperature is blown into the interior of the drying chamber.

The drying chamber may include at least one ventilation fan and/or at least one exhaust duct for dehumidifying the interior of the chamber, to thereby accelerate drying of articles on the spiral conveyor 140.

Some embodiments may include an air circulation system within or coupled to the drying chamber. Advantageously, this may reduce energy consumption and reduce the heating up time within the chamber.

In some embodiments, one or more additional filtration systems to reduce the humidity and/or maintain the air quality may be added.

Referring now to Figures 3 and 4, there is shown an alternative embodiment of a washing apparatus 200. Those components labelled with the same reference numerals as used in Figures 1 and 2 should be understood to have the same function as their counterparts in Figures 1 and 2.

As shown in Figures 3 and 4, the washing apparatus 200 is similar in construction to washing apparatus 10, but includes an alternative embodiment of a drying module 230, which comprises a double-spiral conveyor 240 which may be enclosed in a drying chamber as mentioned above in connection with drying module 130. The belt 234 of conveyor 240 passes over rollers 236a and 236b, and through two successive helical sections 242a and 242b. Respective helical sections 242a and 242b are supported on respective supports 232a and 232b.

In use, washed articles 12 are received at the loading section 241 of the conveyor 240, and enter the first helical section 242a, whereupon they are transported along a helical path and are elevated from a first height 254 (which may be the height of the loading section 241, for example) to a second height 256. After the articles 12 exit the first helical section 242a they are transferred, via a linear transition section 248, to an entry of the second helical section 242b. The entry of the second helical section 242b may also be at the second height 256, for example. The second helical section 242b then transports the articles 12 along a second helical path and lowers them from the second height 256 to the first height 254. The articles 12 exit the second helical section 242b and reach an unloading section 246 where they can be retrieved.

By using two helical conveyors it is possible to further increase the residence time within the drying chamber of drying module 230, whilst minimizing the increase in footprint. Further, by providing a return path from the second height 256 to the first height 254, the second helical conveyor 242b may make it easier for dried articles to be removed from the drying module 230.

The drying module 230 may comprise or be coupled to an air blower for forcing air (optionally heated by one or more heating elements) into the interior of the drying chamber, as mentioned above in relation to the embodiment of Figures 1 and 2. Drying module 230 may also comprise at least one ventilation fan and/or at least one exhaust duct, and/or may include an air circulation system within or coupled to the drying chamber, as described above. Further, one or more additional filtration systems to reduce the humidity and/or maintain the air quality in the drying chamber may be added.

As in relation to the embodiment of Figures 1 and 2, the drying module 230 may include a plurality of temperature zones, to subject the washed articles to different temperatures dependent on their position within the drying module 230. The temperature zones may be arranged in order of increasing temperature with height. So, for example, as articles 12 are raised by the first helical section 242a, they encounter progressively higher temperatures. Then, as the articles 12 descend down the second

helical section 242b, they are progressively cooled since the temperature zones decreased with temperature from the second height 256 to the first height 254.

5 Whilst the foregoing description has described exemplary embodiments, it will be understood by those skilled in the technology concerned that many variations in details of design, construction and/or operation may be made without departing from the scope of the present invention. For example, while each helix of the conveyors 140, 240 is shown with a right-handed configuration, it will be appreciated that each could have a left-handed configuration. In addition, while it will generally be advantageous to convey 10 washed articles along the conveyors 140, 240 such that they are elevated during transport, it will be appreciated that in some embodiments the conveyors may be arranged such that as washed articles are transported along helical section 142 (for example), they are lowered relative to the height of loading section 141. At the same time, the temperature zones of the drying module may be arranged such that as the 15 washed articles are lowered, they encounter increasingly higher temperatures.

Claims

1. An apparatus for washing articles, the apparatus comprising:
 - at least one washing module; and
 - 5 a drying module configured to receive washed articles from the at least one washing module and to dry the washed articles;
 - wherein the drying module comprises a conveyor which is configured to move the washed articles along a transport path having a first substantially helical section to transport the washed articles from a first height to a second height and a second
 - 10 substantially helical section configured to transport the washed articles from the second height to the first height;
 - wherein the drying module includes a plurality of temperature zones, the temperature zones of the first helical section arranged in order of increasing temperature from the first height to the second height; and the temperature zones of
 - 15 the second helical section arranged in order of decreasing temperature from the second height to the first height.
- 20 2. An apparatus according to claim 1, comprising a continuous transition section at the second height between an exit of the first substantially helical section and an entry of the second substantially helical section.
- 25 3. A drying module for an industrial washing apparatus comprising at least one washing module, the drying module being configured to receive washed articles from the at least one washing module and to dry the washed articles; the drying module comprising: a conveyor which is configured to move the washed articles
- 30 along a transport path comprising a first substantially helical section to transport the washed articles from a first height to a second height and a second substantially

helical section configured to transport the washed articles from the second height to the first height;

wherein the drying module includes a plurality of temperature zones, the temperature zones of the first helical section arranged in order of increasing temperature from the first height to the second height; and the temperature zones of the second helical section arranged in order of decreasing temperature from the second height to the first height.

4. A drying module according to claim 3, comprising a continuous transition section at the second height between an exit of the first substantially helical channel and an entry of the second substantially helical channel.

5. A method of drying washed articles, the method comprising the steps of: conveying the washed articles along a transport path having at least one substantially helical section;

- such that the conveying step includes conveying the washed articles along a first helical path between a first height and a second height; progressively heating the washed articles as they travel along the first helical path; conveying the washed articles along a second helical path between the second height and the first height; and progressively cooling the washed articles as they travel along the second helical path.