



(11)

EP 4 772 101 A1

(12)

EUROPEAN PATENT APPLICATION
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.07.2026 Bulletin 2026/28

(51) International Patent Classification (IPC):
A47L 15/00 ^(2006.01)

(21) Application number: **24905688.8**

(52) Cooperative Patent Classification (CPC):
A47L 15/00; A47L 15/42; A47L 15/48

(22) Date of filing: **13.09.2024**

(86) International application number:
PCT/CN2024/118781

(87) International publication number:
WO 2025/130196 (26.06.2025 Gazette 2025/26)

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
GE KH MA MD TN

(72) Inventors:
• **LIU, Shanshan**
Wuhu, Anhui 241000 (CN)
• **WANG, Zhen**
Wuhu, Anhui 241000 (CN)
• **LIU, Richao**
Wuhu, Anhui 241000 (CN)
• **WANG, Buer**
Wuhu, Anhui 241000 (CN)

(30) Priority: **19.12.2023 CN 202311751244**

(74) Representative: **Ran, Handong et al**
Maucher Jenkins
Seventh Floor Offices
Artillery House
11-19 Artillery Row
London SW1P 1RT (GB)

(71) Applicant: **Wuhu Midea Smart Kitchen Appliance
Manufacturing Co., Ltd.**
Wuhu, Anhui 241000 (CN)

(54) **TABLEWARE TREATMENT DEVICE AND TABLEWARE TREATMENT CONTROL METHOD**

(57) A tableware treatment device, comprising: a housing (110), an air return channel (120), a fan (132), a first heat exchanger (134), a second heat exchanger (136), a first throttling device (140), a heat pump channel (150), a circulating pump (152), a third heat exchanger (154), a compressor (160), a first reversing valve (172), and a second reversing valve (174). The housing (110) is provided with an accommodation cavity (112), and an air outlet (113), an air return port (114), a water outlet (115) and water return ports (116) that are in communication with the accommodation cavity (112), and the accommodation cavity (112) is used for accommodating tableware; the air return channel (120) is in communication with the air outlet (113) and the air return port (114), the heat exchanger is arranged close to the air outlet (113), the second heat exchanger (136) is arranged close to the air

return port (114), and the first throttling device (140) is connected between the first heat exchanger (134) and the second heat exchanger (136); the heat pump channel (150) is in communication with the water outlet (115) and the water return ports (116), a first heat exchange valve is separately connected to an outlet (164) of the compressor (160), the second heat exchanger (136) and the third heat exchanger (154), so as to connect the outlet (164) of the compressor (160) and the second heat exchanger (136) or the third heat exchanger (154); and the second reversing valve (174) is separately connected to the first heat exchanger (134), the second heat exchanger (136) and the third heat exchanger (154), so as to connect the third heat exchanger (154) and the second heat exchanger (136) or the first heat exchanger (134).

EP 4 772 101 A1

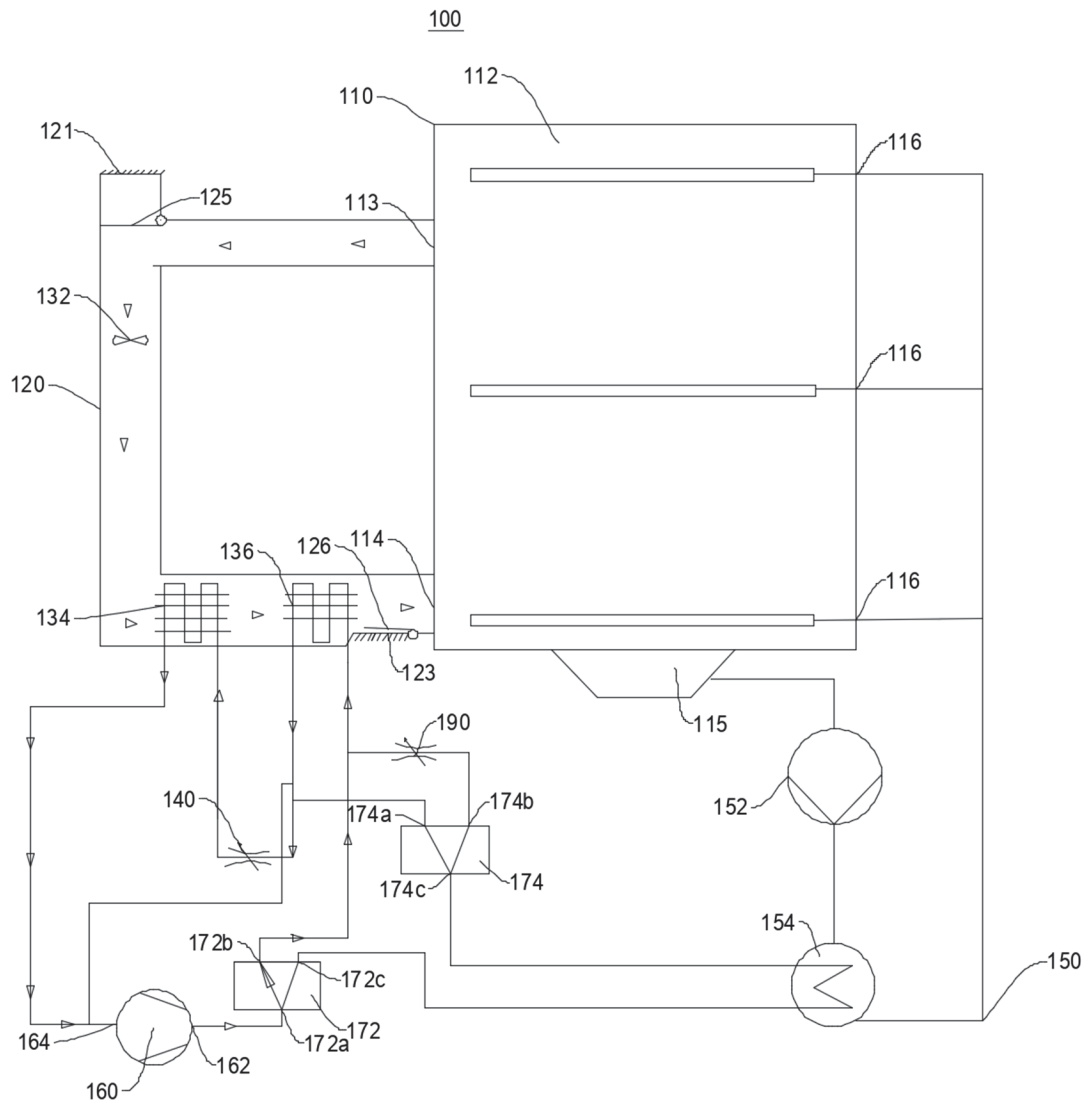


FIG. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Chinese Patent Application No. 202311751244.9, filed on December 19, 2023, the contents of which are herein incorporated by reference in the entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of electrical appliances, and in particular to a tableware treatment device and a tableware treatment control method.

BACKGROUND

[0003] A tableware treatment device is an intelligent household appliance product that may replace manual tableware treatment and is widely applied nowadays. During a tableware washing process, washing water may be delivered to each rotating spray arm by a circulation pump so as to continuously spray the water onto tableware and wash the tableware, thereby achieving a purpose of cleaning the tableware. To further shorten a washing time of the tableware treatment device, a washing system of an existing tableware treatment device may adopt an electric heater to raise a temperature of the washing water. When the washing water is circularly sprayed onto the tableware, the high-temperature washing water may flush contaminants off the tableware and transfer heat to the tableware, such that the tableware treatment device may obtain both a high cleaning rate and a high drying rate within a short washing time. During the entire working cycle, since a heating energy consumption of the washing water may account for more than 80% of an overall energy consumption of the tableware treatment device, reducing the heating energy consumption of the washing water is therefore a key technical direction for reducing the energy consumption of the tableware treatment device. In the related art, the heating efficiency of the tableware treatment device is relatively low, resulting in high energy consumption of the tableware treatment device.

SUMMARY

[0004] The present disclosure aims to solve a technical problem of low heat pump efficiency and high energy consumption at least to some extent. Accordingly, some embodiments of the present disclosure provide a tableware treatment device and a tableware treatment control method.

[0005] According to a first aspect of the present disclosure, some embodiments of the present disclosure may provide a tableware treatment device including a housing, an air return channel, a fan, a first heat exchan-

ger, a second heat exchanger, a first throttling device, a heat pump channel, a circulation pump, a third heat exchanger, and a compressor. The housing may define an accommodating chamber, an air outlet, an air return port, a water outlet, and a water return port. The accommodating chamber may be configured to accommodate a tableware. The air outlet, the air return port, the water outlet, and the water return port may be in communication with the accommodating chamber. The air return channel may be in communication with the air outlet and the air return port. The fan, the first heat exchanger, and the second heat exchanger may be disposed in the air return channel. The first heat exchanger may be disposed adjacent to the air outlet. The second heat exchanger may be disposed adjacent to the air return port. The first throttling device may be connected between the first heat exchanger and the second heat exchanger. The heat pump channel may be in communication with the water outlet and the water return port, and the circulation pump and the third heat exchanger may be disposed in the heat pump channel. A first heat exchanging valve may be respectively connected to an outlet of the compressor, the second heat exchanger, and the third heat exchanger, and may be configured to enable the outlet of the compressor to be in communication with the second heat exchanger or the third heat exchanger. The second reversing valve may be respectively connected to the first heat exchanger, the second heat exchanger, and the third heat exchanger, and may be configured to enable the third heat exchanger to be in communication with the second heat exchanger or the first heat exchanger.

[0006] In the drying system, the second heat exchanger may function as a condenser and the first heat exchanger may function as an evaporator, so the power of the second heat exchanger may be higher than the power of the first heat exchanger. The power of the heat pump system where the second heat exchanger is connected to the third heat exchanger and functions as an evaporator may be greater than the power of the heat pump system where the first heat exchanger is connected to the third heat exchanger and functions as an evaporator. During the washing process, the power requirement for the heat pump system varies due to a washing mode, actual loading capacity, etc., so the first heat exchanger or the second heat exchanger may be selected based on an operating parameter of the tableware treatment device, thereby improving the heat pump power and reducing the overall energy consumption of the device.

[0007] In some embodiments, the second reversing valve may define a first connection port, a second connection port, and a third connection port.

[0008] In some embodiments, the first connection port may be in communication with the first heat exchanger.

[0009] In some embodiments, the second connection port may be in communication with the second heat exchanger.

[0010] In some embodiments, the third connection port may be in communication with the third heat exchanger.

[0011] In some embodiments, the tableware treatment device may further include a second throttling device.

[0012] In some embodiments, the second throttling device may be connected between the second heat exchanger and the third heat exchanger.

[0013] In some embodiments, the first connection port may be connected between the second heat exchanger and the first throttling device.

[0014] In some embodiments, the first reversing valve may include a first communication port, a second communication port, and a third communication port.

[0015] In some embodiments, the first communication port may be in communication with the outlet of the compressor.

[0016] In some embodiments, the second communication port may be in communication with the second heat exchanger.

[0017] In some embodiments, the third communication port may be in communication with the third heat exchanger.

[0018] In some embodiments, the air return channel may define an air inlet and an air exhaust port.

[0019] In some embodiments, the air inlet may be defined between the first heat exchanger and the air outlet.

[0020] In some embodiments, the air exhaust port may be defined between the second heat exchanger and the air return port.

[0021] In some embodiments, in a case where the circulation pump is turned on, the air inlet and the air exhaust port may be turned on, and the air outlet and the air return port may be turned off.

[0022] In some embodiments, the tableware treatment device may further include a first air valve.

[0023] In some embodiments, the first air valve may be disposed between the air outlet and the air inlet.

[0024] In some embodiments, the first air valve may be configured to enable the air outlet to be in communication with the air return channel and the air inlet to be disconnected from the air return channel, or to enable the air outlet to be disconnected from the air return channel and the air inlet to be in communication with the air return channel.

[0025] In some embodiments, the tableware treatment device may further include a second air valve. The second air valve may be disposed between the air exhaust port and the air return port.

[0026] In some embodiments, the second air valve may be configured to enable the air exhaust port to be in communication with the air return channel and the air return port to be disconnected from the air return channel, or the second air valve may be configured to enable the air exhaust port to be disconnected from the air return channel and the air return port to be in communication with the air return channel.

[0027] In some embodiments, the air outlet and the air return port may be defined on a same side of the housing.

[0028] In some embodiments, the second heat ex-

changer may be connected to an inlet of the compressor.

[0029] In some embodiments, the first throttling device may include a plurality of throttling assemblies.

[0030] In some embodiments, each of the plurality of throttling assemblies may include a throttling valve and a control valve connected to the throttling valve in series.

[0031] In some embodiments, the control valve of at least one of the plurality of throttling assemblies may be connected in parallel to at least one of the other of the plurality of throttling assemblies.

[0032] In some embodiments, the plurality of throttling assemblies may include a first throttling assembly and a second throttling assembly.

[0033] In some embodiments, the first throttling assembly may include a first throttling valve and a first control valve.

[0034] In some embodiments, the second throttling assembly may include a second throttling valve and a second control valve.

[0035] In some embodiments, the first control valve may be connected to the first throttling valve in series.

[0036] In some embodiments, the second control valve may be connected to the second throttling valve in series.

[0037] In some embodiments, the second control valve may be connected in parallel to the first throttling valve and the first control valve.

[0038] In some embodiments, the first control valve, the first throttling valve, and the second throttling valve may be connected in sequence. A first connection point may be defined between the first throttling valve and the second throttling valve. An end of the second control valve may be connected to the first connection point.

[0039] In some embodiments, an end of the second control valve away from the first connection point may be connected to an end of the first control valve away from the first throttling valve, forming an input point. An end of the second throttling valve away from the first throttling valve may form an output point.

[0040] In some embodiments, the first throttling valve may be connected to the second throttling valve in series.

[0041] According to a second aspect of the present disclosure, some embodiments of the present disclosure may provide a tableware treatment control method applied to the tableware treatment device provided by the first aspect. The tableware treatment control method may include: in response to a heating signal of the tableware treatment device, controlling the circulation pump to turn on and controlling the first reversing valve to enable the outlet of the compressor to be in communication with the third heat exchanger; obtaining an operating parameter of the tableware treatment device; determining whether a condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter; controlling, in a case where the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied, the second reversing valve to enable the third heat exchanger to be in communication

with the second heat exchanger; and controlling, in a case where the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied, the second reversing valve to enable the third heat exchanger to be in communication with the first heat exchanger.

[0042] The tableware treatment control method provided by the second aspect may share some technical effects with the tableware treatment device provided by the first aspect, which will not be repeated herein.

[0043] In some embodiments, in a case where the operating parameter includes a heating temperature value, determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, may include: obtaining the heating temperature value carried in the heating signal; determining whether the heating temperature value is greater than or equal to a set temperature value; determining, in a case where the heating temperature value is greater than or equal to the set temperature value, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the heating temperature value is less than the set temperature value, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

[0044] In some embodiments, in a case where the operating parameter includes image information, determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, may include: obtaining image information in the accommodating chamber; determining whether a tableware in the accommodating chamber is greater than or equal to a set loading capacity based on the image information; determining, in a case where the tableware in the accommodating chamber is greater than or equal to the set loading capacity, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the tableware in the accommodating chamber is less than the set loading capacity, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

[0045] In some embodiments, determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, may include: determining whether the heating signal is an accelerated heating signal; determining, in a case where the heating signal is the accelerated heating signal, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the heating signal is not the accelerated heating signal, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] In order to describe the technical solutions of some embodiments of the present disclosure more clearly, a brief introduction may be given below to the drawings that are required in the description of the embodiments. It is apparent that the drawings described below merely illustrate some embodiments of the present disclosure. Other drawings may further be obtained by those skilled in the art without inventive effort based on these drawings.

FIG. 1 is a schematic structural view of a tableware treatment device according to some embodiments of the present disclosure, where the tableware treatment device is in a drying mode.

FIG. 2 is a schematic structural view of the tableware treatment device according to some embodiments of the present disclosure, where the tableware treatment device is in a heat pump mode and a second heat exchanger is configured to function as an evaporator.

FIG. 3 is a schematic structural view of the tableware treatment device according to some embodiments of the present disclosure, where the tableware treatment device is in the heat pump mode and a first heat exchanger is configured to function as an evaporator.

FIG. 4 is a schematic structural view of a first throttling device of the tableware treatment device according to some embodiments of the present disclosure.

FIG. 5 is another schematic structural view of the first throttling device of the tableware treatment device according to some embodiments of the present disclosure.

FIG. 6 is a schematic flowchart of a tableware treatment control method according to some embodiments of the present disclosure.

FIG. 7 is a schematic flowchart of block S312 to block S318 of the tableware treatment control method according to some embodiments of the present disclosure.

FIG. 8 is a schematic flowchart of block S322 to block S328 of the tableware treatment control method according to some embodiments of the present disclosure.

FIG. 9 is a schematic flowchart of block S332 to block S336 of the tableware treatment control method according to some embodiments of the present disclosure.

[0047] Reference numerals: 100, tableware treatment device; 110, housing; 112, accommodating chamber; 113, air outlet; 114, air return port; 115, water outlet; 116, water return port;

120, air return channel; 121, air inlet; 123, air exhaust

port; 125, first air valve; 126, second air valve;
 132, fan; 134, first heat exchanger; 136, second heat
 exchanger;
 140, first throttling device; 141, throttling assembly;
 141a, throttling valve; 141b, control valve;
 142, first throttling assembly; 142a, first throttling
 valve; 142b, first control valve; 143, second throttling
 assembly; 143a, second throttling valve; 143b, sec-
 ond control valve; 145, third throttling assembly;
 145a, third throttling valve; 145b, third control valve;
 146a, first connection point; 146b, input point; 146c,
 output point;
 150, heat pump channel; 152, circulation pump; 154,
 third heat exchanger; 160, compressor; 162, inlet;
 164, outlet; 172, first reversing valve; 172a, first
 communication port; 172b, second communication
 port; 172c, third communication port; 174, second
 reversing valve; 174a, first connection port; 174b,
 second connection port; 174c, third connection port;
 190, second throttling assembly.

DETAILED DESCRIPTION

[0048] The technical solutions of the embodiments of the present disclosure may be described clearly and completely below in conjunction with the drawings of the embodiments of the present disclosure. It is apparent that the embodiments described are merely a part of the embodiments of the present disclosure, rather than all of the embodiments. Based on the embodiments of the present disclosure, all other embodiments obtained by those skilled in the art without inventive effort shall fall within the protection scope of the present disclosure.

[0049] It should be noted that all directional indications in the embodiments of the present disclosure may be used only to explain the relative positional relationships or motion conditions of the components under a certain posture. When the posture changes, the corresponding directional indications may be changed accordingly.

[0050] In the present disclosure, unless otherwise clearly specified and limited, the terms "connected" and "fixed" may be interpreted in a broad sense. For example, "fixed" may refer to fixed connection, detachable connection, or integrally formed; it may refer to mechanical connection or electrical connection; it may refer to a direct connection or an indirect connection through an intermediate medium, and it may also refer to internal communication or interaction between two components, unless otherwise clearly limited. For those skilled in the art, the meaning of the above terms in the present disclosure may be understood based on the context.

[0051] In addition, the descriptions involving "first," "second," and the like in the present disclosure may be used merely for descriptive purposes and may not be construed as indicating or implying relative importance or implicitly specifying the number of the indicated technical features. Therefore, features defined by "first" and "sec-

ond" may expressly or implicitly include at least one such feature. Furthermore, the technical solutions among the various embodiments may be combined with each other, but such combination has to be based on the capability of realization by those skilled in the art. When the combination of technical solutions is contradictory or cannot be realized, it shall be understood that such combination does not exist and is not within the protection scope of the present disclosure.

[0052] A tableware treatment device is an intelligent household appliance product that may replace manual tableware treatment and is widely applied nowadays. During a tableware washing process, washing water may be delivered to each rotating spray arm by a circulation pump, by way of which the water is continuously sprayed onto tableware and wash the tableware, thereby achieving a purpose of cleaning the tableware. To further shorten a washing time of the tableware treatment device, a washing system of an existing tableware treatment device may adopt an electric heater to raise a temperature of the washing water. When the washing water is circularly sprayed onto the tableware, the high-temperature washing water may flush contaminants off the tableware and transfer heat to the tableware, such that the tableware treatment device may obtain both a high cleaning rate and a high drying rate within a short washing time. During the entire working cycle, since a heating energy consumption of the washing water may account for more than 80% of an overall energy consumption of the tableware treatment device, reducing the heating energy consumption is therefore a key technical direction for reducing the energy consumption of the tableware treatment device.

[0053] In the related art, the heating efficiency of the tableware treatment device is relatively low, resulting in high energy consumption of the tableware treatment device. The tableware treatment device and a tableware treatment control method according to some embodiments of the present disclosure may solve the above problems. The tableware treatment device and the tableware treatment control method according to some embodiments of the present disclosure may improve the heat pump efficiency and reduce the overall energy consumption of the device.

[0054] Some technical solutions of the present disclosure may be described below with reference to the drawings and embodiments.

[0055] As shown in FIG. 1, some embodiments of the present disclosure provide a tableware treatment device 100. The tableware treatment device 100 according to some embodiments of the present disclosure may improve the heat pump efficiency and reduce the overall energy consumption of the device.

[0056] As shown in FIG. 2 and FIG. 3, in some embodiments, the tableware treatment device 100 may include: a housing 110, an air return channel 120, a fan 132, a first heat exchanger 134, a second heat exchanger 136, a first throttling device 140, a heat pump channel 150, a circu-

lation pump 152, a third heat exchanger 154, a compressor 160, a first reversing valve 172, and a second reversing valve 174.

[0057] The housing 110 may define an accommodating chamber 112, an air outlet 113, an air return port 114, a water outlet 115, and a water return port 116. The air outlet 113, the air return port 114, the water outlet 115, and the water return port 116 may be in communication with the accommodating chamber 112. The accommodating chamber 112 may be configured to accommodate a tableware.

[0058] The air return channel 120 may be in communication with the air outlet 113 and the air return port 114. The fan 132, the first heat exchanger 134, and the second heat exchanger 136 may all be disposed in the air return channel 120. The first heat exchanger 134 may be disposed adjacent to the air outlet 113. The second heat exchanger 136 may be disposed adjacent to the air return port 114. The first throttling device 140 may be connected between the first heat exchanger 134 and the second heat exchanger 136.

[0059] The heat pump channel 150 may be in communication with the water outlet 115 and the water return port 116. The circulation pump 152 and the third heat exchanger 154 may be disposed in the heat pump channel 150.

[0060] The first reversing valve 172 may be respectively connected to an outlet 164 of the compressor 160, the second heat exchanger 136, and the third heat exchanger 154, and may be configured to conduct the outlet 164 of the compressor 160 with the second heat exchanger 136 or the third heat exchanger 154; i.e., enable the outlet 164 of the compressor 160 to be in communication with the second heat exchanger 136 or the third heat exchanger 154. The second reversing valve 174 may be respectively connected to the first heat exchanger 134, the second heat exchanger 136, and the third heat exchanger 154, and may be configured to conduct the third heat exchanger 154 with the second heat exchanger 136 or the first heat exchanger 134, i.e., enable the third heat exchanger 154 to be in communication with the second heat exchanger 136 or the first heat exchanger 134.

[0061] The housing 110 may be configured as a main body of the tableware treatment device 100 and as an installation base of the tableware treatment device 100. The housing 110 may provide the installation base for other components of the tableware treatment device 100. The housing 110 may further provide protective functions for other components of the tableware treatment device 100.

[0062] The accommodating chamber 112 may be configured to accommodate the tableware. Multiple levels of baskets may be disposed in the accommodating chamber 112. The tableware may be placed on the baskets. A spacing between the baskets may be different to accommodate the tableware of different types and sizes.

[0063] The air return channel 120 may be connected to the air outlet 113 and the air return port 114, thereby forming a drying branch. After the tableware cleaning is

completed, the air return channel 120 may be configured to dry the tableware. The heat pump channel 150 may be configured to heat washing water. The washing water may be sprayed onto the tableware to achieve the purpose of cleaning.

[0064] In some embodiments, the compressor 160, the first heat exchanger 134, the second heat exchanger 136, and the first throttling device 140 may form a part of a drying system. The first heat exchanger 134 may be disposed adjacent to the air outlet 113, the second heat exchanger 136 may be disposed adjacent to the air return port 114, and the outlet 164 of the compressor 160 may be connected to the second heat exchanger 136. After humid and hot air in the accommodating chamber 112 enters the air return channel 120, the humid and hot air may first pass through the first heat exchanger 134. After heat exchange by the first heat exchanger 134, moisture in the humid and hot air may be condensed to form dry and cold air. The dry and cold air may form dry and hot air after heat exchange by the second heat exchanger 136, and the dry and hot air may enter the accommodating chamber 112 from the air return port 114.

[0065] The compressor 160, the first heat exchanger 134, the second heat exchanger 136, and the first throttling device 140 may form the complete drying system. The outlet 164 of the compressor 160 may also be connected to the third heat exchanger 154. After the washing water in the accommodating chamber 112 enters the heat pump channel 150, the washing water may be heated by the third heat exchanger 154 and enter the accommodating chamber 112 again from the water return port 116.

[0066] In some embodiments, the first reversing valve 172 and the second reversing valve 174 may cooperate with each other. In a case where the first reversing valve 172 enables the outlet 164 of the compressor 160 to be in communication with the second heat exchanger 136, the drying system may operate. In a case where a first heat exchanging valve enables the outlet 164 of the compressor 160 to be in communication with the third heat exchanger 154, a heat pump system may operate. The second reversing valve 174 may conduct the second heat exchanger 136 or the first heat exchanger 134, so that one of the first heat exchanger 134 and the second heat exchanger 136 may be selected to function as an evaporator.

[0067] In the drying system, the second heat exchanger 136 may function as a condenser and the first heat exchanger 134 may function as an evaporator, so the power of the second heat exchanger 136 may be higher than the power of the first heat exchanger 134. The power of the heat pump system where the second heat exchanger 136 is connected to the third heat exchanger 154 and functions as an evaporator may be greater than the power of the heat pump system where the first heat exchanger 134 is connected to the third heat exchanger 154 and functions as an evaporator. During the washing process, the power requirement for the heat pump system varies due to a washing mode, actual loading capa-

city, etc., so the first heat exchanger 134 or the second heat exchanger 136 may be selected based on an operating parameter of the tableware treatment device 100, thereby improving the heat pump power and reducing the overall energy consumption of the device.

[0068] In some embodiments, for the convenience of description, a process in which the compressor 160, the first heat exchanger 134, and the second heat exchanger 136 dry the humid and hot air may be defined as a drying mode. A process in which the compressor 160, the third heat exchanger 154, and the first heat exchanger 134 or the second heat exchanger 136 heat the washing water may be defined as a heat pump mode.

[0069] In some embodiments, the second reversing valve 174 may include a first connection port 174a, a second connection port 174b, and a third connection port 174c. The first connection port 174a may be in communication with the first heat exchanger 134. The second connection port 174b may be in communication with the second heat exchanger 136. The third connection port 174c may be in communication with the third heat exchanger 154.

[0070] The second reversing valve 174 may be a three-way valve. The three ports of the second reversing valve 174 may include one inlet and two outlets. The third connection port 174c may be in communication with the second connection port 174b or may be in communication with the first connection port 174a. In a case where the third connection port 174c is in communication with the first connection port 174a, the third heat exchanger 154 may be in communication with the first heat exchanger 134, so that the first heat exchanger 134 may function as an evaporator to form the heat pump system with the third heat exchanger 154. In a case where the third connection port 174c is in communication with the second connection port 174b, the second heat exchanger 136 may function as an evaporator to form the heat pump system with the third heat exchanger 154.

[0071] In some embodiments, the tableware treatment device 100 may further include a second throttling device 190. The second throttling device 190 may be connected between the second heat exchanger 136 and the third heat exchanger 154. The first connection port 174a may be connected between the second heat exchanger 136 and the first throttling device 140.

[0072] The first throttling device 140 may be a throttling component of the drying system, and the second throttling device 190 may be a throttling component of the heat pump system. In a case where the first heat exchanger 134 is connected to the third heat exchanger 154, the first throttling device 140 may function as a throttling component of the heat pump system.

[0073] In other embodiments, the tableware treatment device 100 may be configured with only the first throttling device 140, and the second throttling device 190 may be omitted. The first throttling device 140 may be used as both a throttling component of the drying system and a throttling component of the heat pump system.

[0074] In some embodiments, the first reversing valve 172 may include a first communication port 172a, a second communication port 172b, and a third communication port 172c. The first communication port 172a may be in communication with the outlet 164 of the compressor 160. The second communication port 172b may be in communication with the second heat exchanger 136. The third communication port 172c may be in communication with the third heat exchanger 154.

[0075] The first heat exchanging valve may function as a switching valve for a drying function and a heat pump function. In a case where the first communication port 172a is in communication with the second communication port 172b, a high-temperature and high-pressure heat exchange medium flowing out of the outlet 164 of the compressor 160 may enter the second heat exchanger 136 to dry the air entering the air return channel 120. In a case where the first communication port 172a is in communication with the third communication port 172c, the high-temperature and high-pressure heat exchange medium flowing out of the outlet 164 of the compressor 160 may enter the third heat exchanger 154 to heat the washing water in the heat pump channel 150.

[0076] In some embodiments, the air return channel 120 may define an air inlet 121 and an air exhaust port 123. The air inlet 121 may be defined between the first heat exchanger 134 and the air outlet 113. The air exhaust port 123 may be defined between the second heat exchanger 136 and the air return port 114. In a case where the circulation pump 152 is turned on, the air inlet 121 and the air exhaust port 123 may be turned on or opened, and the air outlet 113 and the air return port 114 may be turned off or closed.

[0077] In a case where the heat pump system of the tableware treatment device 100 is in operation, the circulation pump 152 may be turned on. One of the first heat exchanger 134 and the second heat exchanger 136 may be configured to operate as an evaporator. The other one of the first heat exchanger 134 and the second heat exchanger 136 may not be in operation. In this way, air within the air return channel 120 may be cool air. To block the cool air from entering into the accommodating chamber 112, the air outlet 113 and the air return port 114 may be turned off or closed. That is, in a case where the circulation pump 152 is turned on, the air inlet 121 and the air exhaust port 123 may be turned on or opened, so that external air may enter into the air return channel 120, exchange heat with the first heat exchanger 134 or the second heat exchanger 136, and then be discharged from the air exhaust port 123.

[0078] Since either the first heat exchanger 134 or the second heat exchanger 136 may be configured to function as the evaporator, the air exhaust port 123 may be defined between the second heat exchanger 136 and the air return port 114. That is, the air inlet 121 may be defined adjacent to the air outlet 113. The air exhaust port 123 may be defined adjacent to the air return port 114.

[0079] In some embodiments, the tableware treatment

device 100 may further include a first air valve 125. The first air valve 125 may be disposed between the air outlet 113 and the air inlet 121. The first air valve 125 may be configured to enable the air outlet 113 to be in communication with the air return channel 120 and the air inlet 121 to be disconnected from the air return channel 120, or to enable the air outlet 113 to be disconnected from the air return channel 120 and the air inlet 121 to be in communication with the air return channel 120.

[0080] The air inlet 121 and the air outlet 113 may be located close to each other. The air inlet 121 and the air outlet 113 may not be opened or closed at the same time. That is, during operation, either the air outlet 113 may be turned on or opened while the air inlet 121 is turned off or closed, or the air outlet 113 may be turned off or closed while the air inlet 121 is turned on or opened. In this way, only one air valve may be required to jointly control the air inlet 121 and the air outlet 113. The first air valve 125 may be disposed between the air inlet 121 and the air outlet 113. In a case where the tableware treatment device 100 operates in a drying mode, the first air valve 125 may be configured to open or turn on the air outlet 113 and close or turn off the air inlet 121, allowing moist hot air in the accommodating chamber 112 to enter into the air return channel 120. In a case where the tableware treatment device 100 operates in a heat pump mode, the first air valve 125 may be configured to close or turn off the air outlet 113 and open and turn on the air inlet 121.

[0081] In some embodiments, the tableware treatment device 100 may further include a second air valve 126. The second air valve 126 may be disposed between the air exhaust port 123 and the air return port 114. The second air valve 126 may be configured to enable the air exhaust port 123 to be in communication with the air return channel 120 and the air return port 114 to be disconnected from the air return channel 120. Or, in some embodiments, the second air valve 126 may be configured to enable the air exhaust port 123 to be disconnected from the air return channel 120 and the air return port 114 to be in communication with the air return channel 120.

[0082] The air return port 114 and the air exhaust port 123 may be located close to each other. The air return port 114 and the air exhaust port 123 may not be opened or closed at the same time. That is, during operation, either the air exhaust port 123 may be turned on or opened while the air return port 114 is turned off or closed, or the air exhaust port 123 may be turned off or closed while the air return port 114 is turned on or opened. In this way, only one air valve may be required to jointly control the air return port 114 and the air exhaust port 123. The second air valve 126 may be disposed between the air return port 114 and the air exhaust port 123. In a case where the tableware treatment device 100 operates in the drying mode, the second air valve 126 may be configured to open or turn on the air return port 114 and close or turn off the air exhaust port 123, allowing dry hot air in the air return channel 120 to return to the accommodating

chamber 112. In a case where the tableware treatment device 100 operates in the heat pump mode, the second air valve 126 may be configured to close or turn off the air return port 114 and open or turn on the air exhaust port 123, allowing the dry cool air in the air return channel 120 to be discharged out of the air return channel 120 through the air exhaust port 123.

[0083] That is, in a case where the tableware treatment device 100 operates in the drying mode, the first air valve 125 may be configured to open or turn on the air outlet 113 and close or turn off the air inlet 121, and the second air valve 126 may be configured to open or turn on the air return port 114 and close or turn off the air exhaust port 123. In this way, the moist hot air in the accommodating chamber 112 may be enabled to enter into the air return channel 120 through the air outlet 113, thereby being dried by the first heat exchanger 134 and the second heat exchanger 136 to form dry hot air. The dry hot air in the air return channel 120 may flow back into the accommodating chamber 112 through the air return port 114. In a case where the tableware treatment device 100 operates in the heat pump mode, the first air valve 125 may be configured to close or turn off the air outlet 113 and open or turn on the air inlet 121, and the second air valve 126 may be configured to close or turn off the air return port 114 and open or turn on the air exhaust port 123. In this way, external air may be enabled to enter into the air return channel 120 through the air inlet 121, thereby exchanging heat with the first heat exchanger 134 or the second heat exchanger 136 to form dry cool air. The dry cool air in the air return channel 120 may be further discharged out of the air return channel 120 through the air exhaust port 123.

[0084] In some embodiments, the air outlet 113 and the air return port 114 may be disposed on a same side of the housing 110. Such arrangement may facilitate the layout of the air return channel 120, reduce the space occupied by the air return channel 120, and allow the tableware treatment device 100 to be more compact, thereby enabling more space to be reserved for accommodating the tableware and increasing the capacity of the tableware treatment device 100.

[0085] In some embodiments, the second heat exchanger 136 may be connected to an inlet 162 of the compressor 160. In a case where the tableware treatment device 100 is in the heat pump mode, both the first heat exchanger 134 and the second heat exchanger 136 may function as evaporators. In a case where the second heat exchanger 136 functions as an evaporator, a heat exchange medium flowing out of the second heat exchanger 136 may need to flow back into the compressor 160. Therefore, the second heat exchanger 136 may be directly connected to the inlet 162 of the compressor 160 to ensure return flow of the heat exchange medium.

[0086] As shown in FIG. 4, in some embodiments, the first throttling device 140 may include a plurality of throttling assemblies 141. Each of the plurality of throttling assemblies 141 may include a throttling valve 141a and a

control valve 141b connected to the throttling valve 141a in series. The plurality of throttling assemblies 141 may be connected in series. The control valve 141b of at least one of the plurality of throttling assemblies 141 may be connected in parallel to at least one of the other of the plurality of throttling assemblies 141.

[0087] Each throttling assembly 141 may include the throttling valve 141a and the control valve 141b connected to the throttling valve 141a in series. The control valve 141b of at least one of the throttling assemblies 141 being connected in parallel to at least one of the other throttling assemblies 141, may indicate that in the throttling assemblies 141, the control valve 141b of one throttling assembly 141 is connected to another throttling assembly 141 in parallel. In a case where the control valve 141b of the one throttling assembly 141 is turned on, the another throttling assembly 141 may be short-circuited and only the throttling valve 141a corresponding to the control valve 141b of the one throttling assembly 141 may be conducted. In a case where the control valve 141b of the one throttling assembly 141 is turned off and the control valve 141b of the another throttling assembly 141 connected in parallel to the control valve 141b of the one throttling assembly 141 is turned on, two throttling valves 141a may be conducted simultaneously. It can be understood that, the control valves 141b may cooperate with each other to conduct different numbers of the throttling valves 141a to obtain different flow rates. By cooperation of the different control valves 141b, the number of the throttling valves 141a may be adjusted to regulate the flow rate. In this way, throttling valves 141a with different flow rates may not be required, thereby reducing the cost of variable flow regulation.

[0088] Opening degrees of the throttling valves 141a may be identical or different. The flow rates may be adjusted based on the number of throttling valves being connected.

[0089] To more clearly describe the above structure, the first throttling device 140 including two throttling assemblies is illustrated by way of example below.

[0090] In some embodiments, the plurality of throttling assemblies may include a first throttling assembly 142 and a second throttling assembly 143. The first throttling assembly 142 may include a first throttling valve 142a and a first control valve 142b. The second throttling assembly 143 may include a second throttling valve 143a and a second control valve 143b. The first control valve 142b may be connected to the first throttling valve 142a in series. The second control valve 143b may be connected to the second throttling valve 141a in series. The second control valve 143b may be connected in parallel to the first throttling valve 142a and the first control valve 142b.

[0091] That is, the second control valve 143b may be connected to two ends of the first throttling assembly 142, respectively, and may be connected to the entire first throttling assembly 142 in parallel. In a case where the first control valve 142b is turned on and the second

control valve 143b is turned off, the first throttling valve 142a and the second throttling valve 141a may operate simultaneously. The first throttling valve 142a and the second throttling valve 141a may be configured to perform flow restriction simultaneously. In a case where the second control valve 143b is turned on and the first control valve 142b is turned off, only the second throttling valve 141a may operate. In this case, only the second throttling valve 141a may be configured to perform flow restriction.

[0092] As shown in FIG. 5, in a case where the throttling device 140 further includes a third throttling assembly 145, the third throttling assembly 145 may include a third throttling valve 145a and a third control valve 145b connected to the third throttling valve 145a. The third throttling valve 145a may be connected to the second throttling valve 141a in series. The third control valve 145b may be connected to the second throttling assembly 143 in parallel. In a case where the first control valve 142b is turned on and both the second control valve 143b and the third control are turned off, the first throttling valve 142a, the second throttling valve 141a, and the third throttling valve 145a may operate simultaneously. The first throttling valve 142a, the second throttling valve 141a, and the third throttling valve 145a may be configured to perform flow restriction simultaneously. In a case where the second control valve 143b is turned on and both the first control valve 142b and the third control valve 145b are turned off, the second throttling valve 141a and the third throttling valve 145a may operate and the first throttling valve 142a may not operate. In a case where the third control valve 145b is turned on and both the first control valve 142b and the second control valve 143b are turned off, only the third throttling valve 145a may operate.

[0093] A connection relationship among the multiple throttling assemblies, the control valves 141b, the throttling valves 141b, or other components may be described as follows. In a case where the multiple throttling assemblies further include other throttling assemblies, the connection relationship may refer to the case in which the multiple throttling assemblies include the first throttling assembly 142 and the second throttling assembly 143, and the corresponding connection relationship will not be repeated.

[0094] In some embodiments, the first control valve 142b, the first throttling valve 142a, and the second throttling valve 141a may be sequentially connected. A first connection point 146a may be provided or defined between the first throttling valve 142a and the second throttling valve 141a. An end of the second control valve 143b may be connected to the first connection point 146a. That is, the second control valve 143b may be connected between the first throttling valve 142a and the second throttling valve 141a to short-circuit the first throttling valve 142a.

[0095] In some embodiments, an end of the second control valve 143b away from the first connection point 146a may be connected to an end of the first control valve

142b away from the first throttling valve 142a, thereby forming an input point 146b. An end of the second throttling valve 141a away from the first throttling valve 142a may form an output point 146c.

[0096] In some embodiments, the input point 146b and the output point 146c may be configured to connect with external components. In a case where the first throttling device 140 is disposed between two heat exchangers, the input point 146b and the output point 146c may be respectively connected to the two heat exchangers. The input point 146b may be connected to the second heat exchanger 136. The input point 146b may be connected to the first heat exchanger 134.

[0097] In some embodiments, the first throttling valve 142a may be connected to the second throttling valve 141a in series.

[0098] It should be noted that a structure of the second throttling device 190 may be completely the same as or different from a structure of the first throttling device 140. In a case where the structure of the second throttling device 190 is the same as the structure of the first throttling device 140, the structure of the second throttling device 190 may refer to the structure of the first throttling device 140, which will not be repeated.

[0099] In the drying system of the tableware treatment device 100 based on some embodiments of the present disclosure, the second heat exchanger 136 may function as a condenser and the first heat exchanger 134 may function as an evaporator, so the power of the second heat exchanger 136 may be higher than the power of the first heat exchanger 134. The power of the heat pump system where the second heat exchanger 136 is connected to the third heat exchanger 154 and functions as an evaporator may be greater than the power of the heat pump system where the first heat exchanger 134 may be connected to the third heat exchanger 154 and functions as an evaporator. During the washing process, the power requirement for the heat pump system varies due to the washing mode, actual loading capacity, etc., so the first heat exchanger 134 or the second heat exchanger 136 may be selected based on the operating parameter of the tableware treatment device 100, thereby improving the heat pump power and reducing the overall energy consumption of the device.

[0100] Based on a same inventive concept, embodiments of the present disclosure further provide a tableware treatment control method. The tableware treatment control method according to some embodiments of the present disclosure may be applied to the above-mentioned tableware treatment device 100. The tableware treatment control method according to some embodiments of the present disclosure may improve the heat pump power and reduce the overall energy consumption of the device.

[0101] The structure of the tableware treatment device 100 will not be repeated here. The tableware treatment control method according to some embodiments of the present disclosure may be configured to select whether

the first heat exchanger 134 functions as an evaporator or the second heat exchanger 136 functions as an evaporator based on the operating parameter of the tableware treatment device 100 in the heat pump mode. The tableware treatment control method may include operations executed by blocks S100-S500 as follows.

[0102] As shown in FIG. 6, at block S100, in response to a heating signal of the tableware treatment device 100, the circulation pump 152 may be controlled to turn on and the first reversing valve 172 may be controlled to enable the outlet 164 of the compressor 160 to be in communication with the third heat exchanger 154.

[0103] In a case where the heating signal is received, it indicates that the washing water needs to be heated and the heat pump mode needs to be turned on. Therefore, the circulation pump 152 may be turned on to enable the washing water in the accommodating chamber 112 to enter the heat pump channel 150. Besides, the first communication port 172a and the third communication port 172c may be in communication with each other, so that the high-temperature and high-pressure heat exchange medium flowing out of the outlet 164 of the compressor 160 may flow to the third heat exchanger 154.

[0104] At block S200, the operating parameter of the tableware treatment device 100 may be obtained.

[0105] Since the first heat exchanger 134 and the second heat exchanger 136 may be selected based on different operating parameters, whether the first heat exchanger 134 or the second heat exchanger 136 is selected to function as an evaporator may be determined based on the operating parameter.

[0106] In some embodiments, the operating parameter may include image information in the accommodating chamber 112, a heating temperature value carried in the heating signal, or a type of the heating signal, such as accelerated heating or normal heating.

[0107] At block S300, whether a condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied may be determined based on the operating parameter.

[0108] Since the powers of the first heat exchanger 134 and the second heat exchanger 136 are different from each other, whether the first heat exchanger 134 or the second heat exchanger 136 functions as an evaporator may be selected based on the operating parameter. Whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied may be determined based on the above-mentioned operating parameter. According to some embodiments of the present disclosure, a first method, a second method, and a third method may be provided to determine whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied. The first way may include operations executed by blocks S312-S318, the second method may include operations executed by blocks S322-S328, and the third method may include

operations executed by blocks S332-S336.

[0109] As shown in FIG. 7, at block S312, the heating temperature value carried in the heating signal may be obtained. The operating parameter may include the heating temperature value.

[0110] In some embodiments, the heating temperature value in the heating signal may be received during a process of receiving the heating signal. The temperature value may be set when the tableware treatment device 100 leaves the factory, or may be set by the user during use. In other embodiments, the washing process may be defined with different temperature levels/settings, and the user may select the heating temperature value corresponding to the temperature settings according to different tableware.

[0111] The heating temperature value may be a target temperature value to which the washing water needs to be heated.

[0112] At block S314, whether the heating temperature value is greater than or equal to a set temperature value may be determined.

[0113] After receiving the heating temperature value, whether the heating temperature value is greater than or equal to the set temperature value may be determined. The larger the set temperature value, the higher the temperature to which the washing water is heated, and the greater the power requirement for the evaporator. Whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied may be determined based on a relationship between the heating temperature value and the set temperature value.

[0114] In some embodiments, the set temperature value may range from 50 degrees Celsius to 60 degrees Celsius.

[0115] At block S316, in a case where the heating temperature value is greater than or equal to the set temperature value, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0116] In a case where the heating temperature value is greater than or equal to the set temperature value, it indicates that the heating temperature value is relatively high, and a larger power may be required to quickly heat the washing water to the heating temperature value. In this case, the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied. Therefore, the second heat exchanger 136 and the third heat exchanger 154 may be in communication with each other, so that the second heat exchanger 136 with larger power may function as an evaporator to heat the washing water, thereby improving the heat pump efficiency.

[0117] At block S318, in a case where the heating temperature value is less than the set temperature value, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the

second heat exchanger 136 is not satisfied.

[0118] In a case where the heating temperature value is less than or equal to the set temperature value, it indicates that the heating temperature value is relatively low, and the first heat exchanger 134 with smaller power may function as an evaporator, thereby ensuring that the washing water may be heated to the heating temperature value and reducing energy consumption. Therefore, the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied.

[0119] Blocks S312-S318 describe determining whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied based on the heating temperature value. Blocks S322-S328 describe determining whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied based on the image information in the accommodating chamber 112.

[0120] As shown in FIG. 8, at block S322, the image information in the accommodating chamber 112 may be obtained. The operating parameter may include the image information.

[0121] The image information in the accommodating chamber 112 may be an actual loading capacity in the accommodating chamber 112. The actual loading capacity in the accommodating chamber 112 may be analyzed based on the image information. The greater the actual loading capacity, the greater the demand for washing water. The less the actual loading capacity, the smaller the demand for washing water.

[0122] At block S324, whether the actual loading capacity in the accommodating chamber 112 is greater than or equal to a set loading capacity may be determined based on the image information.

[0123] After the image information is obtained, the actual loading capacity in the accommodating chamber 112 may be analyzed based on the image information, and whether the actual loading capacity is greater than the set loading capacity may be determined. In a case where the actual loading capacity is greater than the set loading capacity, it indicates that the actual loading capacity in the accommodating chamber 112 may be relatively large, and the demand for washing water may be relatively large. In a case where the actual loading capacity is less than the set loading capacity, it indicates that the actual loading capacity in the accommodating chamber 112 may be relatively small, and the demand for washing water may be relatively small. The demand for washing water may be determined based on the actual loading capacity, and the first heat exchanger 134 or the second heat exchanger 136 may be selected to function as an evaporator.

[0124] In some embodiments, the set loading capacity may be half of a rated capacity of the accommodating chamber 112.

[0125] At block S326, in a case where the actual load-

ing capacity in the accommodating chamber 112 is greater than or equal to the set loading capacity, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0126] In a case where the actual loading capacity is greater than or equal to the set loading capacity, it indicates that the actual loading capacity in the accommodating chamber 112 may be relatively large, the demand for washing water may be relatively large, and a large amount of washing water needs to be provided in a short time. At this time, the power demand for the evaporator may be relatively high, a high-power evaporator may be needed, and the second heat exchanger 136 may be selected as an evaporator. That is, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0127] At block S328, in a case where the actual loading capacity in the accommodating chamber 112 is less than the set loading capacity, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied.

[0128] In a case where the actual loading capacity is less than the set loading capacity, it indicates that the actual loading capacity in the accommodating chamber 112 may be relatively small, and the demand for washing water may be relatively small. At this time, the power demand for the evaporator may be relatively low, a small-power evaporator may be selected, and the first heat exchanger 134 may be selected as an evaporator. That is, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied.

[0129] Blocks S322-S328 are for determining whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied based on the image information in the accommodating chamber 112. Blocks S332-S338 are for determining whether the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied based on the type of the heating signal.

[0130] As shown in FIG. 9, at block S332, whether the heating signal is an accelerated heating signal may be determined.

[0131] After receiving the heating signal, the type of the heating signal may be determined, i.e., whether the heating signal is a normal heating signal or an accelerated heating signal may be determined. In a case where the heating signal is the accelerated heating signal, the washing water needs to be heated to the heating temperature value in a short time, and the power demand for the evaporator may be relatively high, so a high-power evaporator needs to be selected.

[0132] At block S334, in a case where the heating signal is the accelerated heating signal, it may be deter-

mined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0133] In a case where the heating signal is the accelerated heating signal, the washing water needs to be heated to the heating temperature value in a short time, and the power demand for the evaporator may be relatively high, so a high-power evaporator needs to be selected. Therefore, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0134] At block S336, in a case where the heating signal is not the accelerated heating signal, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied.

[0135] In a case where the heating signal is not the accelerated heating signal, the power demand for the evaporator may be relatively low, so a small-power evaporator needs to be selected. Therefore, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied.

[0136] It should be noted that the above description provides three different determination methods. As long as a determination result of any one of the above three methods meets a corresponding determination condition, it may be determined that the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied.

[0137] As shown in FIG. 6, at block S400, in a case where the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied, the second reversing valve 174 may be controlled to enable the third heat exchanger 154 to be in communication with the second heat exchanger 136.

[0138] In some embodiments, in a case where the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is satisfied, it indicates that a high-power evaporator may be needed for heat exchange. Therefore, the second connection port 174b may be controlled to communicate with the third connection port 174c, enabling the heat exchange medium flowing out of the third heat exchanger 154 to flow to the second heat exchanger 136.

[0139] At block S500, in a case where the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied, the second reversing valve 174 may be controlled to enable the third heat exchanger 154 to be in communication with the first heat exchanger 134.

[0140] In a case where the condition for enabling the third heat exchanger 154 to be in communication with the second heat exchanger 136 is not satisfied, it indicates that a small-power evaporator may be selected for heat exchange. Therefore, the first connection port 174a may

be controlled to communicate with the third connection port 174c, enabling the heat exchange medium flowing out of the third heat exchanger 154 to flow to the first heat exchanger 134.

[0141] In the tableware treatment control method according to some embodiments of the present disclosure, the power requirement for the heat pump system varies due to a washing mode, actual loading capacity, etc., so the first heat exchanger 134 or the second heat exchanger 136 may be selected based on an operating parameter of the tableware treatment device 100, thereby improving the heat pump power and reducing the overall energy consumption of the device.

[0142] In the description of the present specification, the terms "one embodiment," "some embodiments," "example," "concrete example," or "some examples," and the like, may indicate that certain features, structures, materials, or characteristics described in connection with the embodiment or example may be included in at least one embodiment or example of the present disclosure. The schematic expression of such terms herein may not necessarily refer to the same embodiment or example. Furthermore, the features, structures, materials, or characteristics described may be combined in one or more embodiments or examples in any suitable manner. In addition, those skilled in the art may combine and integrate different embodiments or examples described herein.

[0143] Moreover, the technical solutions of the respective embodiments may be combined with each other, provided that such combinations can be implemented by those skilled in the art. When the combination of technical solutions may be contradictory or cannot be realized, it may be considered that such a combination does not exist and does not fall within the scope of protection of the present disclosure.

[0144] Although the embodiments of the present disclosure have been illustrated and described, those skilled in the art may understand that various changes, modifications, substitutions, and alterations may be made to these embodiments without departing from the principles and spirit of the present disclosure. The scope of the present disclosure is defined by the appended claims and their equivalents.

Claims

1. A tableware treatment device, comprising:

a housing, defining an accommodating chamber, an air outlet, an air return port, a water outlet, and a water return port, wherein the accommodating chamber is configured to accommodate a tableware, and the air outlet, the air return port, the water outlet, and the water return port are in communication with the accommodating chamber;

an air return channel, a fan, a first heat exchanger, a second heat exchanger, and a first throttling device, wherein the air return channel is in communication with the air outlet and the air return port; the fan, the first heat exchanger, and the second heat exchanger are disposed in the air return channel; the first heat exchanger is disposed adjacent to the air outlet, the second heat exchanger is disposed adjacent to the air return port, and the first throttling device is connected between the first heat exchanger and the second heat exchanger;

a heat pump channel, a circulation pump, and a third heat exchanger, wherein the heat pump channel is in communication with the water outlet and the water return port, and the circulation pump and the third heat exchanger are disposed in the heat pump channel; and

a compressor, a first reversing valve, and a second reversing valve, wherein a first heat exchanging valve is separately connected to an outlet of the compressor, the second heat exchanger, and the third heat exchanger, and is configured to enable the outlet of the compressor to be in communication with the second heat exchanger or the third heat exchanger, and the second reversing valve is separately connected to the first heat exchanger, the second heat exchanger, and the third heat exchanger, and is configured to enable the third heat exchanger to be in communication with the second heat exchanger or the first heat exchanger.

2. The tableware treatment device as claimed in claim 1, wherein the second reversing valve defines a first connection port, a second connection port, and a third connection port, wherein the first connection port is in communication with the first heat exchanger, the second connection port is in communication with the second heat exchanger, and the third connection port is in communication with the third heat exchanger.

3. The tableware treatment device as claimed in claim 2, further comprising a second throttling device, wherein the second throttling device is connected between the second heat exchanger and the third heat exchanger, and the first connection port is connected between the second heat exchanger and the first throttling device.

4. The tableware treatment device as claimed in any one of claims 1-3, wherein the first reversing valve comprises a first communication port, a second communication port, and a third communication port, wherein the first communication port is in communication with the outlet of the compressor, the second communication port is in communication with the

second heat exchanger, and the third communication port is in communication with the third heat exchanger.

5. The tableware treatment device as claimed in any one of claims 1-4, wherein the air return channel defines an air inlet and an air exhaust port, wherein:

the air inlet is defined between the first heat exchanger and the air outlet, and the air exhaust port is defined between the second heat exchanger and the air return port; and
in a case where the circulation pump is turned on, the air inlet and the air exhaust port are turned on, and the air outlet and the air return port are turned off.

6. The tableware treatment device as claimed in claim 5, further comprising a first air valve, wherein the first air valve is disposed between the air outlet and the air inlet, and the first air valve is configured to enable the air outlet to be in communication with the air return channel and the air inlet to be disconnected from the air return channel, or to enable the air outlet to be disconnected from the air return channel and the air inlet to be in communication with the air return channel.

7. The tableware treatment device as claimed in claim 5 or 6, further comprising a second air valve, wherein the second air valve is disposed between the air exhaust port and the air return port, and the second air valve is configured to enable the air exhaust port to be in communication with the air return channel and the air return port to be disconnected from the air return channel, or to enable the air exhaust port to be disconnected from the air return channel and the air return port to be in communication with the air return channel.

8. The tableware treatment device as claimed in any one of claims 1-7, wherein the air outlet and the air return port are defined on a same side of the housing.

9. The tableware treatment device as claimed in any one of claims 1-8, wherein the second heat exchanger is connected to an inlet of the compressor.

10. The tableware treatment device as claimed in any one of claims 1-9, wherein the first throttling device comprises a plurality of throttling assemblies, wherein each of the plurality of throttling assemblies comprises a throttling valve and a control valve connected to the throttling valve in series, wherein the control valve of at least one of the plurality of throttling assemblies is connected in parallel to at least one of others of the plurality of throttling assemblies.

11. The tableware treatment device as claimed in claim 10, wherein the plurality of throttling assemblies comprise a first throttling assembly and a second throttling assembly, wherein the first throttling assembly comprises a first throttling valve and a first control valve, and the second throttling assembly comprises a second throttling valve and a second control valve,

wherein the first control valve is connected to the first throttling valve in series, the second control valve is connected to the second throttling valve in series, and the second control valve is connected in parallel to the first throttling valve and the first control valve.

12. The tableware treatment device as claimed in claim 11, wherein:

the first control valve, the first throttling valve, and the second throttling valve are connected in sequence;

a first connection point is defined between the first throttling valve and the second throttling valve; and

an end of the second control valve is connected to the first connection point.

13. The tableware treatment device as claimed in claim 12, wherein:

an end of the second control valve away from the first connection point is connected to an end of the first control valve away from the first throttling valve, forming an input point; and

an end of the second throttling valve away from the first throttling valve forms an output point.

14. The tableware treatment device as claimed in any one of claims 11-13, wherein the first throttling valve is connected to the second throttling valve in series.

15. A tableware treatment control method, applied to the tableware treatment device as claimed in any one of claims 1-14 and comprising:

in response to a heating signal of the tableware treatment device, controlling the circulation pump to turn on and controlling the first reversing valve to enable the outlet of the compressor to be in communication with the third heat exchanger;

obtaining an operating parameter of the tableware treatment device;

determining whether a condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter;

controlling, in a case where the condition for enabling the third heat exchanger to be in com-

munication with the second heat exchanger is satisfied, the second reversing valve to enable the third heat exchanger to be in communication with the second heat exchanger; and controlling, in a case where the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied, the second reversing valve to enable the third heat exchanger to be in communication with the first heat exchanger.

16. The tableware treatment control method as claimed in claim 15, wherein in a case where the operating parameter comprises a heating temperature value, determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, comprises:

obtaining the heating temperature value carried in the heating signal; determining whether the heating temperature value is greater than or equal to a set temperature value; determining, in a case where the heating temperature value is greater than or equal to the set temperature value, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the heating temperature value is less than the set temperature value, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

17. The tableware treatment control method as claimed in claim 15 or 16, wherein in a case where the operating parameter comprises image information, determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, comprises:

obtaining the image information in the accommodating chamber; determining whether an actual loading capacity in the accommodating chamber is greater than or equal to a set loading capacity based on the image information; determining, in a case where the actual loading capacity in the accommodating chamber is greater than or equal to the set loading capacity, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the actual loading capacity in the accommodating chamber is less

than the set loading capacity, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

18. The tableware treatment control method as claimed in any one of claims 15-17, wherein determining whether the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied based on the operating parameter, comprises:

determining whether the heating signal is an accelerated heating signal; determining, in a case where the heating signal is the accelerated heating signal, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is satisfied; and determining, in a case where the heating signal is not the accelerated heating signal, that the condition for enabling the third heat exchanger to be in communication with the second heat exchanger is not satisfied.

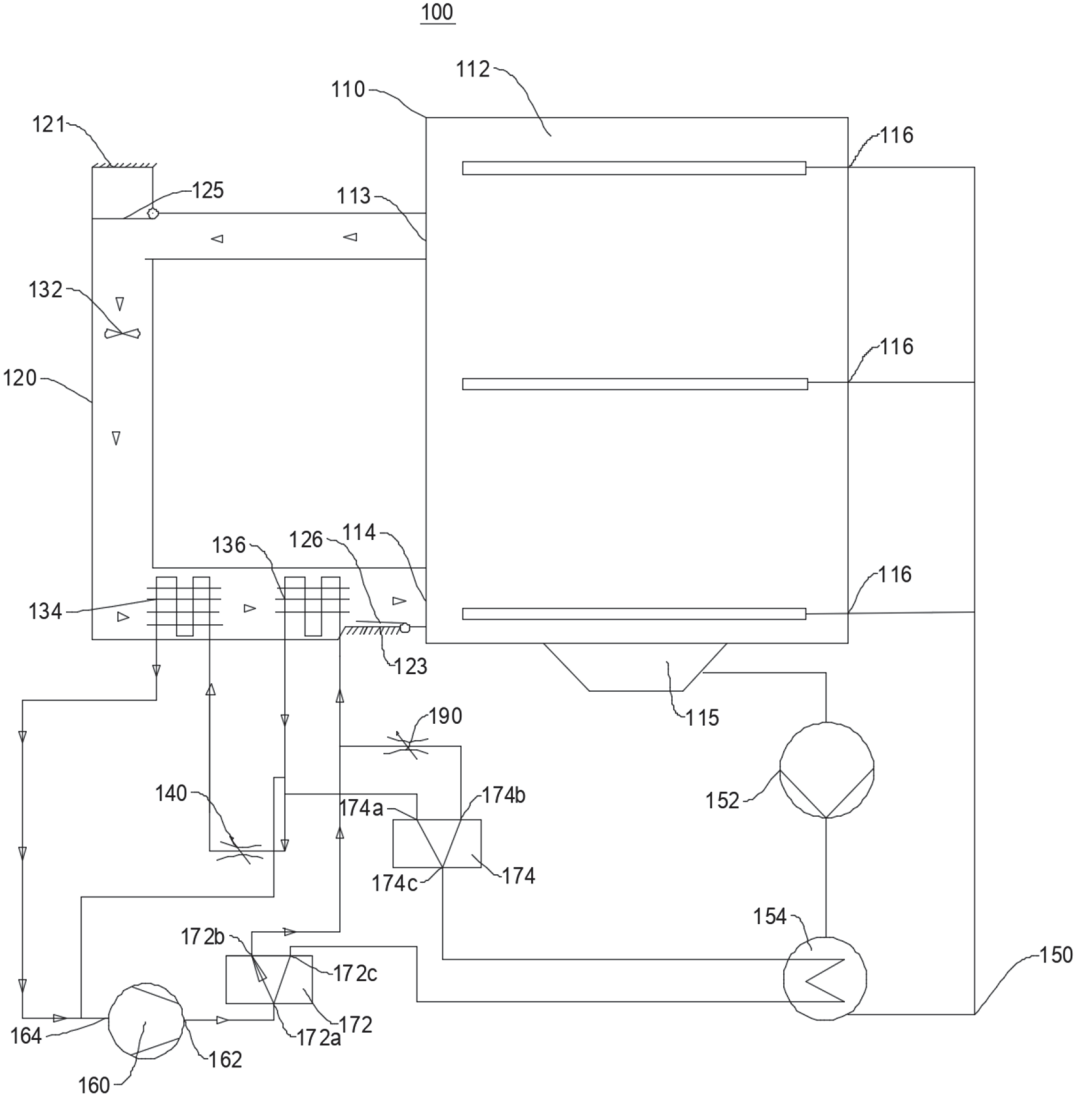


FIG. 1

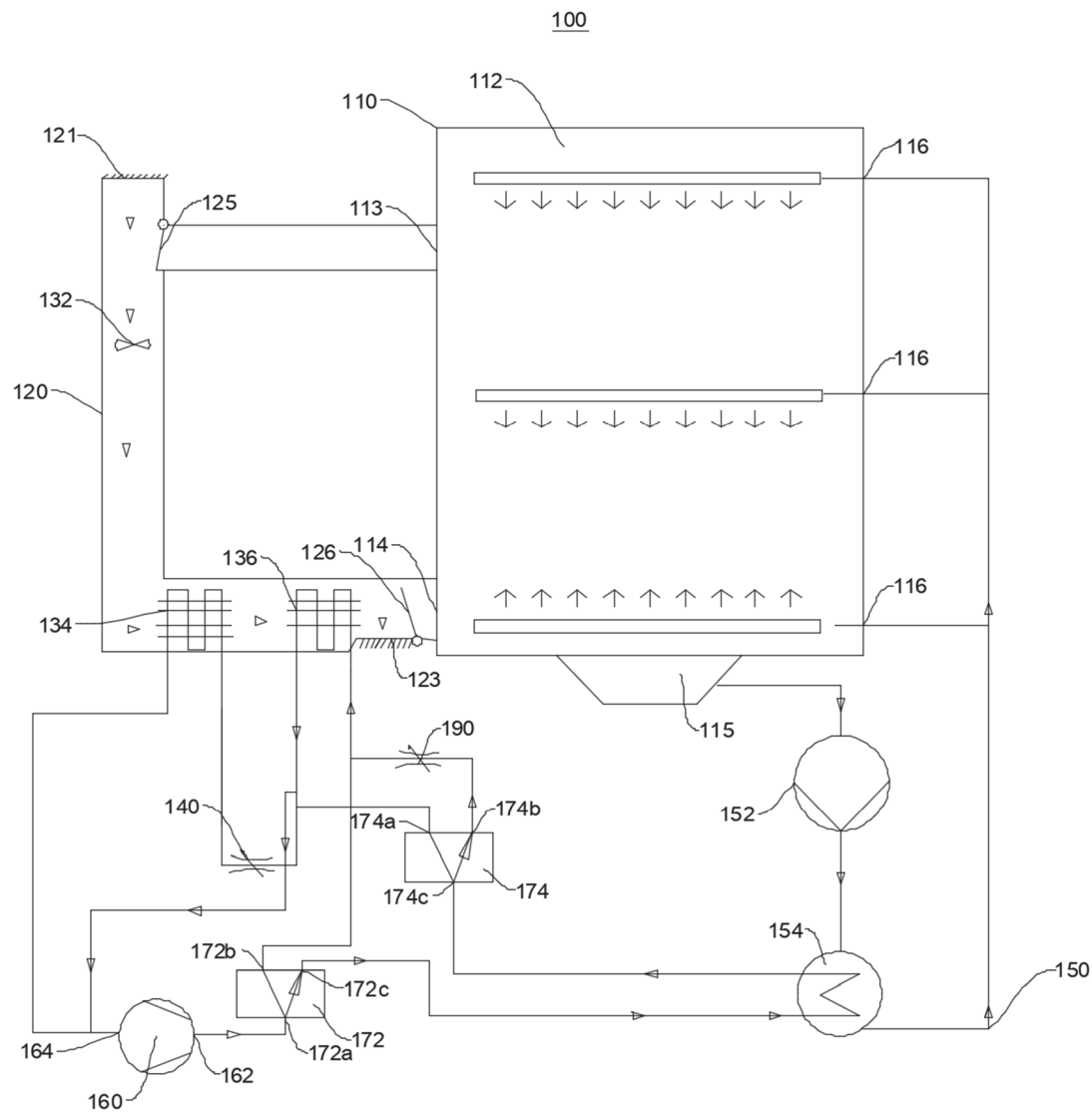


FIG. 2

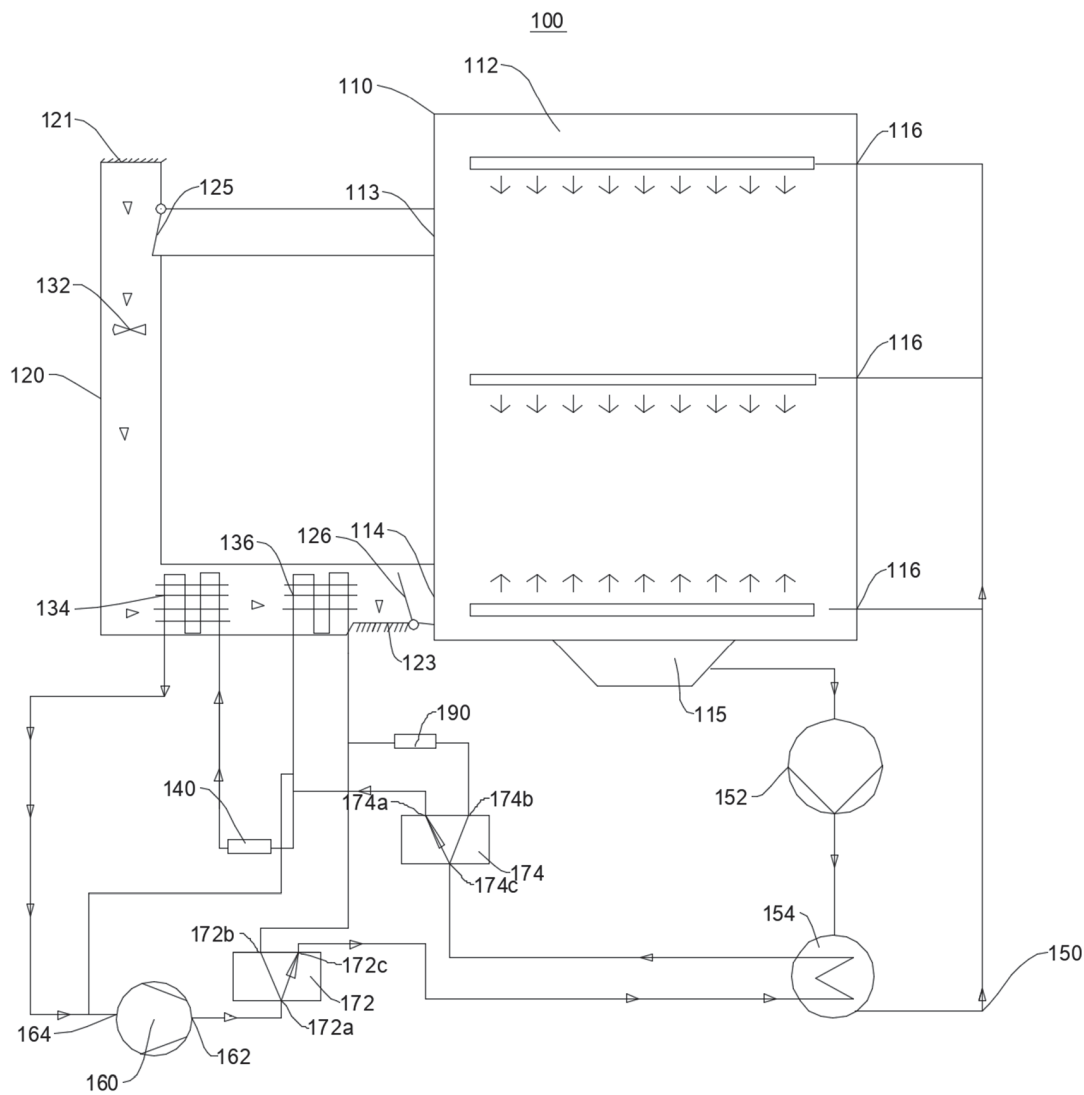


FIG. 3

140

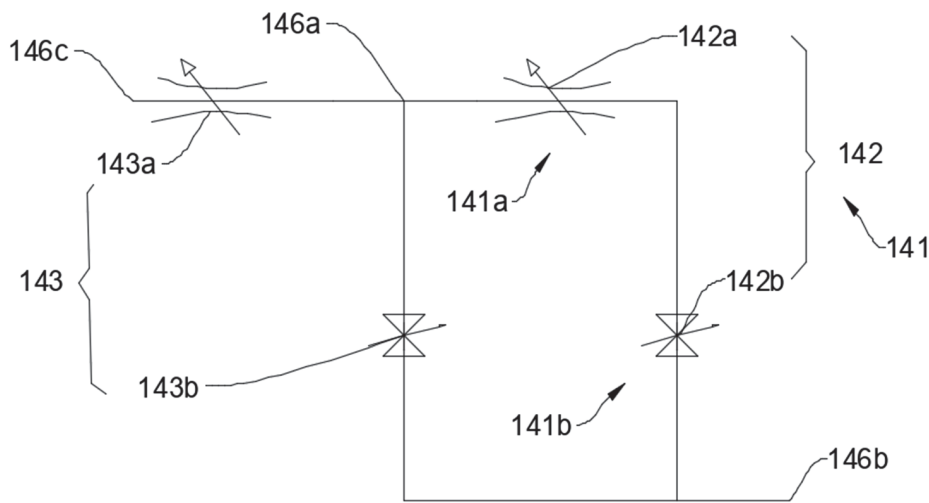


FIG. 4

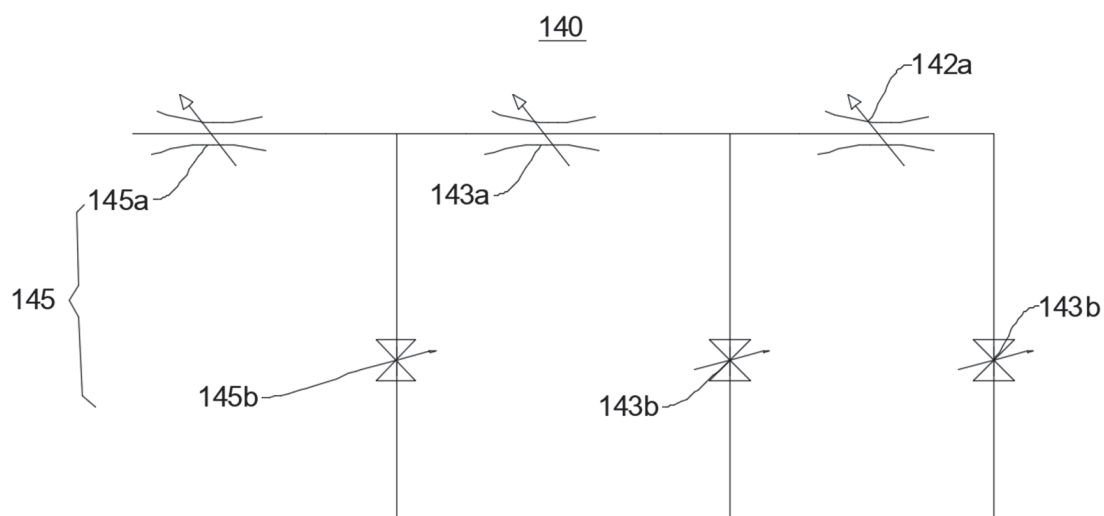


FIG. 5

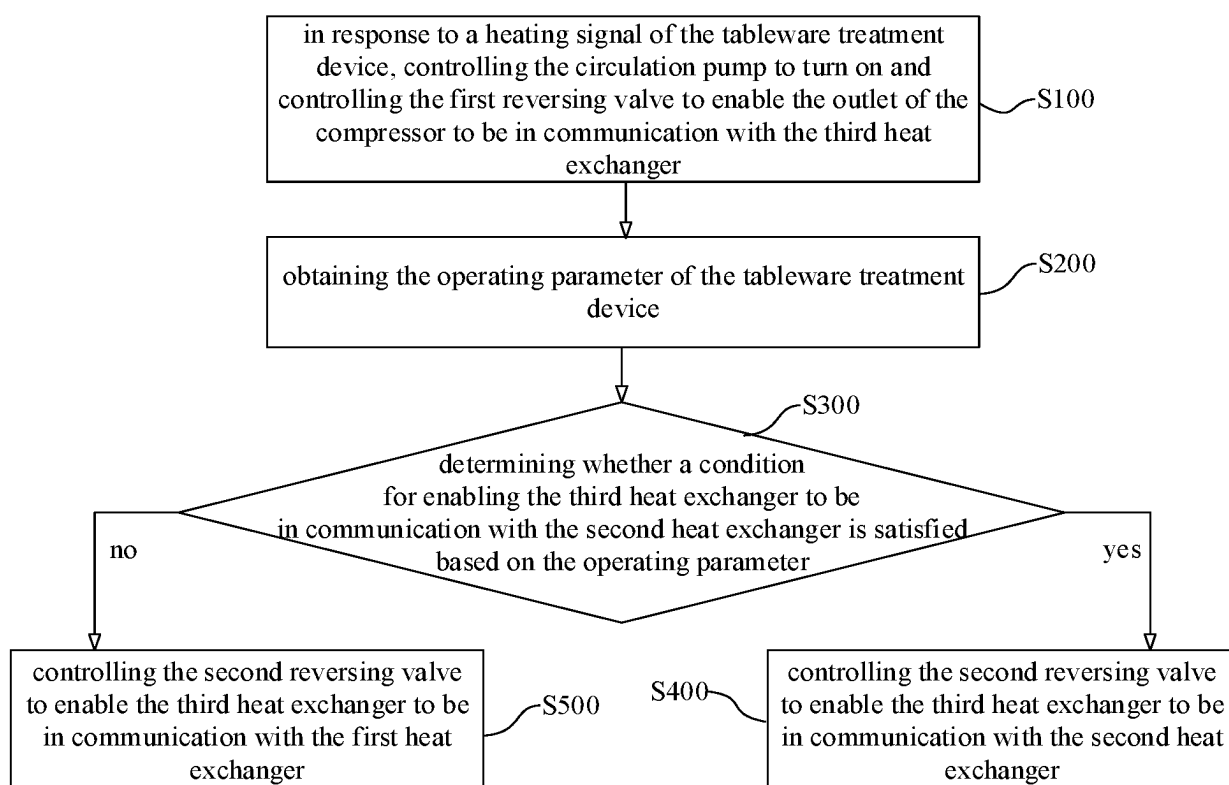
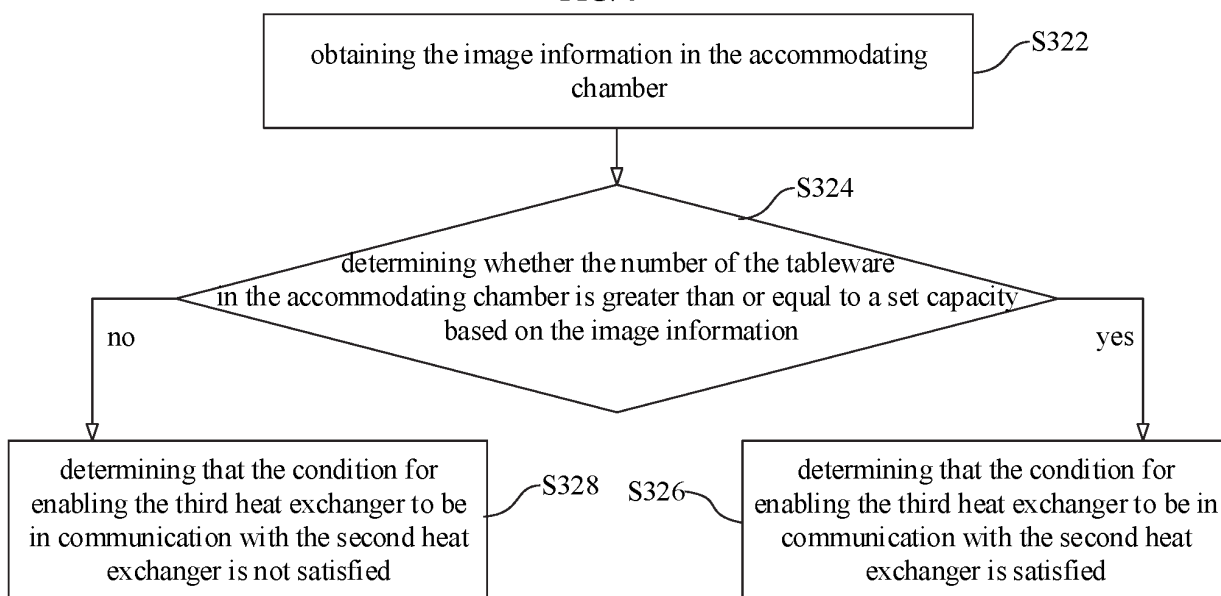
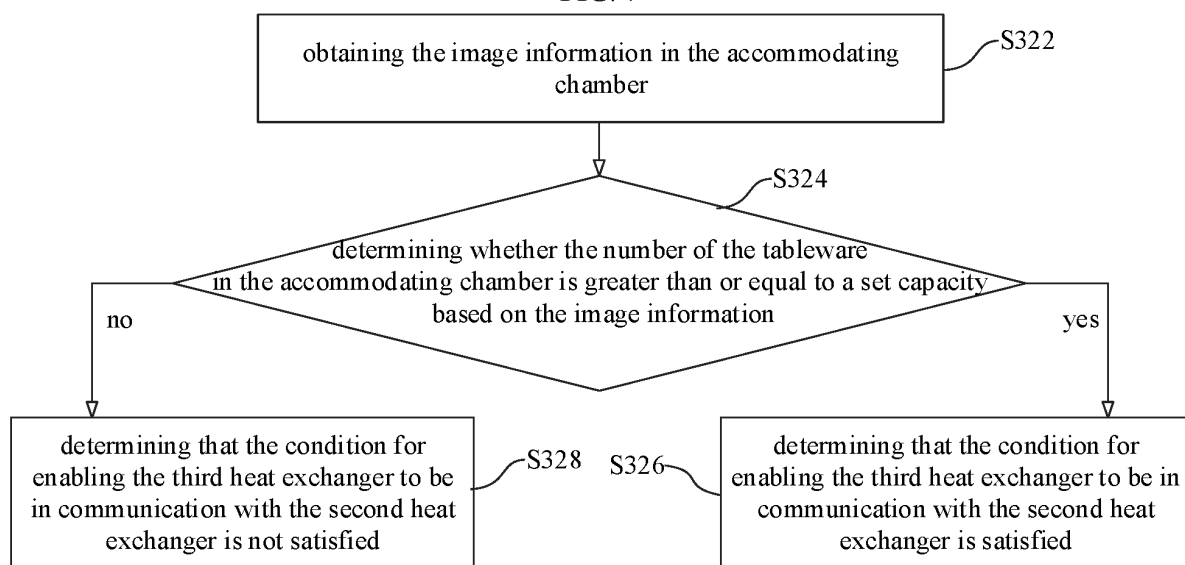
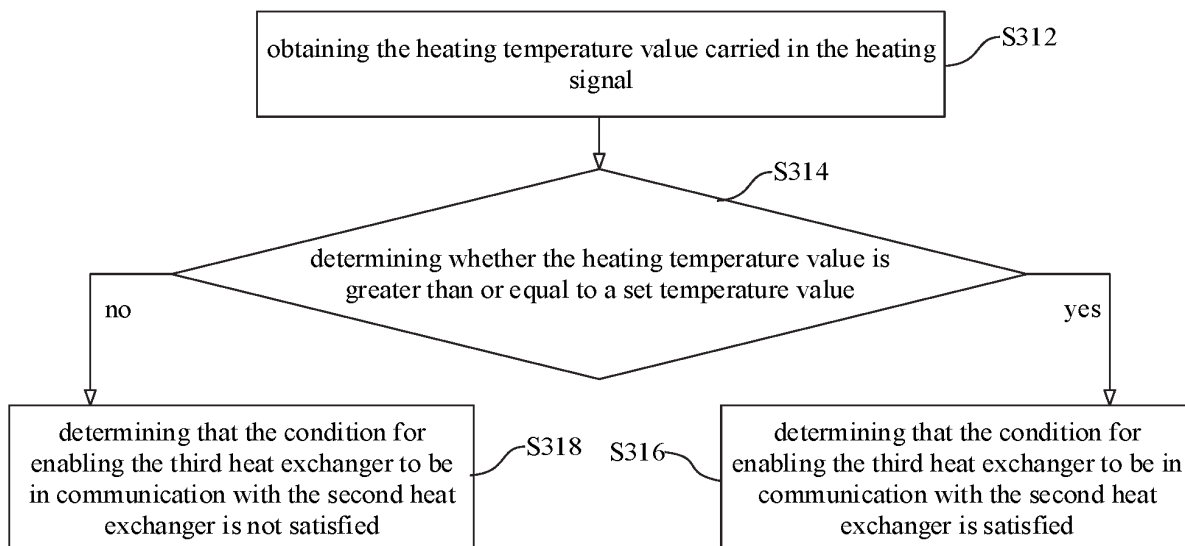


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/118781

A. CLASSIFICATION OF SUBJECT MATTER

A47L15/00(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)

IPC:A47L15/-

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)

CNXTX, ENTXTX, CNKI: 不同, 餐具, 大于, 导通, 低于, 第二, 阀, 分配, 高于, 功率, 换热器, 切换, 清洁, 清洗, 热泵, 筛选, 碗, 洗, 小于, 选取, 选用, 选择, 压缩机, 蒸发器, 指定, tableware, bowl, greater, conduct+, second, valve, distribut+, higher, power, heat exchanger, switch, wash+, clean+, less, choose, option, compressor, evaporator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 106606342 A (HANGZHOU SANHUA HOME APPLIANCE THERMAL MANAGEMENT SYSTEM CO., LTD.) 03 May 2017 (2017-05-03) description, paragraphs [0051]-[0073], and figure 1	1-14
A	CN 108113618 A (FOSHAN SHUNDE MIDEA WASHING APPLIANCES MFG. CO., LTD. et al.) 05 June 2018 (2018-06-05) entire document	1-18
A	CN 109381145 A (QINGDAO HAIER DISHWASHER CO., LTD.) 26 February 2019 (2019-02-26) entire document	1-18
A	CN 110151082 A (QINGDAO HAIER DISHWASHER CO., LTD.) 23 August 2019 (2019-08-23) entire document	1-18
A	CN 114795049 A (GREE ELECTRIC APPLIANCES INC. OF ZHUHAI) 29 July 2022 (2022-07-29) entire document	1-18

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

“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)

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

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

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

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

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

“&” document member of the same patent family

Date of the actual completion of the international search

05 November 2024

Date of mailing of the international search report

12 November 2024

Name and mailing address of the ISA/CN

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

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No

PCT/CN2024/118781

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0862889 A2 (PREMARK FEG LLC) 09 September 1998 (1998-09-09) entire document	1-18

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2024/118781

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	106606342	A	03 May 2017	None			
CN	108113618	A	05 June 2018	None			
CN	109381145	A	26 February 2019	None			
CN	110151082	A	23 August 2019	None			
CN	114795049	A	29 July 2022	None			
EP	0862889	A2	09 September 1998	EP	0862889	A3	07 April 1999
				DE	19707287	A1	03 September 1998

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 202311751244 [0001]