

CONDENSATION TYPE DEHUMIDIFIER

TECHNICAL FIELD

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[001] This invention concerns dehumidifier for the control of the room humidity and temperature. The dehumidifier is of the condensation type and may be used in air conditioners or as part of air handling unit (AHU) in air conditioning systems or in enclosed environments where hygroscopic control is required
10 independently from air cooling.

BACKGROUND ART

15 [002] Indoor climate control apparatus such as the general air conditioner has two functions, namely temperature lowering and humidity reduction. While lowering temperature is obvious in tropical regions, reducing humidity is often taken for granted because the chilled parts of an air conditioners (such as the heat exchanger of the indoor unit) automatically functions as a dehumifier when
20 moisture in room air becomes dew upon contact with the chilled parts and removed as water dripping out to the air conditioner's outdoor unit. Nevertheless, dehumidifying process is often more important than the air cooling process of air conditioning comfort as determined by the feel of ease of

sweat being evaporated from the skin and which is thus determined by relative humidity of the ambient air.

[003] Three main methods of removing moisture from the air are (i)
5 compression and aftercooling method, (ii) absorption method, and (iii)
condensation method. The first method, i.e. dehumidifying by compression
and aftercooling, is used typically in a compressed air system in which the
compressed air output is required to have reduced moisture to be used for e.g.
automatic control instruments or cleaning of delicate machined parts. However,
10 the power required for such compression systems is so high compared to that
of other dehumidifying methods that the compression system is not an
economical one unless it is for the aforesaid use or for clean rooms.

[004] The second method, i.e. adsorption method, uses sorbent materials
15 such as silica gels, activated alumina and aluminium bauxite. Liquid sorbents
include halogen salts such as lithium chloride, lithium bromide, and calcium
chloride, and organic liquids such as ethylene, diethylene, and triethylene
glycols and glycol derivatives. Sorbent materials are hygroscopic to water
vapour and once the material has absorbed moisture, it needs to be heated at
20 high temperatures to evaporate the water into vapour and discharged.

[005] A typical absorption dehumidifier uses a wheel containing sorbent
materials which are cycled to absorb moisture from the room and heated to
discharge the water as vapour outside the room before being recycled back to

the room. In addition to high energy consumption for heating the sorbent material, the adsorption dehumidifier undergoes constant enthalpy (isenthalpic) process in which, if the humidity is reduced, air temperature is then increased. The increase of this air temperature will be playing a part to increase the temperature of the air supply resulting in the lower efficiency of the air conditioning system.

[006] The third method, i.e. dehumidifying with condensation process is based on the principle of condensing water vapour in the air into dew or water condensate upon contact with a medium that is cooler than the dew point temperature of the air. The condensate is drained through pipe outside the building. The most common used medium is the cooling coil, also known as evaporator in the air conditioning system. The cooling agent employed in the medium may be a refrigerant and/or chilled water. When the high humidity and temperature air flow through the cooling coil which have lower temperature than the dew point temperature, the air will have lower temperature. The lower humidity is a result of the condensation of water moisture in the room air which is collected and discharged outside the room or building through the water pipe. This type of dehumidifier is the most common one used in air conditioners.

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[007] The condensation dehumidifier that uses refrigerant has the limitation in reducing air flow temperature to close to water freezing point to achieve humidity reduction because it would require the air flow to be cooled to dew point at 2°C. The condensation dehumidifier is not effective for this because of

the freezing problem as well as the difficulty in reaching temperatures below 7°C. Typical condensation type dehumidifier are only capable of reaching 10°C – 15°C.

5 [008] Thus, to reduce the humidity by lowering the dew point temperature to below 10°C, an engineer will choose absorption dehumidifier over condensation dehumidifier. As the adsorption dehumidifier works to adsorb the humidity from the air in the air conditioning area by hygroscopic means and then discharge the humidity outside the building it avoids the limitation from
10 freezing because the humidity is in the same phase all the time. Nevertheless, the humidity discharging process of the absorption dehumidifier needs heat from a heat source such as electric heating coil water stream or heat from gas, etc. Thus, the adsorption dehumidifier is not only expensive but also requires high energy consumption especially in the case that using electric heating coil.

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[009] In addition, when using the dehumidifier to control the temperature and relative humidity inside the air conditioning room, it is required to reheat the air to the room to the desired temperature in case where the air is overchilled. Moreover, if the reheating employs the electric heat coil, it results in higher
20 energy consumption.

SUMMARY OF DISCLOSURE

[010] It would be desirable to dehumidify the air at the dew point temperature, which is close to the freezing point of the water, without using adsorption
5 dehumidifying methods, and without limitation from the freezing problem is used. The condensation dehumidifier according to our invention endeavours to produce a supply of air which temperature is as low as 2°C and to reuse the heat conventionally to be discharged. Therefore, our invention has higher efficiency than conventional adsorption dehumidifier and would be suitable for
10 conditioning systems that need dew point temperatures close to 0°C without freezing problem.

[011] This is thus the main novel aspect of the condensation type dehumidifier according to our invention which may be implemented for the low price air
15 conditioner that is required to provide a low temperature range from 10°C to 2°C with energy conservation of about 30 – 40% compare to conventional systems, especially adsorption dehumidifier that requires higher energy consumption and expensive.

20 [012] Another aspect of the condensation dehumidifier according to our invention is to re-use the compressor hot gas discharge from the room as part of energy conservation purpose without the need for separate electric heating coil. To enable our condensation type dehumidifier to reuse the heat from the compressor to control the supply air temperature as desired, a hot gas

modulating valve is used and controlled precisely to provide the humidity controlling system with full efficiency. As such, our system is able to lower the temperature at the same quantity of air supplied compare to the adsorption dehumidifier.

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[013] Chiller in which supplies cold water at about 0°C or equal to 0°C that composed of compressor Condensing Coil Refrigerant Control Valve or Pressure Valve and Evaporator which are similar to other chillers. But this chiller is for cold water distribution built in the Cooling Coil inside Air Handling
10 Unit (AHU). According to this patent, there will be additional instrument that is the Discharge Refrigerant Gas Control Valves that are two types: Turn on / off and Ratio type to control the flow of the high temperature gas to hot gas reheat coil; that is installed in the Air Handling Unit (AHU). They are behind the Chilled Water Cooling Coil in the appropriate quantity to warm up the air process of
15 temperature and humidity controlling in air conditioning room.

[014] Inside the Air Handling Unit (AHU), it is composed of Air Filter Set, Chilled Water Cooling Coil Set, Hot Gas Reheat Coil Set and Supply Air Fan, which installed according to the direction of airflow and constructed to be one
20 set inside the Air Handling Unit (AHU). Chilled Water Cooling Coil Set will obtain cold water from the chiller via the pipe that contains at least one pump. This pump is used for pump water in the evaporator. The water will pass through ice cool water pipe and the valve that control water flow through the Chilled Water Cooling Coil and then flow back through the suction's side of the

cold water pump as one cycle. Hot Gas Coil will receive the hot air at the exporting side which connected by the reagent's pipe from the exporting pipe behind the valve that control the flow of the hot air in the chiller. After the hot air flow through the Hot Gas Reheat Coil, it will flow back to the high-pressure side
5 with the reagent in front or behind the Condensing Coil (depend on the design).

[015] Inside the Air Handling Unit (AHU), when the fan starts working, hot air and the humidity will flow through every part inside the Air Handling Unit (AHU), respectively. The air will be cooler and lower the humidity when it pass through
10 Chilled Water Cooling Coil. The reduction of the humidity using the Chilled Water Cooling Coil is the humidity reduction by condensed method. It is from the property of the Cooling Coil which contain cold water distributed at about 0°C that result in the cool air from the Cooling Coil have the low dew point. In case of the temperature of the cold water is 0°C, the air from the Cooling Coil
15 will have a dew point at about 2°C in which there is no problem of the ice formation of Cooling Coil. After the cool airflow drains away of the Cooling Coil, it will inflow to the Hot Gas Coil.

[016] The Hot Gas Coil will function to warming the air to be suited for control
20 stable temperature and relative humidity in the room by controlling the quantity of the reagent, flowing of the reagent through Hot Gas Coil that will be leading to the instability of the reagent pressure. Therefore, the stability of the reagent pressure is stabilized by the adjustment of the speed of the fan to be consistent

to the flow of the reagent. This was done by installation of the sensor of the reagent pressure at the export side as controlled by automatic program.

[017] This can be expressed that Hot Gas Coil that installed next to the Chilled
5 Water Cooling Coil in the Air Handling Unit has received the heat from hot air
compression from the compressor inside the chiller. The Hot Gas Coil function
as the air warm for the precisely control of the room temperature and humidity
without the need of other heat providing instruments such as Electric Heater.
This resulting in the air conditioning system according to this patent able to
10 control temperature and humidity to be lower than other air conditioner and
humidity reducing instrument and energy conservation which can be used
instead of Absorption Type Dehumidifier that is expensive and not conserved
energy.

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LIST OF ACCOMPANYING DRAWINGS

[018] We would now refer to the following drawing(s) which accompanies this
specification to provide a better understanding of our invention through a
20 detailed description that follows. The drawings are to be understood as non-
limiting and exemplary illustration of specific or preferred embodiments of our
invention, in which:

[019] FIGURE 1 illustrates in a schematic diagram showing the flow of air inside the air conditioning system that use the cooling coil with direct expansion (DX) coil for reheating usage type according to our invention;

5 [020] FIGURE 2 shows a hygrometric graph useful for designing the air conditioning system according to the diagram shown in Figure 1;

[021] FIGURE 3 depicts a table listing some technical information of the cooling coil of the air conditioning system in Figure 1;

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[022] FIGURE 4 illustrates another table listing some technical information of the refrigerant type reheating system in air conditioning system in Figure 1;

[023] FIGURE 5 shows a schematic diagram of an air conditioning system
15 which uses the cooling coil and reheat coil, including a chiller;

[024] FIGURE 6 depicts a circuit diagram of the chiller and the reheating coil control valve turn off/on type; and

20 [025] FIGURE 7 illustrates a circuit diagram showing the cycle of the refrigerant in chiller and refrigerant controlling valve for linear reheat coil.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[026] FIGURE 1 is a diagram showing the flow of the air of an air conditioning system in which temperature and humidity lower than that could be achieved by conventional or normal air conditioner is required. This air conditioning system uses the technique wherein the condensation of the water vapour in the air to become liquid and then discarded through the waste water pipe is rearranged to reuse the heat from the refrigerant pipe from the compressor of the chiller. The major components comprising the system are Air Handling Unit (AHU) 1, air quantity or intake adjusting set from the outside air 2, air filter 3, cooling coil 4, refrigerant type reheat coil 5 and air supply fan 6 which functions to blow cool air through air supply pipe to the air conditioning area through air supply diffuser 8 into the air conditioning room 9. The air that is inside the room 17 will then be sucked back via ventilator 10 and flowed through the air pipe return 11 and mixed with the intake air from outside the building in the air mixer 13 at the Air Handling Unit (AHU) 1 and then cycled back to the air filter 3.

[027] The schematic diagram of our air conditioning system, as shown in Figure 1, is similar to other condensation type dehumidifying air conditioning system for controlling the humidity in many aspects but there are key differences which enables it to supply the air at a much lower dew point temperature with the precise control of the reheat coil 5 according to this invention. With this achievement, it is able to dehumidify and lower the temperature more efficiently than the others air conditioners.

[028] In our case, the dew point temperature of the air supply that we can achieve may be as low as 2°C. To enable the temperature of air supply to reach this low, the chiller [to be described later] would have to cool down the water to 0.5°C before it is supplied to the cooling coil to give it the dew point temperature at 2°C. In addition, to provide a constant control over the temperature and humidity, the air conditioner have to be installed with the reheat coil 5 at the same time for the reduction of the heat load in the room. This reheat coil 5 receives heat from the hot gas flowing through the pipe from the compressor [to be described later]. This is reusable waste energy which may be separately harnessed from the chiller apart from cooling water. Thus, cooling coil, choice of reheat coil and system designing are important techniques in designing the present high efficiency air conditioning system.

[029] Supposing that the air conditioner according to FIG. 1 is to control the room 17 temperature at 18°C with the relative humidity (RH) at 35%, the air supply rate at 2000 cm³ and the ratio between air mixture from outside the building 12 to the air in the air conditioning room is 10:90. The air temperature and humidity in the air conditioning process according to FIG. 1 and the design based on the hygrometric graph in FIGURE 2, at the point of air intake from outside the building 12 at 36°C and relative humidity 60% RH. In other words, the supplied air is mixed with the air being drained away from the room 17 that has the temperature of 18°C and 35% RH at a ratio of 10:90 with the adjustment of the flow back's air quantity and air quantity from the outside. At the admixed

ratio of air in chambers 13 and 14 will have the temperature at 19.8°C DB (dry bulb)/12.8°C WB (wet bulb) prior to passing through the cooling coil 4, which forms the basis for choosing cooling coil design.

5 [030] When the air flows through the cooling coil 4 into chamber 15 at a rate of 2000 cm³, the air from the cooling coil 4 must have the dew point temperature at or lower than the dew point temperature inside the room 17 from the hygrometrics. According to FIG. 2, the air inside room 17 at 18°C / 35% RH will have the dew point temperature equal to 2.3°C and the mixture of air or the air
10 that flows through cooling coil from chambers 13 and 14 at 19.8°C DB/12.8°C WB will have dew point temperature at 7.2°C. This means the cooling coil in this case must be able to cool down from 7.2°C to 2.3°C dew point temperature and according to this characteristic of the cooling coil of the bypass factor, the air from the cooling coil will have 95% relative humidity.

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[031] Therefore, we can summarize the stage of the air at the beginning in chamber 13 and the last stage from the cooling coil as follows:

[032] At the stage of the air is before flow through cooling coil from chamber
20 13

-	Dry Bulb Thermometer	19.8°C DB
-	Wet Bulb Thermometer	12.8°C WB
-	Relative humidity	43.9% RH
-	Dew point temperature	7.2°C

- Absolute humidity 6.32 g/kg of dry air
- Enthalpy 35.9 kJ/kg

[033] The air after draining away from cooling coil at chamber 15

- 5 - Dry Bulb Thermometer 3°C DB
- Wet Bulb Thermometer 2.7° WB
- Relative humidity 95% RH
- Dew point temperature 2.3°C
- Absolute humidity 4.49 g/kg of dry air
- 10 - Enthalpy 29.5 kJ/kg

[034] The heat process of the cooling coil will have the properties as shown below:

- Air quantity 2000 cm³
- 15 - Air in 19.8°C DB / 12.8°C WB
- Air out 3°C DB / 2.7°C WB
- Humidity reduction quantity 4.42 kg/hr
- Total cooling quantity 14.47 kW
- Relative heat reduction quantity 11.40 kW

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[035] The air supply and processing as described above are necessary considerations for choosing cooling coil design in the air conditioning to control humidity. This information is based on the thermodynamic process of the air, which is for controlling the quantity or volume of the chilled water flow,

temperature of chilled water intake and output and other factors of the cooling coil.

[036] FIGURE 3 lists out the parameters of the cooling coil as chosen from the
5 information above as calculated from the hygrometric diagram of FIG. 2 and the
summary of the air process as described before. The chosen results are
grouped into three parts of the cooling coil, i.e. air flow related data, fluid data
and physical data. Based on these data, we sent the following specifications to
the cooling coil manufacturer to fabricate the cooling coil according to our
10 design; size at 533 x 500 mm, diameter of the copper pipe 12 mm, the
aluminum type thickness 0.15mm, fin density 10 fin/inches (FPI), comprised in
6 rows of copper pipe.

[037] If we use this particular design of the cooling coil in our prototype that
15 has water supply chilled at 0.5°C, water flow out at 3.5°C and flow rate at 4.24
cm³/cm, the cooling coil 4 will have a pressure drop at 25.3 kPascal. Moreover,
if the air in of the cooling coil has the property as mention above at the
chamber 13, it can be seen that the air drains away from the cooling coil 4 will
have some minor changes from the requirement as shown here.

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[038] The air flow out from the cooling coil at chamber 15 has the following
properties:

- | | | |
|---|----------------------|----------|
| - | Dry Bulb Thermometer | 2.7°C DB |
| - | Wet Bulb Thermometer | 2.5°C WB |

-	Relative humidity	96.8% RH
-	Dew point temperature	2.2°C
-	Absolute humidity	4.46 g/kg of dry air
-	Enthalpy	13.9 kJ/kg

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[039] This is the actual condition that drains away from the cooling coil 4 as stated, and is proximately near to the requirement value. However, it can be noticed that the cooling coil 4 is able to supply cooling effect to reach the dew point temperature as low as 2.2°C by using chilled water supply with freezing point as low as 0.5°C and the chilled water temperature at 3.5°C. It can be further noticed that the differences between the water in and out is lower than air conditioning which design is to give the very low different temperature between water in and out. This technique is the important technique that lowers down the air supply temperature to be lower than air conditioner. The air at the cooling coil have the high temperature at 19.8°C DB / 12.8° WB and the air flow speed at the surface of the cooling coil is 2.08 m/s which is high enough for the heat transfer between chilled water at 0.5°C and 19.8°C which will not create the freezing. Thus if the chilled water supply temperature is lower than 0°C, the system risks freezing at the cooling coil which is the limitation of using condensation dehumidifier.

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[040] When the air flows out of the cooling coil into chamber 15 which have the dew point temperature at 2.2°C it will flow through the reheat coil 5 that functions to reheat to keep the room air 17 to have constant temperature at

18°C and humidity 35°RH at every loading status. Thus the air flowing through the reheat coil will have its temperature adjusted at chamber 16 to be in the range of 2.7°C DB to 18°C DB in order to get the constant dew point temperature at 2.2°C at the volume of the air supply at 2000 cm³. The reheat
5 coil 5 in this prototype has been configured to use *Freon*[™] refrigerant R22 from the Hot Gas Supply Duct of the compressor at the chiller selected by using condenser selection in FIGURE 4.

[041] FIG. 4 shows the heating coil being used as the reheat coil using
10 *Freon*[™] refrigerant R22 at the saturated temperature of the refrigerant's condensation at 50°C which has the same volume and property as the cooling coil capacity, but which has only 2 rows. This reheat coil will have the capacity to supply the heat at 11.8 kW making a 2000 cm³ air flowing at 2.7°C temperature to increase to 19.4°C which will be enough to supply the heat in
15 the air conditioning that requires air supply of temperature not more than 18°C.

[042] FIGURE 5 shows the dehumidifier that can supply air at the lower dew point temperature with the reheat coil according to this invention. It comprises an Air Handling unit (AHU) 1 that has the following important components:
20 cooling coil 4, reheat coil 5, fan 6 and other components as described before. In addition, it has another component, which is a first temperature sensor 18 for the mixture of air in chamber 13 and a second temperature sensor 19 for the flow of air from cooling coil 4 in chamber 15, dew point temperature sensor 20 for the air supply in chamber 16 and temperature, and humidity sensor 21 for

sensing the air 17 in the air conditioned room 9. These sensors can be installed depending on the needs of the automatic controlling system.

[043] Chiller 25 functions as a supplier of chilled water flowing through the
5 chilled water duct 22 to the cooling coil 4 at the appropriate temperature for the
cooling coil 4 with chilled water pump 23. The quantity of the water conducted
will be more or less according to the temperature and humidity reading of the
sensor 21 in the air conditioned room 17. The control system will automatically
check and control the chilled water flow by adjusting the speed of the chilled
10 water pump 28 or controlling the chilled water valve 27. The chiller 25 also
handles return duct 24 which is connected to the reheat coil 5 in order to supply
the heat to the heat coil by the control system which controls the refrigerant
valves 26 and 27.

15 [044] The air in the air conditioning room 17 will be sucked back to a return air
duct 11 when the fan is turned on. The air will flow through the Mixed Air
Chamber 13 to the air filter 3 and then to the chilled water coil to decrease the
temperature and humidity in the air which will become cool air in chamber 15
as sensed by the dry bulb thermometer as the low dew point temperature
20 before flowing through the reheat coil 5 to supply the appropriated amount of
heat to the air to warm it while the dew point temperature is maintained at
constant in chamber 16. The heat generation of the heating coil is controlled by
the system that functions by comparing the reading of the dry bulb thermometer
in the air conditioning area from the sensor 12 with the temperature set by the

user. In addition, the sensor will provide data for the control system to control the hot gas valve 26 and 27 to turn on and off accordingly to warm the air alternately in order to modulate the temperature in the air conditioning room to keep to the user-set temperature point. This constant control system will enable
5 the required humidity attained in the air conditioning room.

[045] FIGURE 6 is showing the cycle of the refrigerant in the chiller including the condenser hot gas valve for the reheat coil. This cycle involves compressor 100 which functions to suck the low pressure air flow from the sucking duct 140
10 and converting it to be high pressure hot gas which is sent to the condenser 200 to condensate it into liquid before sending it to the refrigerant control valve 300 and injecting it into the evaporator 400 to cool the chilled water at the required temperature. The vaporized stream of refrigerant will be sucked back to the compressor 51. The components of the water cooler as described are
15 typical components that are usually used in the conventional chiller, but our chiller will have two of the condenser refrigerant valves i.e. valve 26 and valve 27 (shown in FIG. 5) for the reheat coil. These two valves will control the refrigerant flow by electrical control means using solenoid coil at the appropriate time to let the refrigerant flow through the condenser duct. High
20 temperature refrigerant flows through the solenoid valve 27 to the condenser gas duct 90 and to the reheat coil at the Air Handling Unit (AHU) to reheat the air conditioning system. Then, the refrigerant will flow back to the return refrigerant duct 100 to the check valve 110 and flow through condenser of the chiller.

[046] The reheat coil functions to release heat from the condenser coil which helps the air conditioning system to discharge the heat and reduce the electricity use by the condenser. But in certain situations this will result in the refrigerant pressure becoming too low in both the condenser and the refrigerant intake side which will lead refrigerant system to become unstable and may even result in compressor seizure if freezing occurs. Thus, the chiller must have a controller to control the refrigerant pressure so that it is not too low. This is achievable by installing a sensor 170 for the condenser refrigerant pressure for sending the data to the control system to control the air release fan of the condenser coil 160 so as to maintain the condenser refrigerant pressure and stabilize the refrigerant system via valve 26 and 27.

[047] In addition, as shown in FIGURE 7, the chiller may be installed with solenoid valve 70 and hot gas bypass valve 80 to send the condenser hot gas to bypass the condenser to evaporator 40 in order to reduce compressor workload at the time the heat load of the evaporator is lower. This is to control the temperature of the chilled water supply so as not to be too low. The bypass valve will make the control system to be more precise.

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[048] FIG. 7 shows the cycle of another chiller embodiment that is similar to the chiller in FIG 6. Despite it uses linear hot gas valve or modulating type valve by using a 3-way modulating valve 280 which can adjust the refrigerant flow to the hot gas reheat coil in order to be consistent to the requirements of

the heat load in the room. The refrigerant that flows out from the 3-way modulating valve will discharge the refrigerant in two ways. In the first way, the refrigerant will flow through the exit duct 90 to the condensing coil 200, while in the other way, the refrigerant will flow out to the exit duct 100 in order to
5 discharge into the hot gas reheat coil. The discharge refrigerant gas released from the hot gas reheat will flow to the return duct 110 as liquid and flow in to mix with the refrigerant that flows out from the condensing coil at the liquid refrigerant flow direction 120 before flowing through the refrigerant control valve 300 there forth.

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[049] It would be obvious to a person having ordinary skill in the art that many of the aforesaid components, parts or processes may be modified or substituted with equivalents which are not to be regarded as departures from the general principles of our condensation dehumidifying invention. For
15 example, while *Freon*TM have been used in many of our prototypes or trial units which are old models of air conditioning systems, we have found that, in making the necessary modifications thereto in accordance with our invention, substituting this undesirable CFC refrigerant with antifreeze liquid such as glycol or glycol derivatives have produced similar or better results. Accordingly,
20 such modifications, variations or equivalents are to be considered as falling within the letter and scope of the following claims.

CLAIMS

We claim:

- 5 1. Condensation Type Dehumidifier in an Air Handling Unit (AHU) of an air conditioning system capable of supplying air at dew point comprising a chilled water cooling coil (4) which obtains chilled water from a chiller (25) and a hot gas reheat coil set (5) that obtains the heat from a discharge refrigerant gas duct of a compressor with a discharge hot gas volume control valve for
- 10 controlling the hot gas by using solenoid valves (26) and (27) that are on / off valves or 3-way modulating valve (280) characterized in that the chiller, which compressor (1), a heat coil (2), a refrigerant control valve (3), and an evaporator (4), operating to cool the water down to closely to the dew point and to supply said chilled water (23) to a chilled water cooling coil by pumping said
- 15 chilled water (23) to said evaporator through a chilled water duct (22) and chilled water cooling coil (4) to dehumidify air at dew point temperature of 2°C without any freezing problems at the cooling coil wherein the chilled water temperature and humidity are regulated with a room in accordance to wherein said chiller comprised a control valve that controls volume of a hot gas flowing
- 20 there through, wherein said gas flow including the steps of flowing through the refrigerant duct and to a hot gas reheat coil by high end pressure of the compressor flowing back to a condenser in the chiller to turn into liquid and then flowing to a pressure regulator thereafter whereby the heat from the hot gas flowing through the compressor in the chiller is recovered to be used to

accurately control the temperature and humidity by a control system employing a microprocessor system to automatically operate the aforesaid components.

2. A condensation type dehumidifier according to Claim 1 wherein the air
5 handling unit (AHU) includes two chilled water cooling coils set put in ordering to the direction of the air flow in order to dehumidify temperature and humidity wherein in the event of high overloaded heat an dew point temperature at a low level is required the first set of chilled water cooling coil operates to dehumidify humidity and air temperature down to said dew point temperature at
10 approximately 8.0 ~ 14.0°C before supplying into a second chilled water cooling coil and continue to lower the dew point to 2.0°C together with the hot gas refrigerant reheat coil in controlling the stabilization of temperature and humidity in room.