

## CONDENSING UNIT

### FIELD OF INVENTION

- 5 The present invention relates to a condensing unit adapted for use in heating, ventilating, and air conditioning (HAVC) and refrigeration systems; and more particularly an environmentally-friendly condensing unit which is capable of reducing temperature of waste heat being released into the environment.

### 10 BACKGROUND OF INVENTION

Heating, ventilating, and air conditioning (HAVC) system such as air conditioning system and chiller system are widely used to cool a designated area so as to achieve a comfortable indoor temperature while refrigeration system such as cool room are  
15 used to generate a specific temperature so as to preserve goods, particularly those that are perishable. It should be noted that while being able to provide the desirous cooling effect or desired temperature, a significant amount of waste heat is also being discharged into the outdoor environment by the condensing unit of HVAC or refrigeration systems. The discharged waste heat could raise the outdoor  
20 temperature which adds to the severity of urban heat islands. It should be noted that higher or warmer outdoor temperature would eventually lead to increased air conditioning demand which resulting in a positive feedback loop.

Further, condensate water produced by the evaporator or cooling coil of HVAC and  
25 refrigeration systems is typically drained into the environment and not being utilised, thereby causing wastage of free water source.

In addition, a typical condensing unit of HVAC and refrigeration systems does not have the functionality to introduce disinfectant into surrounding environment for  
30 disinfection purposes. Consequently, users are required to utilise other resources and/or equipment to carry out disinfection when needed by which this is time consuming and results in the incurrence of additional expenditure.

In view of these and other shortcomings, it is desirous to provide a condensing unit which is capable of reducing temperature of waste heat being discharged into the outdoor environment during its operation. It is also another objective of the present invention to provide a condensing unit which is utilising cold condensate water as  
5 an additional cooling medium and water source during its operation. It is also a further objective of the present invention to provide a condensing unit that is capable of introducing disinfectant into surrounding environment for disinfection purposes.

The condensing unit according to the preferred embodiments of the present  
10 invention and its combination of elements or parts thereof will be described and/or exemplified in the detailed description.

## SUMMARY OF THE INVENTION

The present invention relates generally to a condensing unit adapted for use in heating, ventilating, and air conditioning (HAVC) and refrigeration systems.

5 According to the preferred embodiments of the present invention, the condensing unit comprises an air outlet, at least one porous side wall, a compressor, a water reservoir for containing water, a centrifugal fan and at least one evaporative pad. In the preferred embodiments of the present invention, the compressor is operatively connected to a chamber, an expansion valve and an evaporator coil through a plurality of refrigerant lines. It should be noted that the chamber of the present invention is designed to replace existing condensing coil and is configured to receive the hot compressed refrigerant discharged from the compressor. Preferably, the compressor and the chamber are mounted on a supporting platform centrally located in the condensing unit. Alternatively, the compressor and the chamber can be housed in a separate compartment being contained within the condensing unit or located outside of the condensing unit. If desired, the compressor can be housed within the condensing unit while the chamber is located outside of the condensing unit or vice versa.

20 In the preferred embodiments of the present invention, the condensing unit is provided with a water pump. The water pump is configured to deliver and supply water contained in the water reservoir to the at least one evaporative pad through at least one conduit. According the preferred embodiments, a portion of the conduit is configured to extend within the chamber. It will be appreciated that the water flowing through the portion of the conduit located within the chamber will absorb heat from the hot compressed refrigerant during operation of the condensing unit. It should be noted that the water, after absorbing heat in the chamber, is preferably delivered to the upper surface of the at least one evaporative pad such that the water flows down and wet the entire evaporative pad.

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According to the preferred embodiments of the present invention, the at least one evaporative pad is preferably disposed above the water reservoir. Preferably, the at least one evaporative pad is suitably mounted proximate the at least one porous side wall of the condensing unit. In the preferred embodiments of the present

invention, the centrifugal fan is suitably positioned proximate the air outlet of the condensing unit. It should be noted that the centrifugal fan is configured to draw ambient air from the at least one porous side wall of the condensing unit through the wetted evaporative pad. It will be appreciated that the drawn air remove heat from the wetted evaporative pad when the air travels through the wetted evaporative pad. In accordance with the preferred embodiments of the present invention, the air that moves through the wetted evaporative pad is discharged through the air outlet of the condensing unit and excessive water from the wetted evaporative pad is cascaded back into the water reservoir.

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In the preferred embodiments of the present invention, the condensate water formed from air condensation on the surface of the evaporator coil or cooling coil of the HVAC and refrigeration systems is drained into the water reservoir of the condensing unit through a condensate line. The condensate water is used as an additional cooling medium to cool the water contained in the water reservoir and also as an additional water source to replenish the volume of water in the water reservoir.

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In accordance with the preferred embodiments of the present invention, the condensing unit is provided with a disinfectant dispenser operatively connected to a control unit. It should be noted that the control unit is configured to regulate the activation and deactivation of the disinfectant dispenser. Preferably, the disinfectant dispenser is disposed above the water reservoir. According to the preferred embodiments of the present invention, the disinfectant dispenser is configured to dispense a predetermined amount of disinfectant into the water reservoir. In one preferred embodiment of the present invention, the water contained in the reservoir, after mixed with the disinfectant, is preferably delivered to the upper surface of the at least one evaporative pad through the at least one conduit such that the disinfectant containing water flows down and wet the entire evaporative pad. It will be appreciated that when the centrifugal fan draws the ambient air from the at least one porous side wall of the condensing unit through the wetted evaporative pad, the disinfectant containing water is vapourised and the same is discharged into the surrounding area through the air outlet of the condensing unit.

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In another preferred embodiment of the present invention, the disinfecting containing water is preferably delivered to a dispensing unit preferably mounted proximate the air outlet of the condensing unit by means of at least one pipeline. Preferably, the pipeline is an independent pipeline operatively connected to a second water pump.

- 5 If desired, the pipeline can be a branch pipeline of the conduit. In this preferred embodiment, the disinfectant containing water is discharged to the surrounding area through the air outlet of the condensing unit when the control unit is activated.

- 10 As an alternative to the disinfectant dispenser as described above, a spray dispenser pre-filled with disinfection aerosol could be provided. The spray dispenser is preferably mounted proximate the air outlet of the condensing unit and operatively connected to the control unit. It should be noted that a predetermined amount of disinfection aerosol is discharged to the surrounding area through the air outlet of the condensing unit when the control unit is activated.

- 15 If desired, the condensing unit may be further provided with a reversing valve operatively connected to the refrigerant lines. It should be noted that the reversing valve is configured to enable the HVAC system to change from cooling operation to heating operation or vice versa.

- 20 In the preferred embodiments of the present invention, the condensing unit may be further provided with a plurality of wheels mounted on a base surface of the condensing unit for portability.

- 25 The condensing unit according to the preferred embodiments of the present invention and its combination of elements and parts thereof will be described and/or exemplified in the detailed description.

- 30 The present invention consists of several novel features and a combination of parts hereinafter fully described and illustrated in the accompanying description and drawings, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The present invention will be fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration  
5 only, and thus are not limitative of the present invention, wherein:

FIG. 1 illustrates a side view of a condensing unit provided with a water receiving tray adapted for use in HVAC and refrigeration systems in accordance with the preferred embodiments of the present invention;

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FIG. 2 illustrates a side view of a condensing unit provided with a trough adapted for use in HVAC and refrigerant systems in accordance with the preferred embodiments of the present invention;

15 FIG. 3 illustrates a side view of a condensing unit of the present invention adapted for use in conjunction with a chiller of HVAC system;

FIG. 4 illustrates a front view of a condensing unit of the present invention provided with a separate compartment to house a compressor and a chamber of the  
20 condensing unit;

FIGS. 5a and 5b illustrate a side view of a condensing unit of the present invention provided with a dispensing unit adapted for dispensing disinfectant containing water;

25 FIG. 6 illustrates a side view of a condensing unit of the present invention provided with a spray dispenser adapted for dispensing disinfection aerosol;

FIG. 7 illustrates a side view of a condensing unit of the present invention provided with a reversing valve;

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FIG. 8 illustrates a top view of the condensing unit as showed in FIGS.1 and 3; and

FIGS. 9a and 9b illustrate a top view of the condensing unit as showed in FIG. 2 showing different embodiments of trough of the condensing unit of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a condensing unit adapted for use in heating,  
5 ventilating, and air conditioning (HAVC) and refrigeration systems. More particularly,  
an environmentally-friendly condensing unit which is capable of reducing  
temperature of waste heat being released into the environment during its operation.  
Hereinafter, this specification will describe the present invention according to the  
preferred embodiments of the present invention. However, it is to be understood that  
10 limiting the description to the preferred embodiments of the invention is merely to  
facilitate discussion of the present invention and it is envisioned that those skilled in  
the art may devise various modifications and equivalents without departing from the  
scope of the appended claims.

15 In the description of embodiments disclosed herein, any reference to direction or  
orientation is merely intended for convenience of description and is not intended in  
any way to limit the scope of the present invention. Relative terms such as “upper”  
and “top” as well as derivative thereof should be construed to refer to the orientation  
as then described or as shown in the drawings under discussion. These relative  
20 terms are for convenience of description only and do not require that the apparatus  
be constructed or operated in a particular orientation.

The condensing unit according to the preferred embodiments of the present  
invention will now be described in accordance with the accompanying drawings  
25 **FIGS. 1 to 9b**, either individually or in any combination thereof. Referring to **FIGS.**  
**1 to 9b**, preferred embodiments of a condensing unit **100** adapted for use in HVAC  
and refrigerant systems **1** in accordance with the present invention are depicted. It  
should be noted that certain elements or parts of the condensing unit **100** of the  
present invention are common to the depicted embodiments and are commonly  
30 numbered in **FIGS. 1 to 9b**.

The condensing unit **100** of the preferred embodiments of the present invention  
comprising an air outlet **110**, at least one porous side wall **120**, a compressor **140**,  
a water reservoir **150** for containing water, a centrifugal fan **170** and at least one

evaporative pad **130**. It should be noted that the condensing unit **100** of the present invention is adapted to be operatively connected to any known evaporators in the HVAC and refrigeration systems. By way of example but not limitation, the condensing unit of the present invention can be operatively connected to an evaporator of an air conditioning system as illustrated in **FIGS. 1 and 2**, an evaporator of a chiller system as illustrated in **FIG. 3** or an evaporator of a cool room system.

According to the preferred embodiments of the present invention, the compressor **140** of the condensing unit **100** is operatively connected to a chamber **200**, an expansion valve **500** and an evaporator coil **310** of an evaporator **300** through a plurality of refrigerant lines **700** and formed a closed circuit. Preferably, the closed circuit is filled with refrigerant. It should be noted that the chamber **200** of the present invention is designed to replace existing condensing coil. According to the preferred embodiments of the present invention, the chamber **200** is configured to receive the hot compressed refrigerant discharged from the compressor **140**. It will be appreciated that the chamber **200** is configured in such a manner so as to improve heat transfer performance. By way of example but not limitation, the chamber **200** is preferably having a spherical-shape. However, it should also be readily apparent that the chamber **200** can come in a variety of shapes. In the preferred embodiments of the present invention, the compressor **140** and the chamber **200** are preferably mounted on a supporting platform **40**. Preferably, the supporting platform **40** is centrally located in the condensing unit **100** as illustrated in **FIGS. 1, 2, 3, 5a, 5b, 6 and 7**. Alternatively, the compressor **140** and the chamber **200** can be housed in a separate compartment being contained within the condensing unit **100** or located outside of the condensing unit **100** as illustrated in **FIG.4**. If desired, the compressor **140** can be housed within the condensing unit **100** while the chamber **200** is located outside of the condensing unit **100** or vice versa.

According to the preferred embodiments of the present invention, a water pump **160** is configured to deliver and supply water contained in the water reservoir **150** to the evaporative pad **130** by means of at least one conduit **10**. It should be noted that the water pump **160** may be placed external to the water reservoir **150** or is a submersible type as illustrated in **FIGS. 1 to 7**. In the preferred embodiments of the

present invention, a portion of the conduit **10**, shown by reference number **10a** extends within the chamber **200** as illustrated in **FIGS. 1 to 7**. It should be noted that the aforesaid configuration could significantly enhance heat exchanging efficiency between the water flowing through the conduit portion **10a** and the hot refrigerant contained in the chamber **200** and thereby, intensifying the cooling effect of the chamber **200**. It should be noted that the water flowing through the conduit portion **10a** located within the chamber **200** will absorb heat from the hot compressed refrigerant in the chamber **200** and thereby, removing heat from the chamber **200** due to heat exchange. In the preferred embodiments of the present invention, the water flowing through the portion of the conduit **10a** located within the chamber **200** will become warm after absorbing the heat from the hot refrigerant in the chamber **200** and the warm water is preferably delivered to the at least one evaporative pad **130**. Preferably, the warm water is delivered to an upper surface **131** of the at least one evaporative pad **130** such that the water flows down and wet the at least one evaporative pad **130**. It should be noted that the excessive water from the wetted evaporative pad **130** will be cascaded back into the water reservoir **150**.

Preferably, the conduit portion **10a** that located within the chamber **200** is arranged in the shape of a coil and can have either a vertical or horizontal orientation. By way of example but not limitation the conduit portion **10a** that located within the chamber **200** can be arranged in the form of a helical coil or a spiral coil or the like. In an alternate embodiment, the conduit portion **10a** that located within the chamber **200** is an independent coil having an inlet and outlet in fluid communication with the conduit **10**.

In accordance with the preferred embodiments of the present invention, the water reservoir **150** is preferably sited below the at least one evaporative pad **130** as illustrated in **FIGS. 1 to 7**. It should be noted that the water reservoir **150** should be filled with sufficient water before the condensing unit **100** is put into operation. If desired, the top of the water reservoir **150** may be covered by a non-corrosive removable mesh screen to prevent dirt or small organisms such as insects from entering the water reservoir **150**. The removable mesh screen may be formed of plastic, aluminium, or any other suitable lightweight non-corrosive material. In the preferred embodiments of the present invention, water is supplied into the water

reservoir **150** through a water inlet **151** connected to a float valve **153** as illustrated in **FIGS. 1 to 7**. The float valve **153** is configured to control water flow so as to replenish and maintain the water level of the water reservoir **150** during operation of the condensing unit **100**.

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According to the preferred embodiments of the present invention, the water reservoir **150** of the condensing unit **100** is provided with an overflow pipe **157**. Preferably, the overflow pipe **157** is located proximate the top of the water reservoir **150** as illustrated in **FIGS. 1, 2, 3, 5a, 5b, 6 and 7**. It should be noted that the overflow pipe **157** is configured to allow surplus water to be discharged from the water reservoir **150** in the event of malfunctioning of the float valve **153**.

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In the preferred embodiments of the present invention, the water reservoir **150** of the condensing unit **100** is provided with a drain pipe **155**. Preferably, the drain pipe **155** is located proximate the bottom of the water reservoir **150** as illustrated in **FIGS. 1 to 7**. It should be noted that the drain pipe **155** is configured to drain water from the water reservoir **150** for maintenance or servicing of the condensing unit **100**.

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According to the preferred embodiments of the present invention, the centrifugal fan **170** is preferably deposited at the central portion of the condensing unit **100** and suitably positioned proximate the air outlet **110** of the condensing unit **100** as illustrated in **FIGS. 1 to 7**.

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In the preferred embodiments of the present invention, the at least one evaporative pad **130** is preferably mounted proximate the at least one porous side wall **120** of the condensing unit **100** as illustrated in **FIG. 1**. It should be noted that the at least one evaporative pad **130** is preferably having dimensions sufficient to conceal the at least one porous side wall **120** of the condensing unit **100**. In the present invention, it is preferred that the number of evaporative pads **130** correspond to the number of porous side walls **120** of the condensing unit **100**. Preferably, the condensing unit **100** of the preferred embodiments of the present invention is provided with three porous side walls **120** and each of the three porous side walls **120** is concealed by the evaporative pad **130**.

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Alternatively, the at least one evaporative pad **130** can be disposed at the center of the condensing unit **100**, either in a horizontal position or a vertical position. In the embodiment of the condensing unit is provided with the at least one evaporative pad **130** disposed horizontally at the center of the condensing unit, the air outlet is preferably sited at a top surface **180** of the condensing unit. In this embodiment, the centrifugal fan **170** is preferably deposited above the at least one evaporative pad **130** and suitably positioned proximate the air outlet **110** of the condensing unit **100**.

In the preferred embodiments of the present invention, the condensing unit **100** may be provided with a water receiving tray **20** as illustrated in **FIGS. 1 and 8** or a trough **30** as illustrated in **FIGS. 2, 9a and 9b**. In the embodiment of the condensing unit **100** is provided with the water receiving tray **20**, the water receiving tray **20** is suitably mounted on top of the condensing unit **100**. Preferably, the water receiving tray **20** is having a recessed channel **21** formed along the water receiving tray perimeter. In this preferred embodiment, the recessed channel **21** situated above the evaporative pad **130** is provided with a plurality of spaced apart apertures **21a** as illustrated in **FIG. 8**. In this preferred embodiment, the water receiving tray **20** is in fluid communication with the at least one conduit **10**. By way of example but not limitation, the at least one conduit **10** may either integrally form with the water receiving tray **20** or affix to an opening **23** of the water receiving tray **20** through interference fit or application of suitable adhesives. In this preferred embodiment, the water in the water receiving tray **20** will be uniformly and continuously dispensed onto the upper surface **131** of the evaporative pad **130** through the plurality of apertures **21a** formed at the base of the recessed channel **21**. By way of example but not limitation, the recessed channel **21** of the water receiving tray **20** may be U-shaped or V-shaped in section. In this preferred embodiment, a lid **50** may be provided to cover the water receiving tray **20** so as to prevent dirt or small organisms such as insects from entering the water receiving tray **20** as illustrated in **FIG. 1**. The lid **50** may be formed of plastic, aluminium, or any other suitable lightweight non-corrosive material.

In the embodiment of the condensing unit **100** is provided with the trough **30**, the trough **30** is suitably positioned above the at least one evaporative pad **130** and is in fluid communication with the at least one conduit **10**. By way of example but not

limitation, the at least one conduit **10** may either integrally form with the trough **30** or affix to an opening of the trough **30** through interference fit or application of suitable adhesives. Preferably, the trough **30** only covers a portion of the upper surface **131** of the evaporative pad **130** as illustrated in **FIG. 2** so as to allow the water to be directly distributed over the upper surface **131** of the evaporative pad **130**. In this preferred embodiment, the trough **30** may be provided with a plurality of spaced apart indentations **31a** preferably formed on at least one side wall **31** of the trough **30** as illustrated in **FIG. 9a**. It should be noted that the plurality of indentations **31a** of the trough **30** are configured to allow the water to flow uniformly out of the trough **30** such that the water is continuously distributed over the upper surface **131** of the evaporative pad **130**. Alternatively, the trough **30** may be provided with a plurality of protruding lips **31b** formed integral with and extend outwardly from the at least one side wall **31** of the trough **30** as illustrated in **FIG. 9b**. It should be noted that the plurality of protruding lips **31b** of the trough **30** are configured to guide and direct the flow of water onto the upper surface **131** of the evaporative pad **130** in a continuous and uniform manner. If desired, a cover (not shown) may be provided to cover the trough **30** so as to prevent dirt or small organisms such as insects from entering the trough **30**. The lid may be formed of plastic, aluminium, or any other suitable lightweight non-corrosive material.

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In each of the preferred embodiments of the present invention, ambient air from the surrounding is drawn by the centrifugal fan **170** from the at least one porous side wall **120** and travelled through the at least one evaporative pad **130**. It will be appreciated that the drawn air cools the water flowing down the at least one evaporative pad **130** through heat transfer. It should be noted that the at least one evaporative pad **130** must have a sufficient thickness so as to allow efficient heat exchange. By way of example but not limitation, the thickness of the evaporative pad **130** is preferably in the range of 1 inch to 5 inches in order to achieve the desirous heat transfer efficiency for domestic HVAC and refrigeration systems while for commercial HVAC and refrigeration systems, the thickness of the evaporative pad **130** is preferably in the range of 5 inches to 32 inches. However, it should also be readily apparent that the thickness of the evaporative pad **130** can be a variety of thicknesses and the thickness may vary depending on the materials of the evaporative pad **130** used in the condensing unit **100**.

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In the preferred embodiments of the present invention, the evaporative pad **130** is preferably honeycomb cooling pad. Preferably, the honeycomb cooling pad is made of cellulose. However, it should be readily apparent that the evaporative pad **130** may be a multilayer fiber pad or a wood wool pad or corrugated cardboard or the like.

In the preferred embodiments of the present invention, the drawn air is discharged through the air outlet **110** of the condensing unit **100**. It will be appreciated that the temperature of the air discharged from the air outlet **110** of the condensing unit **100** of the present invention is in the range of about 22°C to 30°C which is significantly lower than the temperature (50°C to 60°C) of waste heat generated by a typical condenser in HVAC and refrigeration systems. More specifically, the temperature of the air discharged from the air outlet **110** of the condensing unit **100** of the present invention is in the range of about 24°C to 30°C during day time when the outdoor temperature is in the range of about 27°C to 35°C. While at night, the temperature of the air discharged from the air outlet **110** of the condensing unit **100** of the present invention is in the range of about 22°C to 27°C when the outdoor temperature is in the range of about 23°C to 30°C.

If desired, a filtering means may be detachably disposed at the porous side walls **120** of the condensing unit **100** so as to filter out dust, dirt, odors or other undesired substances carried in the air entering the condensing unit **100** and thereby, extending the life and efficiency of the evaporative pad **130**. By way of example, the filtering means may include but not limited to carbon filter.

In accordance with the preferred embodiments of the present invention, condensate water formed on the surface of the evaporator coil **310** or cooling coil **400** of the HVAC and refrigeration systems **1** is preferably being channeled into the water reservoir **150** of the condensing unit **100** through a condensate line **90** as illustrated in **FIGS. 1 to 7**. It should be noted that aside from being used as an additional cooling medium to cool the water contained in the water reservoir **150**, the condensate water is also used as an additional water source to replenish the volume of water contained in the water reservoir **150**.

In accordance with the preferred embodiments of the present invention, the condensing unit **100** is provided with a disinfectant dispenser **600** as illustrated in **FIGS. 1, 2, 3, 4, 5a, 5b and 7**. It should be noted that the disinfectant dispenser **600** can be filled with any disinfectant deemed suitable for disinfection. According to the preferred embodiments of the present invention, the disinfectant dispenser **600** is operatively connected to a control unit (not shown) whereby the control unit is configured to regulate the activation and deactivation of the disinfectant dispenser **600**. Preferably, the disinfectant dispenser **600** is disposed above the water reservoir **150** as illustrated in **FIGS. 1, 2, 3, 4, 5a, 5b and 7**. According to the preferred embodiments of the present invention, the disinfectant dispenser **600** is configured to dispense a predetermined amount of disinfectant into the water reservoir **150** when a function switch (not shown) of the control unit is actuated by a user. In one preferred embodiment of the present invention, the water contained in the water reservoir **150**, after mixed with the disinfectant, is preferably delivered to the upper surface **131** of the at least one evaporative pad **130** through the at least one conduit **10** such that the disinfectant containing water flows down and wet the entire evaporative pad **130**. In the embodiment of the condensing unit **100** is provided with the water tray **20** or trough **30**, the disinfectant containing water is preferably delivered to the water tray **20** or trough **30** of the condensing unit **100** of the present invention for uniform distribution of the disinfectant containing water onto the evaporative pad **130**. It will be appreciated that when the centrifugal fan **170** draws the ambient air from the at least one porous side wall **120** of the condensing unit **100** through the wetted evaporative pad **130**, the disinfectant containing water is vapourised and the same is discharged into the surrounding area through the air outlet **110** of the condensing unit **100** and, thereby achieving the purpose of disinfection.

In another preferred embodiment of the present invention, the disinfecting containing water is preferably delivered to a dispensing unit **800** by means of at least one pipeline **60** as illustrated in **FIGS. 5a and 5b**. In this preferred embodiment, the dispensing unit **800** is preferably mounted proximate the air outlet **110** of the condensing unit **100**. Preferably, the pipeline is an independent pipeline **60** operatively connected to a second water pump **70** as illustrated in **FIG. 5a**. If desired,

the pipeline **60** can be a branch pipeline of the conduit **10** and the pipeline **60** is preferably branched out from the conduit **10** before the conduit portion **10a** extends within the chamber **200** as illustrated in **FIG. 5b**. In this preferred embodiment, actuation of the function switch of the control unit will simultaneously activate the dispensing unit **800**, to thereby discharge the disinfectant containing water into the surrounding environment through the air outlet **110** of the condensing unit **100**. Preferably, the dispensing unit **800** is adapted for discharging the disinfectant containing water in the form of fog or mist.

As an alternative to the disinfectant dispenser **600** as described above, a spray dispenser **900** pre-filled with disinfection aerosol could be provided. The spray dispenser **900** is preferably mounted proximate the air outlet **110** of the condensing unit **100** as illustrated in **FIG. 6** and operatively connected to the control unit. The spray dispenser **900** is configured to dispense a predetermined amount of disinfection aerosol to the surrounding area through the air outlet **110** of the condensing unit **100** when the function switch (not shown) of the control unit is actuated by a user.

If desired, the condensing unit **100** of the present invention may be further provided with a reversing valve **80** operatively connected to the refrigerant lines **700** as illustrated in **FIG. 7**. It should be noted that the reversing valve **80** is configured to change the flow direction of the refrigerant in the refrigerant lines **700** so as to enable the HVAC system to change from cooling operation to heating operation or vice versa, as desired by a user. It should be noted that during operation in the heating mode, the direction of the refrigerant flow is changed by the reversing valve **800** and the condensing unit **100** of the present invention becomes an evaporator while the evaporator **300** of the present invention acts as a condenser so as to introduce warm air to an indoor space.

According to each of the preferred embodiments of the present invention, the condensing unit **100** may be further provided with a plurality of wheels (not shown) for portability. Preferably, the plurality of wheels are mounted on a base surface of the condensing unit.

It should be noted that configurations of various parts, elements and/or members used to carry out the above-mentioned embodiments are illustrative and exemplary only. One of ordinary skill in the art would recognize that those configurations, parts, elements and/or members used herein may be altered in a manner so as to obtain  
5 different effects or desired operating characteristics. Other combinations and/or modifications of the above-described configurations, arrangements, structures, applications, functions or components used in the practice of the present invention, in addition to those not specifically recited, may be varied or otherwise particularly adapted to specific environments and conditions, manufacturing specifications,  
10 design parameters or other operating requirements without departing from the general principles of the same.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the  
15 principle and scope of the invention, and all such modifications as would be obvious to one skilled in the art intended to be included within the scope of following claims.

**CLAIMS**

1. A condensing unit (100) adapted for use in heating, ventilation and air conditioning (HVAC) and refrigeration systems (1), characterised in that the  
5 condensing unit (100) comprises  
a compressor (140) operatively connected to a chamber (200), an expansion valve (500) and an evaporator coil (310) through a plurality of refrigerant lines (700);  
a water pump (160) configured to deliver and supply water contained in a water  
10 reservoir (150) to at least one evaporative pad (130) through at least one conduit (10), wherein a portion of the conduit (10a) extends within the chamber (200); and  
a centrifugal fan (170) positioned proximate an air outlet (110), wherein the centrifugal fan (170) is configured to draw ambient air through the at least  
15 one evaporative pad (130) from at least one porous side wall (120) and directed air into the environment through the air outlet (110).
2. The condensing unit (100) according to Claim 1, characterised in that the chamber (200) is configured to receive the compressed refrigerant discharged  
20 from the compressor (140).
3. The condensing unit (100) according to Claim 1, characterised in that the portion of the conduit (10a) that located within the chamber (200) is arranged in the shape of a coil.  
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4. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is provided with a condensate line (90).
5. The condensing unit (100) according to Claim 1, characterised in that the  
30 condensing unit (100) is provided with a disinfectant dispenser (600), wherein the disinfectant dispenser (600) is configured to dispense a controlled amount of disinfectant into the water reservoir (150).

- 5 6. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is provided with a spray dispenser (900), wherein the spray dispenser (900) is configured to dispense a predetermined amount of disinfection aerosol into the surrounding area.
- 10 7. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is further provided with a reversing valve (80) operatively connected to the refrigerant lines (700).
- 15 8. The condensing unit (100) according to Claim 1, characterised in that the at least one evaporative pad (130) is preferably disposed above the water reservoir (150).
9. The condensing unit (100) according to Claim 1, characterised in that the at least one evaporative pad (130) is preferably honeycomb cooling pad.
- 20 10. The condensing unit (100) according to Claim 1, characterised in that excessive water in the at least one evaporative pad (130) is cascaded back into the water reservoir (150) of the condensing unit (100).
- 25 11. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is provided with a water receiving tray (20) in fluid communication with the at least one conduit (10) and suitably mounted on top of the condensing unit (100), the water receiving tray (20) is having a recessed channel (21) formed along the water receiving tray perimeter, wherein a plurality of spaced apart apertures (21a) is formed at the base of the recessed channel (21) situated above the evaporative pad (130).
- 30 12. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is provided with a trough (30), wherein the trough (30) is in fluid communication with the at least one conduit (10) and is suitably positioned above the evaporative pad (130).

13. The condensing unit (100) according to Claim 12, characterised in that the trough (30) is provided with a plurality of spaced apart indentations (31a) formed on at least one side wall (31) of the trough (30).
- 5 14. The condensing unit (100) according to Claim 12, characterised in that the trough (30) is provided with a plurality of spaced apart protruding lips (31b) formed on at least one side wall (31) of the trough (30).
- 10 15. The condensing unit (100) according to Claim 1, characterised in that the water reservoir (150) is provided with a float valve (153) connected to a water inlet (151).
- 15 16. The condensing unit (100) according to Claim 1, characterised in that the water reservoir (150) is provided with a drain pipe (155) located proximate the bottom of the water reservoir (150).
- 20 17. The condensing unit (100) according to Claim 1, characterised in that the water reservoir (150) is provided with an overflow pipe (157) located proximate the top of the water reservoir (150).
18. The condensing unit (100) according to Claim 1, characterised in that the condensing unit (100) is further provided with a plurality of wheels mounted on a base surface of the condensing unit (100).