Description

DEVELOPMENT OF AN ENERGY SAVING AND ENVIRONMENTALLY FRIENDLY MOBILE ATMOSPHERIC DEHUMIDIFIER FOR WATER GENERATOR AND DRINKING PURPOSES

Technical Field

This invention relates to a water generator.

Background of the Invention

Today many countries around the world are experiencing a water shortage crisis where water resources are becoming scarce. And not only have water sources been drastically reduced due to pollution and impurities but furthermore changing weather patterns have reduced rainfall in some places. In addition, water treatment using chemicals such as chlorine and other halogens causes toxic effects and health problems. Groundwater can be polluted by pollutants such as pesticides and chemical discharges. The withdrawal of large amounts of groundwater can lead to serious problems such as subsidence and shortages of needed water sources or environmental problems.

Attempts have been made to create a system to condense air moisture and purify the resulting water to make it potable. Producing drinking water by condensing air moisture is a promising alternative.

In a previous similar invention (IDP000031198, Arda Rahardja Lukitobudi, "An energy saving and environmentally friendly mobile atmospheric dehumidifier for water generator and drinking purposes"), an air handling unit for an atmospheric dehumidifier produces dew water from water vapor present in the air suitable for water and drinking water production. A method and device for producing pure dew water from airborne water

vapor using an energy saving and environmentally friendly atmospheric dehumidifier of a condensing unit comprises: In hot climates, fresh atmospheric air is filtered and sanitized and passed through a number of evaporator cooling coils to condense water vapor in the air. The dew water is then collected in a drip pan and flowed into discharge line cooler. To save energy, the cold air after passing through the evaporator cooling coil is then passed to the condenser of a condensing unit of an air handling unit. A refrigerant discharge line coming out of the compressor is then dipped into the condensation water of the discharge line cooler to further save energy. In winter, fresh cold air is filtered and sanitized and then passed to the condenser of the condensing unit of an air handling unit. The heated fresh air is then passed through a number of evaporator cooling coils to condense the water vapor present in the air. The dew water is then collected in a drip pan. A refrigerant discharge line coming out of the compressor is then dipped in condensation water on the discharge line cooler. The system is retrofitted using an environmentally friendly alternative refrigerant that can further save energy. In this invention all equipment and parts of the unit, including pipes, tanks, containers, pumps etc. through which the dew flows have not been made of food grade metal preferably stainless steel and the evaporator has not been equipped with a heat pipe so that the dew water produced can still be improved.

In a previous invention (IDS00006224, Tandi Sutandi, Sumeru, "Portable Vaccine Storage Cooler Box Using AC and DC Electricity"), a method of vaccine storage in the form of a portable cooler box whose cabin temperature can be adjusted from 5^0C to -40^0C using R401A and R404A refrigerants. The portable cooler box can be operated using AC (alternating current) electricity or DC (direct current) electricity. AC electricity

sources can come from electrical power source or other sources, while DC electricity from batteries. The dimensions of the portable cooler are 20 cm to 50 cm long, 20 cm to 40 cm high and 20 cm to 40 cm wide. The advantage of this invention is that there are several power source options, making it more attractive.

In a previous invention (IDP000040839, Arda Rahardja Lukitobudi, Budhi Haryanto, "Energy Saving and Environmentally Friendly Multipurpose Air Conditioning as a Generator of Dew Drinking Water, Hot Water and Dryer"), a method and machine for producing fresh and cold air, dew drinking water, hot air for dryer, hot water for bathing or other purposes using an energy saving and environmentally friendly multipurpose air conditioning machine. The mixture of fresh air and return air from the room is passed to the evaporator coils to condense the water vapor coming from the air to produce pure and fresh dew water and fresh cold air, which is then returned to the room. Municipal network drinking water or other water then soaks the hot discharge line to cool the refrigerant before it enters the condenser thus saving energy and at the same time producing hot water that can be used for bathing or other purposes. The hot air coming from the air-cooled condenser can be used as a dryer. In the invention all equipment and parts of the unit, including pipes, tanks, containers, pumps etc. through which the dew flows, must be made of food grade metal preferably made of stainless-steel metal but the evaporator has not been equipped with a heat pipe so that the dew water produced can be further improved. This invention also in addition to producing dew drinking water can also produce cold air, hot water, hot air, all three of which are not required in the proposed atmospheric dehumidifier machine development invention.

In a previous invention (IDP000029002, Arda Rahardja Lukitobudi, Budhi Haryanto, "Air Conditioning and Condensing Machine for Energy Saving and Environmentally Friendly Drinking Water Production"), a method and machine for producing drinking water from outside air by utilizing an energy saving and environmentally friendly air conditioning machine, comprising the following steps: filtering and sterilizing outside air, the outside air being passed over a plurality of evaporator coils for condensation of the air and the air dew being saturated to produce water droplets, and the water droplets being collected in a condensate drip pan; passing an auxiliary condenser through the condensate air and dipping another auxiliary condenser in the condensate drip pan, then the refrigerant in the condenser pipe cools down and after being passed through an expansion valve, is further exchanged with brine as a second cooling medium on a heat exchanger; wherein the brine is passed to a plurality of evaporator coils in the air handling unit to cool and condense the air passing through the air handling unit, some of the air condenses into water droplets and some is passed to a room to be cooled. In the invention, all equipment and parts of the unit, including pipes, tanks, container, pumps etc. through which the dew flows, have been made of food grade metal, preferably stainless steel, but the evaporator has not been equipped with a heat pipe so that the dew produced can be further improved.

In a previous invention (IDP000058597, Arda Rahardja Lukitobudi, Budhi Haryanto, "Method and Apparatus of Atmospheric Dehumidifier for Water and Drinking Water Production"), an energy saving method and apparatus of atmospheric dehumidifier was designed to produce dew water from water vapor present in the air suitable for water dan drinking water production in which atmospheric air is filtered, sanitized, flowing

alternately into one of the identical air ducts, which include an input air damper, a number of evaporator coils, an output air damper. Then the air is directed to the condenser coil. The dew water formed is collected in a drip pan, flowed by a water pump to a water filter system, an Ultra Violet light tube and to a water storage tank. In the present invention, all equipment and parts of the unit, including pipes, tanks, containers, pumps, etc. through which the dew flows, have been made of *food-grade* metal, preferably stainless steel, but the method used is not suitable for use in a mobile atmospheric dehumidifier machine and the evaporator has not been equipped with a heat pipe so that the dew water produced can be further improved. The object of the invention is to provide a mobile dehumidifier for condensing air moisture and purifying it and all equipment and parts of the unit, including pipes, tanks, containers, pumps etc. through which the dew flows, made of *food grade* metal preferably made of stainless steel metal and the evaporator equipped with a heat pipe so that the dew water produced can be further improved.

Invention Summary

Throughout this document, other than to the contrary, the term "comprising" shall be construed as including it and not excluding it.

An atmospheric dehumidifier consists of:

air handling unit located on a movable machine frame and can be equipped with a generator unit or electrical power source or other power source;

atmospheric air *blower* fan installed in the air handling unit;

a number of initial air filters, medium filters and UV light lamps are located before the atmospheric air blower fan;

the refrigeration machine installed in the air handling unit comprising of: a compressor, condenser, expansion valve, evaporator equipped with heat pipes and a number of auxiliary components where the refrigerant used is environmentally friendly;

another atmospheric air blower fan that has a greater air flow rate than the previous fan installed after the condenser of the cooling machine that takes fresh air from outside and cold air coming from the evaporator equipped with heat pipes so that it cools the condenser which results in saving energy;

A dehumidifier and water condensation system / condensing device to condense the water vapor contained in the air consists of:

an air filter device consists of a number of pre air filters, medium filters and a UV light lamp to filter and sanitize humid input atmospheric air; a condensing device consisting of an evaporator equipped with heat pipes from a cooling machine to condense water vapor taken from air humidity to form dew;

an atmospheric air blower fan to draw moist air through air filters and a condensing device placed before the air blower fan to form dry air;

and a device for discharging dew from a condensing device to dew drip pan, u-pipes, dew pumps, dew filters, UV light tubes, dew collection tanks, ultra-violet light dipping lamps wherein all parts, including pipes, tanks, containers, pumps etc. through which the dew flows, shall be made of food grade metal preferably made of stainless-steel metal so that the dew is fit for drinking.

A panel mounted on the machine frame for running tools and machines including an inverter motor adapter mounted on the

machine frame as well as a number of control devices and a number of sensors.

Brief Description of Figure

Figure 1 is a diagram depicting the process flow of the system.

Full Description of Invention

The following description is the development of an energy saving and environmentally friendly mobile atmospheric dehumidifier for water generator and drinking purposes. The system uses alternative refrigerants that are environmentally friendly and can also further save energy.

In accordance with Figure 1, the description below will describe in detail the development of an energy saving and environmentally friendly mobile atmospheric dehumidifier for water generator and drinking purposes.

Atmospheric dehumidifier machine is contained in an air handling unit (33) which is located on a machine frame (34) where there are several wheels so that it can be moved and which can be equipped with a generator, or electrical power source or other power source.

Compressor (10) will compress the refrigerant vapor at high pressure and temperature to the condenser (12) through the discharge line (11) to discharge the heat so that the phase changes to liquid.

This refrigerant liquid will flow to the check valve (13) through the liquid line (14), then to the liquid receiver (15), to the filter dryer (16), to the sight glass (17), to the solenoid valve (18), to the expansion valve (19) to lower the pressure and temperature drastically and then enter the evaporator coil (20) which is equipped with a heat pipe (32) to

take heat from the fresh air (1) to be cooled and the water vapor contained in the air will be condensed, so that the refrigerant in the evaporator coil (20) will evaporate and return to the compressor (10), through the suction line (21).

Meanwhile, fresh air from outside (1) will be sucked in by an atmospheric air blower fan (8) through the pre air filters (2) and medium air filters (3) so that dust, dirt and other pollutants are removed, as well as through an ultra violet light lamp (6) to sanitize the air.

Then the air will enter through the partition (4) to the evaporator coil (20) which is equipped with a heat pipe (32) to take heat so that the air becomes cold and the water vapor in the air will condense and the dew droplets will be collected in the dew drip pan (5) which will be pumped by the dew pump (25) through the dew droplet hole (23), u pipe (24), dew pipe to dew filters (26), ultra violet light tubes (27) and to the dew storage tank (28) where an ultra-violet light dipping lamp (29) has been installed so that the dew is suitable for drinking.

Then the dew will be pumped by another dew pump (30) to the output (31).

Meanwhile, the cold fresh air after passing through the evaporator coil (20) equipped with a heat pipe (32) will be sucked by an atmospheric air blower fan (8) to flow into the condenser (12) so that it will cool the condenser (12) and reduce the energy to the outside air (22) again because it is sucked by another atmospheric air blower fan (9).

The other atmospheric air blower fan (9) that sucks the air passing through the condenser (12) has a greater air flow rate than the atmospheric air blower fan (8) because in addition to sucking cold air coming from the evaporator coil (20) equipped with a heat pipe (32) it will also suck some fresh air from outside so that it results in saving energy.

The evaporator coil (20) is equipped with a heat pipe (32) where the heat absorbing part of the heat pipe is placed before the evaporator coil (20) as an initial cooling device and the heat rejection part of the heat pipe is placed after the evaporator coil (20) as a fluid condensing device in the heat pipe, where the heat absorbing part and the heat rejection part of the heat pipe are connected.

It is important to control the temperature so that fresh air is cooled at its dew point and water vapor will condense at that point.

It is also important to control the minimum and maximum allowable refrigerant pressure to keep the compressor (10) at a safe condition.

Oil pressure control is also important to ensure that oil remains in the compressor (10).

If the pre (2) and medium (3) air filters are dirty and need to be replaced, it is important to have a control device that can signal when the filters need to be replaced.

Another control device is the dew control device, which when the dew is at the upper or lower-level limit to turn off or start the dew machine.

While the required sensors will sense the following parameters: discharge pressure, suction pressure, discharge temperature, suction temperature, outside air temperature and relative humidity, air temperature and relative humidity before evaporator coil, air temperature and relative humidity after evaporator coil, room air temperature and relative humidity, etc. The electrical sensors are as follows: voltage, frequency, *cos-phi* efficiency of the electric motor, *rpm of the electric* motor, electric current of the compressor, electric current of the condenser fan, electric current of the *blower* fan of the air processing unit, total electric current, UV light

indicator, compressor light indicator, condenser fan light indicator, air handling unit blower fan light indicator, system failure light indicator, dew level indicator in the dew collection tank etc.

This unit can also be equipped with *inverter* motor *adapters* and generators or electrical power source or other power sources as its power source. The water generator of this invention uses environmentally friendly cooling media and refrigerants to support the use of environmentally friendly materials.

All equipment and parts of the unit, including pipes, tanks, containers, pumps etc. through which the dew flows, must be made of food grade metal preferably stainless steel so that the dew is fit for drinking.

Although part of this invention has been disclosed, modifications and variations from experts are considered to be within the scope of this invention.

Claims:

1. An atmospheric mobile dehumidifier consists of: (a) an air handling unit container located on a movable machine frame and can be equipped with a generator unit or electrical power source or other power source; (b) an atmospheric air blower fan installed in the air handling unit container; (c) a number of pre air filters, medium filters and UV light lamps located before the atmospheric air blower fan; (d) refrigeration machines installed in the air handling unit container, namely compressors, condensers, expansion valves, evaporators equipped with heat pipes and a number of auxiliary component tools where the refrigerant used is environmentally friendly; (e) another atmospheric air blower fan that has a greater air flow rate than the previous fan installed after the condenser of the cooling machine that takes in fresh air from outside and cold air coming from the evaporator equipped with heat pipes so as to cool the condenser which results in energy saving; (f) all equipment and parts of the unit, including pipes, tanks, containers, pumps etc. through which the dew flows, shall be made of food grade metal preferably stainless steel so that the dew is fit for drinking; (g) a panel mounted on the machine frame for running tools and machines including an inverter motor adapter mounted on the machine frame as well as a number of controls and a number of sensors. An atmospheric mobile dehumidifier and a water condensing system/condensing device to condense the water vapor contained in the air consists of: (a) air filters consisting of a number of pre air filters, medium filters and a UV light lamp to filter and sanitize the humid input atmospheric air; (b) a condensing device consisting of an evaporator equipped with heat pipes from a

refrigeration machine to condense water vapor drawn from air humidity to form dew; (c) an atmospheric air blower fan to draw moist air through air filters and a condensing device placed before the atmospheric air blower fan to form dry air; and (d) a device for removing dew from the condensing device to the dew drip pan, u-pipes, dew pumps, dew filters, UV light tubes, dew storage tanks, ultra violet light dipping lamps so that the dew can be suitable for drinking.

2. An apparatus according to claim 1 relating to an evaporator equipped with a heat pipe useful for producing more dew wherein said heat pipe comprises a heat absorbing part. The heat pipe comprises a heat absorbing section, an adiabatic section and a heat rejection section wherein the heat absorbing section of the heat pipe is placed before the evaporator for the purpose of pre- cooling so that the atmospheric air flowing into the evaporator is cooler and produces more dew while the heat rejection section of the heat pipe is placed after the evaporator for the purpose of condensing the fluid inside the heat releasing section of the heat pipe so that the fluid will flow back towards the heat absorbing section of the heat pipe.