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(54) DRYER

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(57) **ABSTRACT**

A heat pump type dryer is provided that enhances supercooling performance using condensation water. The circulation type heat pump dryer may include a cabinet, a drum, a drying duct that circulates dry air, an evaporator, a condenser, a compressor and an expansion apparatus. The condenser may include a first condenser that liquefies a high-temperature, high-pressure refrigerant circulated from the compressor, and a second condenser that condenses the refrigerant condensed by the first condenser again. The second condenser may be formed below a condensation water level, the condensation water being accumulated at a lower portion of the drying duct, below the first condenser, to cool the second condenser using condensation water chilled by the evaporator.

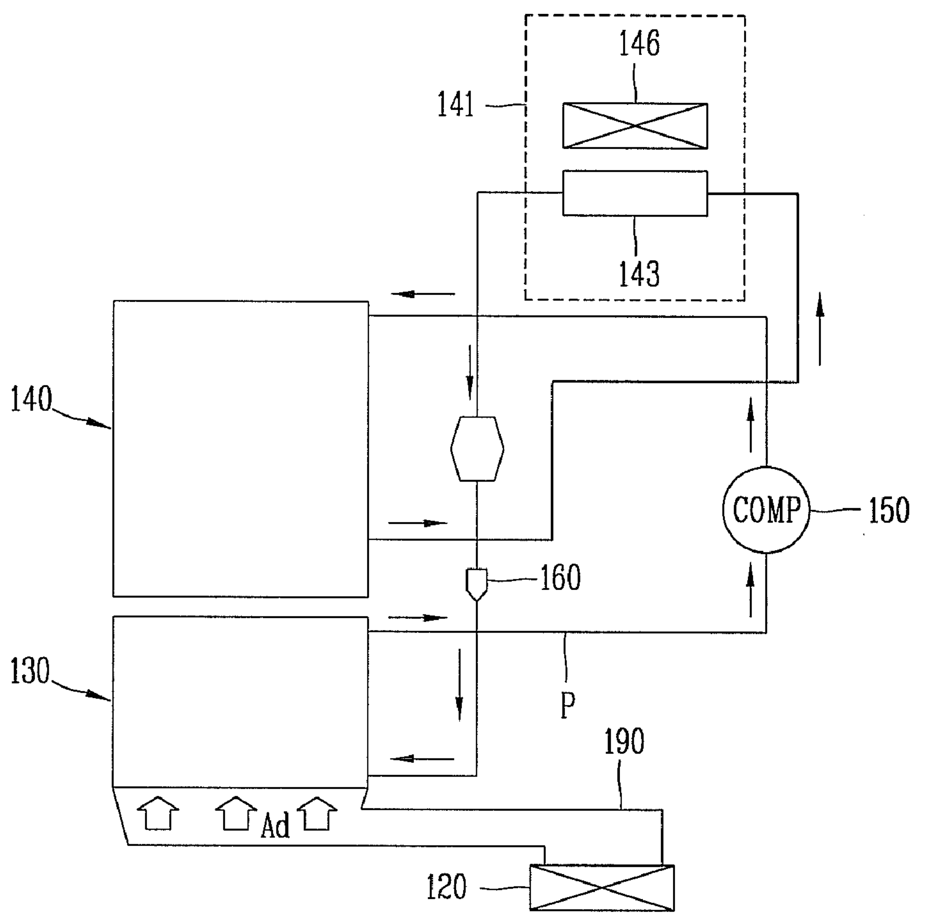


FIG. 1

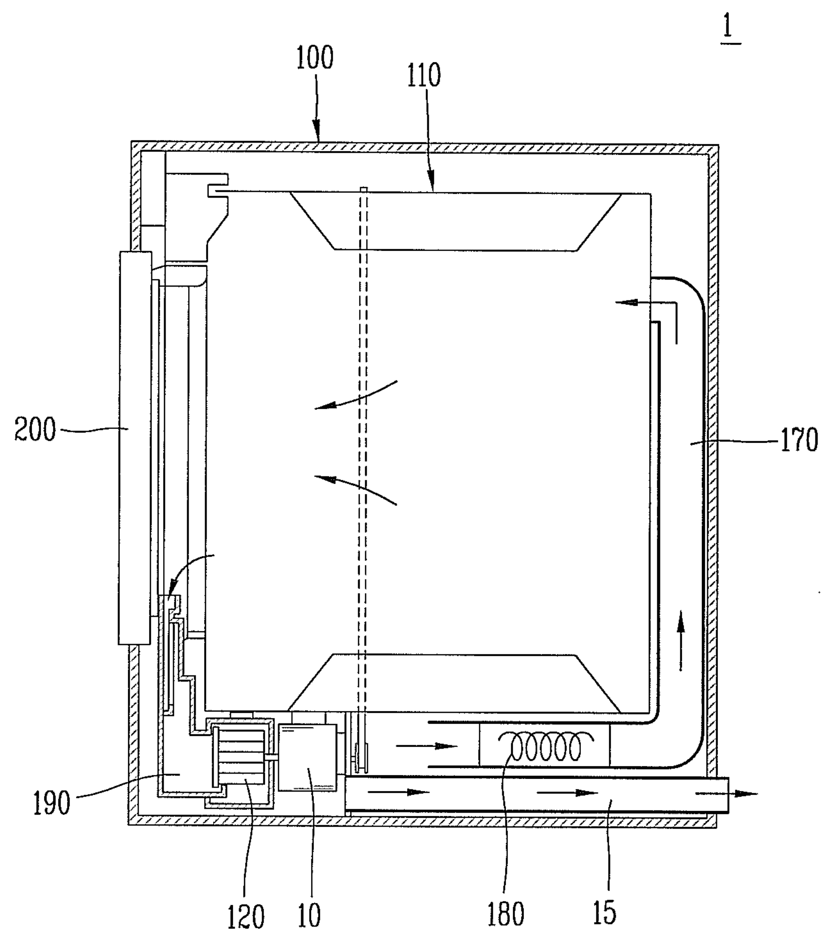


FIG. 2

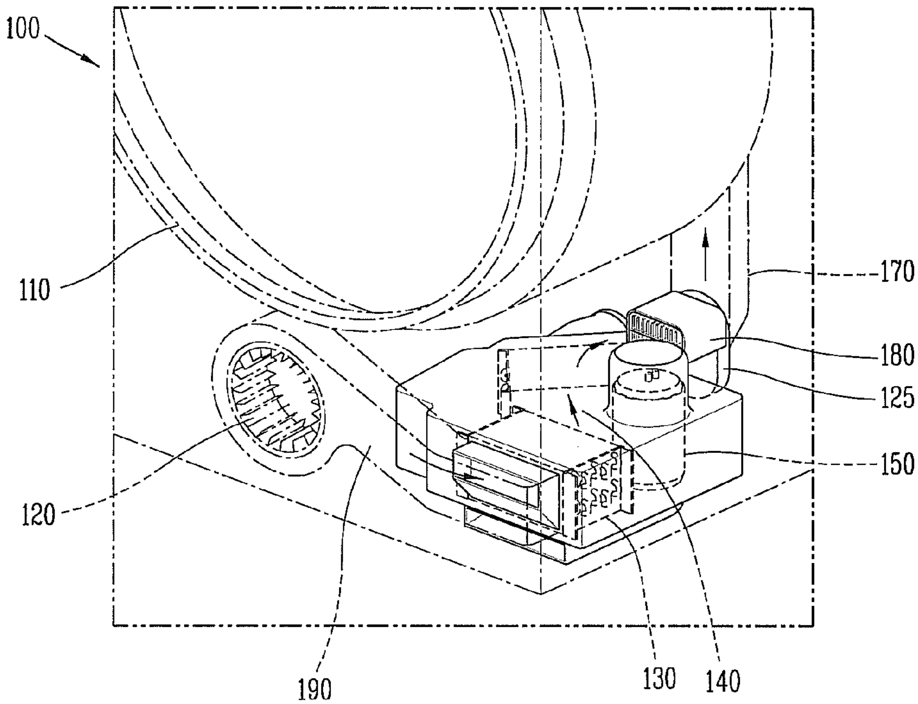

100
110
120
190
130
140
150
125
180
170

FIG. 3

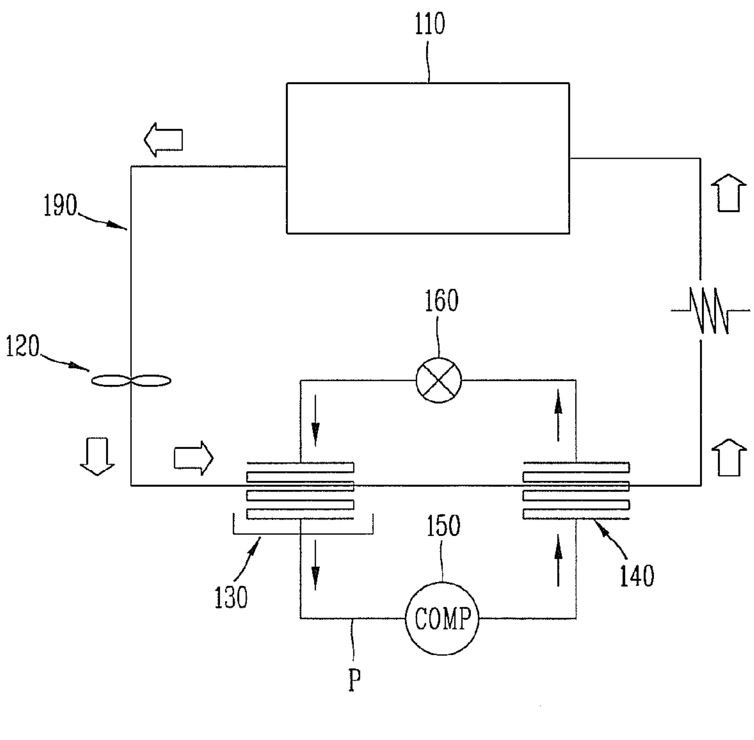
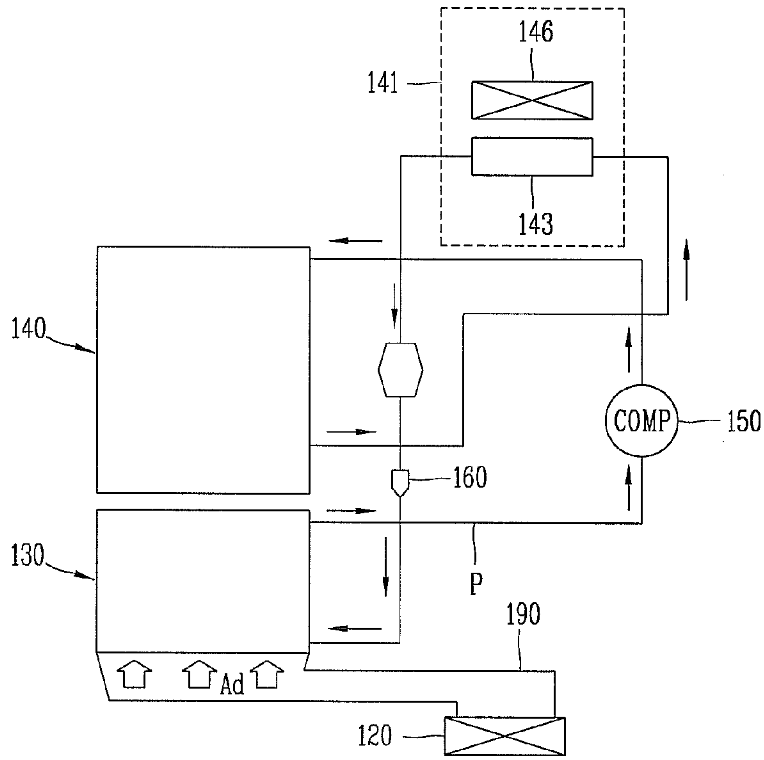
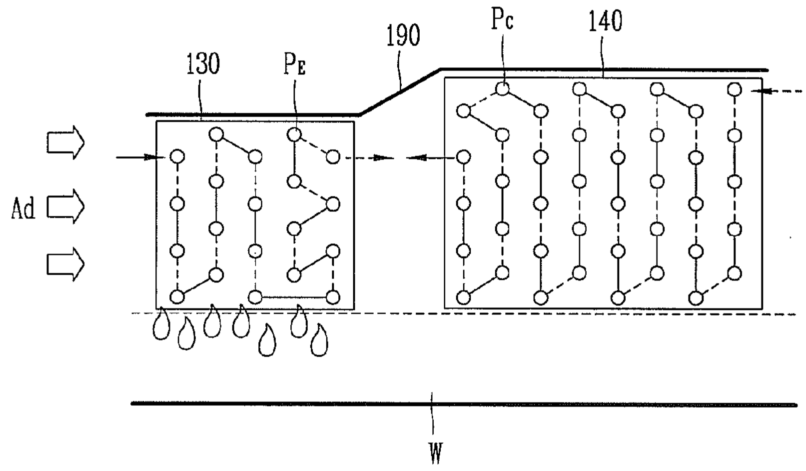

110
190
120
160
130
150
COMP
140
P

FIG. 4



146
141
143
140
COMP
150
160
130
P
190
Ad
120

FIG. 5



130
PE
190
Pc
140
Ad
W

FIG. 6

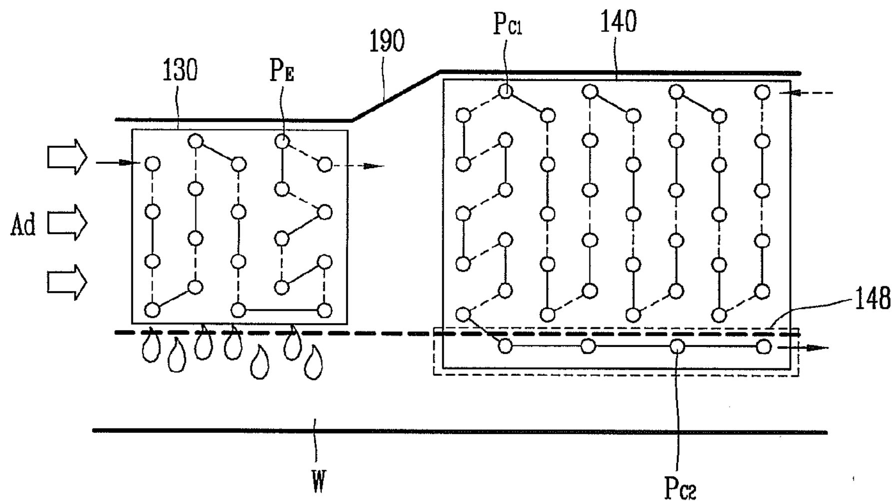
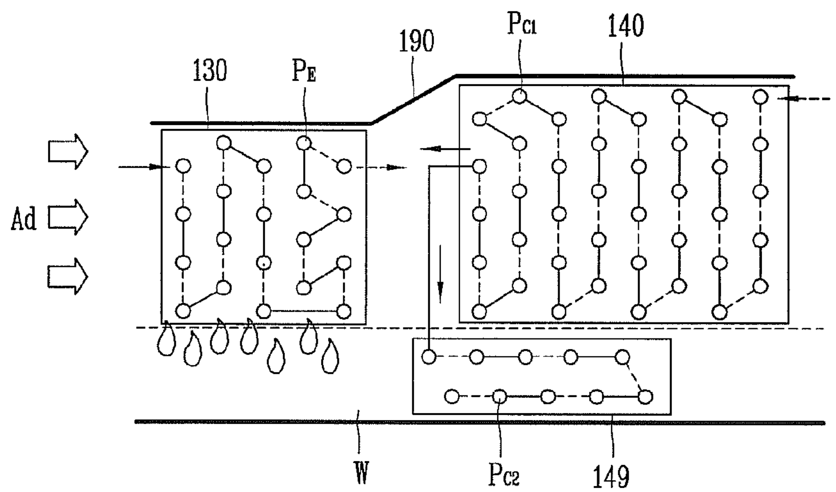


FIG. 7



DRYER

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority under 35 U.S.C. §119 to Korean Application No. 10-2012-0117467 filed on Oct. 22, 2012, whose entire disclosure is hereby incorporated by reference.

BACKGROUND

[0002] 1. Field

[0003] This relates to a dryer, and more particularly, to a heat pump type dryer.

[0004] 2. Background

[0005] In a laundry treating apparatus having a drying function, after washing and dehydration is complete, hot air may be supplied into the drum to evaporate moisture from the laundry, thereby drying the laundry. Such a dryer may include a drum rotatably provided within a cabinet, a drive motor to drive the drum, a blower fan to blow air into the drum, and a heating device to heat air conveyed into the drum. The heating device may use high-temperature electric resistance heat, or combustion heat generated by combusting gas.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The embodiments will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

[0007] FIG. **1** is a side view of an internal structure of an exemplary dryer;

[0008] FIG. **2** is a partial detail view of a circulation type heat pump within the dryer shown in FIG. **1**;

[0009] FIG. **3** is a schematic diagram of a drying process of the heat pump;

[0010] FIG. **4** is a schematic diagram of a circulation path of a refrigerant using an additional condenser, according to embodiments as broadly described herein;

[0011] FIG. **5** illustrates dryer air passing through an evaporator and condenser;

[0012] FIG. **6** illustrates application of an additional condenser according to another embodiment as broadly described herein; and

[0013] FIG. **7** illustrates application of an additional condenser according to still another embodiment as broadly described herein.

DETAILED DESCRIPTION

[0014] The various embodiments described herein and configurations shown the drawings are exemplary and do not necessarily represent all of possible embodiments, and there may be various equivalents and modification examples that may replace them at the time of application, as understood by one of ordinary skill in the art.

[0015] Dryers may be classified according to a method for processing the high temperature humid air discharged from the drum. A condensation (circulation) type dryer condenses moisture contained in the high temperature humid air by cooling the air below the dew point temperature as it circulates, without discharging the high temperature humid air out of the dryer. An exhaustion type dryer directly discharges the high temperature humid air from the drum to the outside.

[0016] In the condensation type dryer, in order to condense air discharged from the drum, the process of cooling the air below the dew point temperature and heating the air to the drying temperature is carried out prior to being supplied to the drum again. Here, a loss of heat energy contained in the air is generated as it is cooled down during the condensation process, and an additional heater may heat the air to a temperature required for drying.

[0017] In the exhaustion type dryer, high temperature humid air is discharged to the outside and outside air at ambient temperature is drawn in, and the air is heated to a required temperature level by the heating device. In particular, residual thermal energy is contained in the air discharged to the outside, thereby reducing thermal efficiency.

[0018] Accordingly, a laundry treating apparatus capable of collecting energy required to generate hot air and unused energy being discharged to the outside may provide increased energy efficiency. For example, a laundry treating apparatus having a heat pump system may provide such capability. The heat pump system may include two heat exchangers, a compressor and an expansion apparatus, and energy contained in the discharged hot air may be reused in heating air being supplied to the drum, thereby increasing energy efficiency.

[0019] Specifically, in such a heat pump system, an evaporator may be provided at the exhaust side of the drum, and a condenser at an inlet side of the drum, and thus thermal energy may be transferred to refrigerant through the evaporator and then thermal energy contained in the refrigerant may be transferred to air conveyed into the drum, thereby generating hot air using waste energy. A heater for reheating air that has already been heated while passing through the evaporator may be additionally provided.

[0020] However, in such a heat pump, the size of the condenser may be somewhat restricted due to limited space, thereby causing difficulty in achieving the desired condensation performance. Accordingly, heat exchange efficiency may be reduced in the heat exchanger and the cooling of refrigerant may not be properly carried out, thereby reducing dehumidifying capability.

[0021] Referring to FIGS. **1** through **3**, a dryer **1** may include a cabinet **100**, and a drum **110** rotatably provided within the cabinet **100**. The drum may be rotatably supported by a supporter at, for example, the front and rear ends thereof. An intake duct **170** may be provided in the cabinet **100** to guide outside air into the cabinet **100** and supply the air to an inner portion of the drum **100**, and may extend vertically at the rear side of the drum **110** to define an intake flow path. The air drawn in through the intake duct **170** may be brought in from the outside of the cabinet **100**, separately from a drying duct **190** connected to an exhaust portion of the drum **110**.

[0022] A heater **180** may be provided within the intake duct **170**. The heater **180** may receive electrical energy to quickly heat air to be supplied to the drum **110**, and may further supply heating such that the refrigerant cycle is stably managed in a normal state.

[0023] When so configured, heating required for drying may be sufficiently supplied in a relatively short period of time, thereby reducing drying time. In other words, additional, or auxiliary, heating may be supplied by the heater **180** when heating cannot be sufficiently supplied in a short enough period of time using only air flowing through the circulation flow path.

[0024] The air conveyed into the drum **110** may be supplied through a circulation flow path formed in the drying duct **190**, separately from the air through the intake flow path. The drying duct **190** may be provided in the cabinet **100** to circulate air discharged from the drum **110** and resupplying it thereto.

[0025] The air conveyed into the drum **110** dries the laundry in the drum **110**, and then flows into a front duct located at a lower front portion of the drum **110**, and is supplied to the drum **110** again through the drying duct **190** by way of a lint filter, or is discharged to the outside of the cabinet **100** through an exhaust duct.

[0026] A blower fan **120** may be provided on the circulation flow path of the drying duct **190**. An evaporator **130** and a condenser **140** may also be sequentially provided on the flow path formed by the drying duct **190**. The evaporator **130** and condenser **140**, serving as a heat exchanger, may form a refrigerant cycle of the heat pump, thereby achieving heat exchange with air (Ad) on the circulation flow path by refrigerant flowing therein.

[0027] The air brought into the drum **110** may be heated by the heater **180** on the intake flow path, or by the condenser **140** on the circulation flow path and become high-temperature dry air, at about, for example, 150-250° C., as it is resupplied to the drum **110**. The high-temperature air is brought into contact with an object to be dried to evaporate the moisture from the object. The evaporated moisture is absorbed and contained in intermediate-temperature air exhausted from the drum **110**. In order to circulate the intermediate temperature humid air and reuse it, the moisture may be removed. Since the moisture content in the air is affected by the temperature, the moisture may be removed by cooling the air. Accordingly, the air on the circulation flow path may be cooled by heat exchange with the evaporator **130**. The air cooled by the evaporator **130** may then be re-heated by high temperature air, carried out by the condenser **140**, and re-supplied to the drum **110**.

[0028] A refrigerant cycle may perform heat exchange with the environment using phase change(s) of refrigerant flowing therethrough. That is, refrigerant may be transformed into a low-temperature and low-pressure gas by absorbing heat from the environment in the evaporator, compressed into a high-temperature and high-pressure gas in the compressor, transformed into a high-temperature and high-pressure liquid by dissipating heat to the environment in the condenser, transformed into a low-temperature and low-pressure liquid by dropping its pressure in the expansion apparatus, and brought into the evaporator again. Due to the circulation of refrigerant, heat may be absorbed from the environment in the evaporator and heat is supplied to the environment in the condenser. Such a refrigerant cycle may be also referred to as a heat pump cycle.

[0029] For purpose of discussion hereinafter, the refrigerant cycle may include the compressor **150** and expansion apparatus **160** along with the evaporator **130** and condenser **140**.

[0030] The flow path of air in heat exchange with the refrigerant cycle is illustrated in FIGS. **2** and **3**. In other words, an arrow passing through the evaporator **130** and condenser **140** and a line connecting the evaporator **130** and condenser **140** does not indicate the flow path of the refrigerant. Rather, they do indicate the flow path of the air in FIGS. **2** and **3**, and the air is sequentially brought into contact with the evaporator and the like to perform heat exchange. As shown in FIG. **3**, the evaporator **130** and condenser **140** may be sequentially disposed, on the circulation flow path (a large circulation line formed along a bold arrow in FIG. **3**) formed by the drying duct **190**.

[0031] As illustrated in FIG. **3**, the air (Ad) on the circulation flow path performs heat exchange with the heat pump during the refrigerant cycle, specifically the air (Ad) on the circulation flow path dissipates heat in heat exchange with the evaporator **130**, and absorbs heat in heat exchange with the condenser. As a result, the air on the circulation flow path absorbs heat dissipated by itself again.

[0032] In general, the evaporator **130** and condenser **140** may mainly perform heat exchange during the refrigerant cycle, and the air from which heat is taken in the evaporator **130** liquefies moisture contained therein, which it exhausts as condensation water, and dry air is heated by the compressor **150** and condenser **140** to be changed into high temperature and dry air. In this manner, the high-temperature air provided by heat exchange with the refrigerant cycle through the circulation flow path is provided into the drum **110** along with the air into the intake flow path for the drying process.

[0033] In certain embodiments, part of the air brought into the drum **110** and used in the drying process is exhausted to the outside of the dryer, and part thereof is reused.

[0034] In the heat pump type dryer, waste heat may be collected using the refrigerant cycle, without causing an overload during the refrigerant cycle. In other words, in a refrigerant cycle, the heat exchange of refrigerant may be carried out by phase change at optimal operating temperatures and pressures, and to this end, a heat exchanger such as an evaporator and a condenser, a compressor, an expansion apparatus and the like may be used. Accordingly, in order to collect more heat, the size of the heat exchanger or compressor may be increased. However, spatial limitations may make this impractical, and thus the heat exchanger, compressor and the like may be limited in size.

[0035] Accordingly, the heater **180** may be provided within the intake duct **170** to continuously provide heating the inhaled air.

[0036] Heating may be replenished by the heater **180** to sufficiently supply the heating required for drying, thereby reducing dry time. Furthermore, in a refrigerant cycle, the heat exchange of refrigerant may be carried out by a phase change at optimal operating temperature and pressure. Otherwise, problems such as refrigerant being supplied to the compressor in a liquid phase or the like may occur, and thus the cycle cannot be stably operated, thereby reducing the reliability of the cycle. Accordingly, as disclosed herein, the air provided to the drum **110** may be replenished with additional, auxiliary heating by the heater **180**, allowing the refrigerant cycle to be stably operated in a normal state.

[0037] An additional blower fan **120** may be provided on the intake flow path to provide more airflow, which may prevent the heater **180** form over-heating, as shown in FIGS. **2** through **4**.

[0038] In alternative embodiments, part of the air may be exhausted to the outside of the cabinet **100**, upstream of the evaporator **130** on the circulation flow path. Accordingly, as illustrated in FIG. **1**, an exhaust duct **15** may be branched from upstream of the evaporator **130** in the drying duct **190**, and the exhaust duct **190** may exhaust part of the air to the outside of the cabinet **100** upstream of the evaporator **130** on the circulation flow path. The exhaust duct **1902** may form an exhaust flow path for discharging hot air coming out of the drum to exhaust part of the air to the outside of the cabinet **100**.

[0039] According to the foregoing configuration, waste heat may be absorbed from some of the intermediate temperature and humid air coming out of the drum **110**, within a range that can be processed by the refrigerant cycle, while the rest of the air is exhausted. Accordingly, it may be possible to reduce energy waste while also avoiding overload during the refrigerant cycle. Furthermore, it may be possible to reduce power consumption as well as enhance reliability.

[0040] Hereinafter, a heat pump type dryer maximizing a condensation effect using a second condenser, according to embodiment as broadly described herein, to enhance dehumidifying capability, will be described with reference to FIGS. **4** through **7**.

[0041] Referring to FIG. **4**, a dryer may include an evaporator **130**, a condenser **140/141**, a compressor **150** and an expansion apparatus **160**. A first condenser **140** may liquefy a high-temperature and high-pressure refrigerant circulated from the compressor **150**, and a second condensing device **141** may condense the refrigerant condensed by the first condenser **140** again to supercool refrigerant during the refrigerant cycle, thereby enhancing dehumidifying capability in the evaporator **130**.

[0042] Refrigerant may pass through the compressor **150** to the first condenser **140**, expansion apparatus **160** and evaporator **130**. The separate second condensing device **141** may be included therein when refrigerant that has passed through the compressor **150** is condensed in the condenser **140**, thereby enhancing the condensation effect.

[0043] As described above, the level of supercooling may be further increased by employing the first condenser **140** and second condensing device **141** to enhance dehumidifying capability in the evaporator **130**, thereby increasing the efficiency of the heat pump. The second condensing device **141** may include a second condenser **143** and a cooling fan **146** for enhancing the supercooling performance of the second condenser **143**. The cooling fan **146** may draw in external air at ambient temperature to cool the second condenser **143**.

[0044] Refrigerant flowing from the outlet of the first condenser **140** may pass through the second condenser **143** without directly passing through the expansion apparatus (or expansion valve) to enhance dehumidifying capability in the evaporator **130**. Accordingly, refrigerant in the second condenser **143** may be further supercooled and brought into the evaporator **130** in a low refrigerant dryness state through the expansion apparatus (or expansion valve), thereby enhancing dehumidifying capability.

[0045] However, the separate cooling fan **146** as well as the second condenser **143** and connecting pipe may increase the raw material cost of the product.

[0046] Consequently, according to another embodiment illustrated in FIG. **6**, a second condenser **148** may be formed below a condensation water line at a lower portion of the drying duct **190**, as a refrigerant line extending from the first condenser **140** and integrally formed therein. Furthermore, the second condenser **148** may be cooled using condensation water cooled by the evaporator **130**. In FIG. **5**, a conventional heat pump structure comprising an evaporator **130** and a condenser **140** in a drying duct is shown. The evaporator **130** and the condenser **140** are arranged at the same height and above the condensation water line WL of the drying duct, up to which condensation water W is collected. The refrigerant lines or refrigerant pipes P_E and P_C of the evaporator **130** and the condenser **140** are connected to each other via the compressor **150**.

[0047] Referring to FIG. **6**, the refrigerant pipe of the first condenser **140** and the refrigerant pipe of the second condenser **148** may be intrusively formed, or inter-mingled, or inter-arranged, in the same heat dissipation fins. Here, considering the intrusive arrangement of the first condenser **140** and second condenser **148** inserted into the heat dissipation fin, the refrigerant pipe Pc**1** of the first condenser **140** may be vertically arranged in a zigzag pattern, and the lowest end portion of the refrigerant pipe thereof may be arranged on or above a condensation water line WL, and the refrigerant pipe Pc**2** of the second condenser **148** may be horizontally arranged below the condensation water line. Accordingly, a separate cooling fan may not be required for the cooling of the condenser, and space utilization may be enhanced, thereby promoting economical efficiency.

[0048] In another embodiment shown in FIG. **7**, the second condenser **148** is disposed below a condensation water line at a lower portion of the drying duct **190**, as an independent refrigerant line separated from the first condenser **140**, to cool the second condenser **148** using condensation water cooled by the evaporator **130**. A partial lower portion of the condenser **140** may be submerged under condensation water (W), and the relevant lower portion of the condenser exhibits a structure for enhancing the supercooling efficiency using the condensation water. Accordingly, a rear end portion at the outlet side of the pipe coming out of the condenser **140** may be submerged under condensation water to achieve supercooling without reducing the performance of the condenser.

[0049] According to still another embodiment shown in FIG. **7**, the first condenser **140** and a second condenser **149** may be configured with independent heat dissipation fins separated from each other. Accordingly, the foregoing embodiment illustrates a case where the first condenser and second condenser form independent refrigerant circulation lines. In the embodiment shown in FIG. **7**, the refrigerant circulation line (Pc**1**) in the first condenser **140** and the refrigerant circulation line (Pc**2**) in the second condenser **149** may be connected by a separate refrigerant circulation line that does not penetrate the heat dissipation fin. Accordingly, referring to FIG. **7**, refrigerant (Pc**1**) circulated from the compressor is all circulated through the condenser **140**, and then circulated again through the second condenser **149** via a separate refrigerant circulation path.

[0050] The refrigerant circulation (Pc**2**) of the second condenser **149** may be submerged under the surface of condensation water (W). According to the present configuration, the second condenser **149** may maximize cooling efficiency through an additional cooling fan as discussed above, but a cooling function may be promoted through condensation water (W) chilled by the evaporator **130** without having an additional cooling fan, thereby avoiding additional components as well as maximizing space utilization.

[0051] Accordingly, the refrigerant pipe of the first condenser may be vertically arranged in a zigzag pattern, and the lowest end portion of the refrigerant pipe does not contact condensation water on the condensation water line, and the refrigerant pipe of the second condenser may be horizontally arranged in a zigzag pattern to be submerged under condensation water below the condensation water line.

[0052] Consequently, according to the present embodiment, the second condenser may have a separate independent condenser structure and the second condenser may be submerged under condensation water. Accordingly, refrigerant that has passed through the first condenser may be supercooled while being circulated through the second condenser submerged under condensation water, and as a result, a cooling fan is not required, and cost may be reduced and space efficiency may be enhanced.

[0053] The aforementioned embodiments are merely exemplary, and provided to enable persons having ordinary skill in the art to which the present disclosure pertains (hereinafter, referred to as "those skilled in the art") to easily implement a heat pump type dryer for enhancing supercooling performance using condensation water. The present disclosure is not limited to the foregoing embodiments and the accompanying drawings, and thus the rights scope of the present disclosure is not limited thereto. Accordingly, it should be understood by those skilled in the art that various substitutions, modifications and changes may be made without departing from the technical concepts as broadly described herein, and it should be also clearly understood that portions which may be easily changed by those skilled in the art will fall with in the rights scope as broadly described herein.

[0054] A dryer is provided, the dryer employing a circulation type heat pump in which a second condenser is added to a first condenser to maximize a condensation effect, thereby enhancing heat exchange efficiency.

[0055] A dryer is provided, the dryer employing a heat pump structure in which refrigerant is supercooled for the cooling of a second condenser during the refrigerant cycle using condensation water generated from a heat exchanger, thereby enhancing dehumidifying capability.

[0056] A dryer is provided, the dryer employing a heat pump structure in which a second condenser itself has a separate independent condenser structure submerged under condensation water, thereby eliminating the need for a cooling fan for use during a supercooling period.

[0057] A dryer as embodied and broadly described herein may include a cabinet; a drum rotatably provided within the cabinet; a drying duct provided in the cabinet to circulate air discharged from the drum by resupplying it thereto; an evaporator and a condenser sequentially provided on a flow path formed by the drying duct; and a compressor and an expansion apparatus configured to form a refrigerant cycle along with the evaporator and the condenser.

[0058] The condenser may include a first condenser configured to liquefy a high-temperature and high-pressure refrigerant circulated from the compressor; and a second condenser configured to condense the refrigerant condensed from the first condenser again to supercool refrigerant during the refrigerant cycle, thereby enhancing dehumidifying capability in the evaporator.

[0059] The second condenser may be formed below a condensation water surface at a lower portion of the drying duct as a refrigerant line extended from the first condenser and integrally formed therewith to cool the second condenser using condensation water frozen by the evaporator.

[0060] The refrigerant pipe of the first condenser and the refrigerant pipe of the second condenser may be intrusively formed in the same heat dissipation fins.

[0061] The refrigerant pipe of the first condenser may be vertically arranged in a zigzag pattern, and the lowest end portion of the refrigerant pipe thereof may be disposed on the condensation water line, and the refrigerant pipe of the second condenser may be horizontally arranged in a zigzag pattern below the condensation water line.

[0062] In another embodiment, the second condenser may be disposed below a condensation water line at a lower portion of the drying duct as an independent refrigerant line separated from the first condenser to cool the second condenser using condensation water frozen by the evaporator.

[0063] The heat dissipation fin of the first condenser and the heat dissipation fin of the second condenser may be configured with independent heat dissipation fins separated from each other, respectively.

[0064] In addition, the refrigerant pipe of the first condenser may be vertically arranged in a zigzag pattern, and the lowest end portion of the refrigerant pipe of the first condenser may be disposed on the condensation water line, and the refrigerant pipe of the second condenser may be horizontally arranged in a zigzag pattern below the condensation water line.

[0065] The first condenser and the second condenser may be connected by a refrigerant circulation line as a whole.

[0066] Thus, a second condenser may be added to a first condenser in a dryer employing a circulation type heat pump to maximize a condensation effect, thereby enhancing heat exchange efficiency.

[0067] Moreover, refrigerant may be supercooled for the cooling of the second condenser during the refrigerant cycle using condensation water generated from the heat exchanger, thereby enhancing dehumidifying capability.

[0068] Furthermore, the second condenser may have a separate independent condenser structure that is submerged under condensation water to eliminate the need for a cooling fan for use during a supercooling period and the space to accommodate such a cooling fan, thereby increasing space efficiency.

[0069] Any reference in this specification to "one embodiment," "an embodiment," "example embodiment," etc., means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the invention. The appearances of such phrases in various places in the specification are not necessarily all referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with any embodiment, it is submitted that it is within the purview of one skilled in the art to effect such feature, structure, or characteristic in connection with other ones of the embodiments.

[0070] Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure. More particularly, various variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the disclosure, the drawings and the appended claims. In addition to variations and modifications in the component parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

What is claimed is:

1. A dryer, comprising:

a cabinet;

a drum rotatably provided within the cabinet;

a drying duct provided in the cabinet, the drying duct forming a flow path that receives air discharged from the drum and guides the received air back to the drum;

an evaporator and a condensing device sequentially provided on the flow path formed by the drying duct; and

a compressor and an expansion apparatus operably coupled with the evaporator and the condensing device to form a refrigerant cycle, wherein the condensing device comprises:

a first condenser configured to liquefy a high-temperature and high-pressure refrigerant received from the compressor; and

a second condenser configured to receive refrigerant from the first condenser and to condense the received refrigerant again,

wherein the second condenser is provided below the first condenser, and below a condensation water line of condensation water accumulated at a lower portion of the drying duct, such that the second condenser is cooled by condensation water chilled by the evaporator.

2. The dryer of claim **1**, wherein the second condenser comprises a refrigerant pipe that extends from the first condenser and is integrally formed therewith.

3. The dryer of claim **2**, wherein the refrigerant pipe of the second condenser extends from a refrigerant pipe of the first condenser, and wherein the refrigerant pipe of the first condenser and the refrigerant pipe of the second condenser are intrusively arranged in the same heat dissipation fins.

4. The dryer of claim **3**, wherein a lowermost end of the refrigerant pipe of the first condenser is positioned at the condensation water line, and wherein the refrigerant pipe of the second condenser extends from the lowermost end of the refrigerant pipe of the first condenser so as to be positioned below the condensation water line.

5. The dryer of claim **3**, wherein the refrigerant pipe of the first condenser is arranged in a zigzag pattern that extends vertically, and the refrigerant pipe of the second condenser is arranged in a zigzag pattern that extends horizontally.

6. The dryer of claim **1**, wherein the second condenser comprises an independent refrigerant pipe that is separated from a refrigerant pipe of the first condenser.

7. The dryer of claim **6**, wherein the second condenser comprises a heat dissipation fin separated from a heat dissipation fin of the first condenser.

8. The dryer of claim **7**, wherein a lowermost end of a refrigerant pipe of the first condenser is disposed on the condensation water line, and the refrigerant pipe of the second condenser is disposed below the condensation water line.

9. The dryer of claim **7**, wherein the refrigerant pipe of the first condenser is arranged in a zigzag pattern that extends vertically, and the refrigerant pipe of the second condenser is arranged in a zigzag pattern that extends horizontally.

10. The dryer of claim **6**, wherein the first condenser and the second condenser are connected by a refrigerant circulation line.

11. A dryer, comprising:

a cabinet;

a drum rotatably provided in the cabinet;

a drying duct that defines an air flow path between a discharge outlet of the drum and an inlet of the drum;

a condensing device provided in the air flow path defined by the drying duct, the condensing device comprising:

a first condenser configured to perform a first condensing operation on refrigerant received from a compressor; and

a second condenser configured to receive refrigerant from the first condenser and to perform a second condensing operation on the refrigerant; and

a heater provided in the air flow path, wherein the heater is configured to be selectively operated to perform an auxiliary heating operation on air to be supplied to the drum.

12. The dryer of claim **11**, further comprising an evaporator and an expander operably coupled with the compressor and the condensing device all provided on the air flow path to form a refrigerant cycle, wherein the refrigerant cycle cools air discharged from the drum, and then heats the air for re-supply to the drum.

13. The dryer of claim **12**, wherein the heater is provided downstream of the refrigerant cycle and is configured to further heat air heated by the refrigerant cycle before the air is supplied to the drum.

14. The dryer of claim **12**, wherein the second condenser is provided below the first condenser, and below a top surface of condensation water accumulated in the drying duct such that the second condenser is at least partially submerged in the accumulated condensation water.

15. The dryer of claim **14**, wherein the first condenser comprises a first refrigerant pipe and the second condenser comprises a second refrigerant pipe that extends from the first refrigerant pipe, and wherein the first and second refrigerant pipes are inter-arranged on the same heat dissipation fins of the condensing device.

16. The dryer of claim **15**, wherein the first refrigerant pipe is arranged in a zigzag pattern that extends vertically, and the second refrigerant pipe is arranged in a zigzag pattern that extends horizontally.

17. The dryer of claim **15**, wherein a lowermost end of the first refrigerant pipe is positioned at the condensation water line, and the second refrigerant pipe is positioned below the condensation water line.

18. The dryer of claim **14**, wherein the first condenser comprises a first refrigerant pipe and the second condenser comprises a second refrigerant pipe that is separate from the first refrigerant pipe, and wherein the first and second refrigerant pipes are arranged on different heat dissipation fins of the condensing device.

19. The dryer of claim **18**, wherein the first refrigerant pipe is arranged in a zigzag pattern that extends vertically, and the second refrigerant pipe is arranged in a zigzag pattern that extends horizontally.

20. The dryer of claim **18**, wherein a lowermost end of the first refrigerant pipe is positioned at the condensation water line, and the second refrigerant pipe is positioned below the condensation water line.

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