HEAT EXCHANGER SYSTEM AND COOLING DEVICE FOR THE SAME

TECHNICAL FIELD

[0001] The present disclosure relates to a heat exchanger system and a cooling device for the heat exchanger system. The heat exchanger system may be, or form part of, an air-conditioner device or unit.

BACKGROUND

[0002] The following discussion of the background is intended to facilitate an understanding of the present disclosure only. It should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or is part of the common general knowledge of the person skilled in the art in any jurisdiction as of the priority date of the invention.

[0003] Heat exchanger systems such as air-conditioners, refrigerators, or temperature regulating systems typically comprise at least one heat exchanger arranged in fluid communication with one or more other heat exchangers. Various forms of heat exchangers such as condenser / evaporator coils or units have been developed for such heat exchanger systems. However, most existing heat exchanger devices are relatively bulky and when implemented can produce copious amounts of heat energy, which is typically dissipated into the surrounding environment or wasted. As such, current heat exchanger systems may generate undesirable amount of heat to the environment. In addition, the chemical refrigerant used/utilized by systems such as air-conditioners may adversely affect the environment and cause pollution.

[0004] Further, most existing portable air-conditioner units require at least one outlet or exhaust hose to dissipate heat generated during the air-conditioner/ refrigerant process.

[0005] In view of the global push to reduce carbon footprint, there exists a need for improved heat exchanger systems, which may include improved heat exchanger devices to provide more efficient heat exchange with reduction of carbon footprint and pollutants. It is also an object to minimize or omit the requirement of an exhaust hose.

SUMMARY

[0006] An aspect of the disclosure relates to a heat exchanger system comprising a first heat exchanger comprising at least one condenser unit; a second heat exchanger comprising at least one evaporator unit; a coolant source; a coolant dispenser arranged to receive a first coolant from the coolant source and dispense coolant to the first heat exchanger; a coolant tray arranged to collect the first coolant from the first heat exchanger and direct the first coolant to the coolant source; and a heat conductor extending from the second heat exchanger to the coolant tray or the coolant source. The heat exchanger system may be used with an air-conditioner device, in particular a portable air-conditioner device, to minimize heat generated by condenser coils

[0007] Another aspect of the disclosure relates to a portable air-conditioner unit comprising a heat exchanger system of any one of the preceding claims, and a compressor having a second coolant flowing through the first heat exchanger to release heat and flowing through the second heat exchanger to absorb heat in a refrigerant cycle configuration.

[0008] Another aspect of the disclosure relates to a cooling apparatus for use with an air-conditioner unit, comprising a water source; a coolant dispenser arranged to receive water from the water source and dispense water to condenser coils of the air-conditioner unit; a tray arranged to collect water from the condenser coils and direct water to the water source; and a copper plate extending from an evaporator unit of the air-conditioner unit to the tray.

[0009] Another aspect of the disclosure relates to a kit for a heat exchanger system comprising a coolant source; a coolant dispenser adapted to receive coolant from the coolant source and dispense coolant to a first heat exchanger; a coolant collector adapter to collect coolant from the first heat exchanger, the coolant collector comprises a conduit to direct coolant to the coolant source; and a copper plate adapted to extend from a second heat exchanger to the coolant collector.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The invention will be better understood with reference to the detailed description when considered in conjunction with the non-limiting examples and the accompanying drawings, in which:

- FIGS. 1 to FIG. 4B show various embodiments of a heat exchanger system and a cooling device for use with the heat exchanger system; and

- FIG. 5 shows an embodiment of the heat exchanger device in the form of a cooling device for use with an air-conditioner unit.

DETAILED DESCRIPTION

[0011] The following detailed description refers to the accompanying drawings that show, by way of illustration, specific details and embodiments in which the disclosure may be practiced. These embodiments are described in sufficient detail to enable those skilled in the art to practice the disclosure. Other embodiments may be utilized and structural, and logical changes may be made without departing from the scope of the disclosure. The various embodiments are not necessarily mutually exclusive, as some embodiments can be combined with one or more other embodiments to form new embodiments.

[0012] The disclosure illustratively described herein may suitably be practiced in the absence of any element or elements, limitation or limitations, not specifically disclosed herein. Thus, for example, the terms “comprising”, “including,” containing”, etc. shall be read expansively and without limitation. The word "comprise" or variations such as "comprises" or "comprising" will accordingly be understood to imply the inclusion of a stated integer or groups of integers but not the exclusion of any other integer or group of integers. Additionally, the terms and expressions employed herein have been used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the disclosure. Thus, it should be understood that although the present disclosure has been specifically described in exemplary embodiments and optional features, modification and variation of the disclosure embodied herein may be resorted to by those skilled in the art.

[0013] Features that are described in the context of an embodiment may correspondingly be applicable to the same or similar features in the other embodiments. Features that are described in the context of an embodiment may correspondingly be applicable to the other embodiments, even if not explicitly described in these other embodiments. Furthermore, additions and/or combinations and/or alternatives as described for a feature in the context of an embodiment may correspondingly be applicable to the same or similar feature in the other embodiments.

[0014] In the context of various embodiments, the articles “a”, “an” and “the” as used with regard to a feature or element include a reference to one or more of the features or elements.

[0015] As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

[0016] As used herein, the term “heat exchanger system” refers broadly to any systems capable of utilizing one or more heat exchanger devices, including, but not limited to, refrigerators and air-conditioners.

[0017] As used herein, the term “heat exchanger or heat exchanger device” may refer to a device to facilitate heat transfer between two or more fluids. Some heat exchangers described in the various embodiments can be utilized in both cooling and heating processes. It may be appreciated that a heat exchanger may include one or more interfaces. An interface of a heat exchanger may include medium to facilitate heat exchange, the interface may include a wall to achieve separation between the fluids. Such a wall may be a solid wall. In some embodiments, the interface may allow the two or more fluids to be in direct contact with one another to facilitate heat exchange.

[0018] As used herein, the term “refrigerant” or “coolant” broadly includes heat exchange medium and/or fluid for facilitating heat exchange. It is appreciable that in some embodiments, a plurality of coolants, for example, a first coolant and a second coolant, may be utilized in a heat exchange system. The term “first” and “second” in the description of the present application are used for distinguishing between similar functional elements within the description and not necessarily for describing a sequential or chronological order.

[0019] As used herein, the term “air-conditioner” includes temperature regulators for heating or cooling an enclosed space/area. The term “air-conditioner” is an example of a heat exchanger system. The term “air-conditioner” may also include an outdoor system having a compressor unit and an indoor device for the regulation of temperature and/or humidity in an enclosed area. The air-conditioner includes conventional systems wherein one or more compressors are placed outdoor and portable systems wherein compressors are integrated with air blowers to form a compact unit.

[0020] As used herein, the term “module” refers to, or forms part of, or include mechanical and/or electronic, electrical components or elements. Non-limiting examples of such elements include application Specific Integrated Circuit (ASIC); a combinational logic circuit; a field programmable gate array (FPGA); a processor (shared, dedicated, or group) that executes code; other suitable hardware components that provide the described functionality; or a combination of some or all of the above, such as in a system-on-chip.

[0021] According to an aspect of the disclosure and with reference to FIG. 1, there is a heat exchanger system 100 comprising a first heat exchanger 102 comprising at least one condenser unit 104; a second heat exchanger 106 comprising at least one evaporator unit 108; a coolant source 110; a coolant dispenser 112 arranged to receive coolant 114 from the coolant source and dispense coolant 114 to the first heat exchanger 102; a coolant tray 116 arranged to collect coolant 114 from the first heat exchanger 102, and direct coolant 114 to the coolant source 110; and a heat conductor 118 having a portion 130A extending from the second heat exchanger 106 to the coolant tray 116. The portion 130A may be a high heat conductive material, for example, copper rod/wire operable to cool the water within the coolant tray 116. A pump 140 may be included in the heat exchanger system 100 to pump coolant from the coolant source 110 to the coolant dispenser 112. The components 110, 112, 114, 116, and 118 may be regarded as a cooling apparatus or system for cooling the first and second heat exchanger devices 102, 106.

[0022] FIG. 2 shows another embodiment of the heat exchanger system 100, wherein the heat conductor 118 is directly connected to the coolant source 110 via a portion 130B. The coolant source 110 may be in the form of a water tank. The portion 130B may be a high heat conductive material, for example, copper rod/wire operable to cool the water within the water source 110. The heat conductor 118 may comprise a plate structure and one or more extensions from one of the evaporator coils 108 of the second heat exchanger 106.

[0023] FIG. 3 shows another embodiment of the heat exchanger system with particular emphasis on the connection between the first heat exchanger 102 and the second heat exchanger 106, wherein the heat conductor 118 comprises a plate structure and a plurality of high heat conductive material strip or wires 130C extending from the plate structure to the condenser unit 104. Each high heat conductive material (for example, copper), may be connected from the evaporator coils 108 of the second heat exchanger device 106 to the condenser coils 104 of the first heat exchanger 102.

[0024] FIG. 4A shows another embodiment of the heat exchanger system 100, wherein the heat conductor 118 comprises an outer casing surrounding part of the second heat exchanger 106, and a high heat conductive material, for example, a copper plate 130D extending to a base portion of the coolant tray 116. Such an arrangement may be advantageous in that the plate structure of the heat conductor 118 increases the surface area for the heat conductor 118 to absorb heat from the coolant tray 116.

[0025] FIG. 4B shows another embodiment of the heat exchanger system 100, including a motor arranged or configured to spray water within the coolant tray 116 to spray coolant from the coolant tray 116 to the first heat exchanger 102 to regulate or adjust the temperature of the coils within the first heat exchanger 102 in operation. This may be particularly advantageous in the case where the heat exchanger system 100 operates as a condenser unit. The motor may comprise a plurality of fins adapted to splash the coolant tray 116 onto the first heat exchanger 102 to further bring down the temperature. In some embodiments, the motor may be attachable to the coolant tray 116.

[0026] Various embodiments of the heat exchanger system 100 shown in FIG. 1 to FIG. 4 may function as a cooling device. FIG. 5 shows an example of the cooling device applied to an air-conditioner device 500 with a compressor 502. Air-conditioner device 500 may be a portable air-conditioner device. The compressor 502 may be configured to provide a refrigerant to condenser coils 104 of the first heat exchanger 102 and evaporator coils 108 of the second heat exchanger 106, in a manner so as to form a refrigerant cycle. In operation, refrigerant in liquid state below ambient temperature may flow through the evaporator coils 108 and absorb heat from the ambient environment, after which the refrigerant turns into the gaseous state. The gaseous refrigerant may then be received and compressed by the compressor 502 into a relatively high temperature high pressure refrigerant vapor which then urged through the condenser coils 104 of the first heat exchanger 102, giving out heat to the ambient environment. The cooled refrigerant may be input into one or more expansion valves before flowing through the evaporator coils 108 and the refrigerant cycle repeats. The air-conditioner device 500 may comprise one or more air-blowers or fans 504 to urge cooled air out after being cooled by the evaporator coils 108.

[0027] In the embodiment of the air-conditioner unit 500, the heat exchanger system 100 may be used to cool the condenser coils 104 in a manner such as to reduce the exhaust heat generated through the refrigerant flowing through the condenser coils 104, and hence reducing the temperature of the exhaust air out of the air-conditioner unit 500. This may be achieved via the combination of the coolant source 110, the coolant dispenser 112, coolant tray 116. The coolant source 110 is arranged to pump a coolant 114 from the coolant source 110 and spray coolant 114 to the first heat exchanger 102. The coolant tray 116 is arranged to collect the coolant 114 from the first heat exchanger 102 and direct coolant 114 to the coolant source 110 via a pump 510. The heat conductor 118 may extend from the second heat exchanger 106 to

the coolant tray 116. Due to the cooling of the condenser coils, it is appreciable that the air-conditioner unit 500 may achieve an exhaust temperature of room temperature without contributing to increased ambient temperature.

[0028] According to another aspect of the disclosure there is a cooling apparatus for use with an air-conditioner unit. The cooling apparatus comprising a water source; a coolant dispenser arranged to receive water from the water source and dispense water to condenser coils of the air-conditioner unit; a tray arranged to collect water from the condenser coils and direct water to the water source; and a copper plate extending from an evaporator unit of the air-conditioner unit to the tray.

[0029] In some embodiments, the cooling device may be retrofitted to an existing portable air-conditioner unit, device, or system in a manner such as to minimize exhaust heat and moisture generated by condenser coils. The retrofitting may result in the minimization or omission of exhaust hose typically required for portable air-conditioner units.

[0030] It is to be appreciated that on-site temperature measurements of the embodiments illustrated in FIG. 1 and FIG. 2 applied to a portable air-conditioner unit with show that the exhaust air temperature drop by about 2 degree Celsius without comprising on the ability of the portable air-conditioner unit to cool an enclosed area.

[0031] In some embodiments where the coolant source is a water tank, the water tank comprises at least one water filtration module. The at least one water filtration module may include various types of filters, for example, ion exchange filter, reverse osmosis filter, ultraviolet filters. The water filtration module may be controlled by an electronic controller to operate the water filtration module between a plurality of purging modes associated with a first usage, a maintenance mode, a filter replacement mode, and a water dispensing mode.

[0032] In some embodiments the coolant dispenser 112 may be at least one of a dripper, a sprayer, or a sprinkler. In some embodiments, the coolant dispenser 112 may be controlled by an electronic controller (not shown) to operate the coolant dispenser 112 between various states. At least one of the states may be a coolant flow control state. The dripper, sprayer, or sprinkler may comprise a plurality of nozzles, the openings of which may be controlled by the electronic controller.

[0033] While the disclosure has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the

invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

CLAIMS

1. A heat exchanger system comprising

a first heat exchanger comprising at least one condenser unit;

a second heat exchanger comprising at least one evaporator unit;

a coolant source;

a coolant dispenser arranged to receive a first coolant from the coolant source and dispense coolant to the first heat exchanger;

a coolant tray arranged to collect the first coolant from the first heat exchanger and direct the first coolant to the coolant source; and

a heat conductor extending from the second heat exchanger to the coolant tray or the coolant source.

2. The heat exchanger system of claim 1, wherein the heat conductor extends to a base portion of the coolant tray.

3. The heat exchanger system of claim 1 or 2, further comprises a heat conducting casing at least partially surrounding the second heat exchanger.

4. The heat exchanger system of any one of claims 1 to 3, wherein the coolant dispenser comprises a dripper, a sprayer, or a sprinkler.

5. The heat exchanger system of any one of the preceding claims, wherein the coolant source is a water tank and the first coolant is water, the water tank optionally comprises at least one water filtration module.

6. The heat exchanger system of any one of the preceding claims, further comprises a motor positioned in a vicinity of or in the coolant tray, the motor comprises a plurality of fins adapted in operation to spray coolant from the coolant tray onto the at least one condenser unit of the first heat exchanger.

7. A portable air-conditioner unit comprising a heat exchanger system of any one of the preceding claims, and a compressor having a second coolant flowing through the first heat exchanger to release heat and flowing through the second heat exchanger to absorb heat in a refrigerant cycle configuration.

8. The portable air-conditioner unit of claim 7, wherein at least one of the first heat exchanger and the second heat exchanger comprises a heat exchanger device having a double pipe configuration with double spiral portions.

9. The portable air-conditioner unit of claim 7 or 8, wherein the coolant is water.

10. The portable air-conditioner unit of any one of claims 7 to 9, further comprises a motor positioned in a vicinity or in the coolant tray, the motor comprises a plurality of fins adapted in operation to spray coolant from the coolant tray onto the at least one condenser unit of the first heat exchanger.

11. A cooling apparatus for use with an air-conditioner unit, comprising a coolant source;

a coolant dispenser arranged to receive coolant from the coolant source and dispense coolant to condenser coils of the air-conditioner unit;

a tray arranged to collect coolant from the condenser coils and direct coolant to the coolant source; and

a copper plate extending from an evaporator unit of the air-conditioner unit to the tray.

12. The cooling apparatus of claim 11, further comprises a motor attachable to the tray, the motor comprises a plurality of fins adapted in operation to splash, spray, or direct coolant from the tray onto the condenser coils of the air-conditioner unit.

13. A kit for a heat exchanger system comprising

a coolant source;

a coolant dispenser adapted to receive coolant from the coolant source and dispense coolant to a first heat exchanger;

a coolant collector adapter to collect coolant from the first heat exchanger, the coolant collector comprises a conduit to direct coolant to the coolant source; and

a copper plate adapted to extend from a second heat exchanger to the coolant collector.