The present invention relates to an air heating unit of the air conditioning including a compressor, a thermal compensation device and an air-cooled condenser connected sequentially with one another by pipeline to define a refrigeration cycle. A high-temperature gaseous refrigerant flowing in inner and outer tubes of the thermal compensation device performs transfers heat with an intermediate-temperature liquid refrigerant flowing in mid tube, so that temperature of a liquid refrigerant flowing in a capillary gap between mid and inner tubes is increased to achieve liquid expand and flow restrained effects. The capillary gap can block bubbles of super heat from entering and suppress the liquid refrigerant from flowing through. Thus, a limited amount of liquid refrigerant can be sucked into the compressor at a low pressure without having lubricating oil to be turned cold. This air heating unit eliminates the use of evaporators other than in a conventional refrigeration system.
AIR HEATING UNIT OF THE AIR-CONDITIONING

FIELD OF THE INVENTION

[0001] The present invention relates to an air heating unit of the air-conditioning, and more particularly to the air heating unit of the air-conditioning that has been designed with no evaporator.

BACKGROUND OF THE INVENTION

[0002] Conventional air-conditioning equipment generally includes four basic items of device, respectively: an evaporator, a compressor, a condenser and a thermal expansion valve, and the four major items of device are connected sequentially with one another by a pipeline to define a refrigeration cycle.

[0003] According to the operation principle of the conventional air-conditioning equipment, a low-pressure low-temperature refrigerant absorbs heat to produce a refrigeration effect in the evaporator. In other words, air blows through the evaporator to lower the temperature of air, and the refrigerant is evaporated to form a low-pressure low-temperature gaseous refrigerant, and then sucked back to the compressor through a suction line and discharged to become a high-pressure and high-temperature gaseous.

[0004] The high-pressure high-temperature gaseous refrigerant is discharged through a discharge line into the condenser for heat exchange to produce a heating effect. In other words, air passes through the condenser to increase the temperature of air, so that the high-pressure high-temperature gaseous refrigerant becomes liquid, and the high-pressure liquid refrigerant enters a thermal expansion device through a liquid line, and the thermal expansion device controls the flow of the refrigerant and disperses the liquid refrigerant into the evaporator in low pressure, low temperature. The high-temperature liquid refrigerant absorbs heat to provide heat to increase the temperature of the air and to produce a heating effect in the evaporator.

[0005] The aforementioned air-conditioning equipment has a different name according to different functions, such as an air-conditioner, a heat pump, a refrigerator, and a dehumidifier, etc. For example, the dehumidifier introduces air into the evaporator to dehumidify the air and lower the temperature, and then, absorb heat from the condenser, so that the discharged air has a higher temperature and a lower enthalpy than the intake air, and thus the dehumidifier is considered as an air-conditioning equipment with dehumidification and heating effect.

[0006] In view of the aforementioned air-conditioning equipment, the evaporator is a necessary device to evaporate the refrigerant into a low-pressure low-temperature gaseous refrigerant, a heat pump for example, in a low-temperature environment, the refrigerant in outdoor evaporator cannot absorb enough heat from the cold temperature environment, but is absorbed from compressor; and the crank case of the compressor will freeze, so cannot generate compression heat. Since the heat pump cannot function right in severe cold weather, therefore most of them require electric heating elements to produce an indoor heating effect. However, the high temperature of the electric heating elements causes an oxygen burning phenomenon, and thus requires improvements.

SUMMARY OF THE INVENTION

[0007] One primary objective of the present invention is to provide an air heating unit of the air-conditioning that eliminates the device-evaporator, so that the operation of the air heating unit is not limited by cold weathers to provide the indoor heating effect in a severe cold weather.

[0008] Another objective of the present invention is to provide an air heating unit of the air-conditioning, wherein the compression heat generated by the compressor is discharged through the condenser, the indoor air temperature is increased, and the indoor moisture is dehumidified, so that there is no longer any issue of the oxygen burning phenomenon.

[0009] To achieve the aforementioned objective, the present invention provides an air heating unit of the air-conditioning, comprising: a compressor, with a discharge end coupled to a first link tube line provided for a high-pressure high-temperature gaseous refrigerant and oil; a thermal compensation device, having an inner tube, a mid tube and an outer tube of different diameters, the mid tube being sheathed with the outer tube therein, and the inner tube being sheathed with the mid tube therein to form a surface temperature subjected to an outer tube, for facilitating the high-pressure high-temperature gaseous refrigerant charged into the inner and outer tubes, and an output end of the inner and outer tubes being coupled to a second link tube line for flowing the high-pressure high-temperature gaseous refrigerant and oil; an air cooled condenser, including an internal condenser coil installed therein and having an intake end coupled to an output end of the second link tube line, a fan installed outside the air cooled condenser, such that the high-pressure high-temperature gaseous refrigerant entering into the condenser coil to change state from a high-pressure intermediate-temperature liquid refrigerant by air blow, and the condensed liquid refrigerant and oil still containing bubbles of super heat inside output end of the condenser coil enter into a third link tube line, in which a thermostat sensor attached thereon for measuring and detecting the liquid refrigerant reaches a predetermined limitation of temperature to control the fan to be turned on or off, and the fan is operated in intermittently to blow air to the condenser for heating once; and the mid tube, having an intake end linked to the third link tube line and an output end coupled to a fourth link tube line respectively, such that the intermediate-temperature liquid refrigerant flowing and passing through mid tube performs a heat exchange respectively with the high-temperature gaseous refrigerant flowing in the inner tube and the outer tube, and the intermediate-temperature liquid refrigerant is expanded by heat gain so do the pressure is increased, and the bubbles of super heat in the liquid refrigerant are blocked outside the inlet of capillary gap between the mid tube and the inner tube; the liquid refrigerant and oil containing no bubbles of super heat flowing out from the outlet of capillary gap between the mid tube and the inner tube flows and enters into the fourth link tube line, the high pressure is depressed at once and the temperature is lowered to become unsaturated liquid refrigerant flowing; and an output end of the fourth link tube line being coupled to a liquid-gas separator to disperse the unsaturated liquid refrigerant into it. In order to drop the pressure and the temperature again inside liquid-gas separator to form low-pressure suitable temperature, the low-pressure suitable temperature liquid refrigerant and oil are sucked from a suction end of the compressor to define a refrigeration cycle.
BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The technical characteristics, contents, advantages and effects of the present invention will be apparent with the detailed description of a preferred embodiment accompanied with the illustration of related drawings as follows.

[0011] FIG. 1 is a schematic view illustrating the pipeline layout of an air heating unit of the air-conditioning to the present invention;

[0012] FIG. 2 is a schematic view illustrating the refrigerant flowing direction of an air heating unit of the air-conditioning to the present invention; and

[0013] FIG. 3 is a cross-sectional view of a thermal compensation device to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] With reference to FIG. 1 to FIG. 3 for the air heating unit of the air-conditioning in accordance with the present invention, the air heating unit comprises a compressor 1, a thermal compensation device 2, an air cooled condenser 3, and four link tube lines 4, 5, 6, 7.

[0015] The compressor 1 is a prior art, such as an electric motor, e.g. used as a motive power to facilitate a low-pressure low-temperature gaseous refrigerant such as the 134A refrigerant and a lubricating oil (hereinafter referred to as "oil") contained in the compressor 1 is compressed into a high-pressure high-temperature gaseous refrigerant. For example, the gaseous refrigerant and oil at approximately 107 Celsius degree moves (in a direction as indicated by the arrows in the figures) from a discharge end 11 of the compressor 1 into the first link tube line 4. Wherein, an intake end of the first link tube line 4 is coupled to the discharge end 11 of the compressor 1, and an output end of the first link tube line 4 is coupled to a double-fork shunt tube 24 of a thermal compensation device 2.

[0016] The thermal compensation device 2 is a tri-tubing structure formed by sheathing an inner tube 21 into a mid tube 22, and the mid tube 22 into an outer tube 23. Wherein, the inner tube 21, the mid tube 22 and the outer tube 23 are made of metal such as copper or a copper alloy and have different diameters such as 5/8", 3/4" and 1 1/4" inches respectively. Intake and output ends of the inner tube 21 and the outer tube 23 are coupled to a double-fork shunt tube 24 and a manifold tube 25 respectively to branch the aforementioned high-pressure high-temperature gaseous refrigerant and oil by the shunt tube 24 to enter and flow in the inner tube 21 and the outer tube 23, so that the high-pressure high-temperature gaseous refrigerant in the inner tube 21 and the outer tube 23 flows respectively through a condenser 3 back to the mid tube 22 to compensate heat with the fast-flowing high-pressure intermediate-temperature liquid refrigerant, so as to perform a heat transfer to the liquid refrigerant. As such, the high-temperature gaseous refrigerant collected by the manifold tube 25 flows towards a second link tube line 5, and the temperature of the high-temperature gaseous refrigerant flowing in the second link tube line 5 drops slightly to approximately 103 Celsius degree.

[0017] An intake end of second link tube line 5 is coupled to the manifold tube 25, and an output end of the second link tube line 5 is coupled to the bottom inlet of air cooled condenser 3 and the condenser coil 31 are in series connection to provide the high-temperature gaseous refrigerant and oil to enter. A conventional fan 32 is provided and the condenser coil 31 is surrounded by a plurality of heat dissipation fins (prior art, not shown in the present invention) to achieve the heat dissipate and condensed effects, so that the high-pressure high-temperature gaseous refrigerant saturated in the condenser coil 31 is cooled to change its state into liquid with high-pressure intermediate-temperature containing bubbles of super heat, and the condensed liquid refrigerant and oil flow out from the output end of condenser coil 31 at the top of the condenser 3 and discharged into a third link tube line 6. Since the liquid refrigerant charged to the condenser coil 31 is full saturated and satisfied, the heat saturation effect can be achieved effectively.

[0018] Wherein, the third link tube line 6 is attached with a thermostat sensor 61, such that if the temperature of the liquid refrigerant passing through the third link tube line 6 detected by the thermostat sensor 61 reaches a predetermined limitation of temperature such as 75 Celsius degree, the fan 32 will be turned on immediately to blow air to the condenser 3 to dissipate the heat of the condenser 3 and turn the air passing through the condenser 3 into hot air for the indoor heating purpose. If the temperature of the liquid refrigerant passing through third link tube line 6 detected by the thermostat sensor 61 is lower than the predetermined thermostat temperature such as 75 Celsius degree, the fan 32 will be turned off immediately to stop blowing air to the condenser 3. The control with the predetermined temperature of the thermostat sensor 61 keeps the fan 32 to blow air to the condenser 3 intermittently and turn the air passing through the condenser 3 into hot air to achieve an indoor heating effect.

[0019] In addition, the gaseous refrigerant enters from the bottom inlet of the condenser 3 and condensed into liquid refrigerant then flows out from the outlet in top of the condenser 3, and such arrangement has the following advantage. The high-temperature gaseous refrigerant is impacted and mixed with the intermediate-temperature liquid refrigerant in the condenser coil 31, so that the liquid refrigerant receives the heat of the super heat of gaseous refrigerant to expedite the liquefaction of the gaseous refrigerant, and a large quantity of liquefied refrigerant can be saturated and satisfied in the condenser coil 31 to achieve a heat saturation effect effectively.

[0020] An output end of third link tube line 6 is coupled to the mid tube 22 of the thermal compensation device 2, such that the intermediate-temperature liquid refrigerant, oil and bubbles of super heat flowing into third link tube line 6 flows towards the mid tube 22. Since the diameters (or sizes) of the mid tube 22 and the inner tube 21 is 3/4" and 1 1/4" inches respectively, therefore the gap in between is very small so as to leave a capillary gap and achieve a kind of capillary tube effect. The intermediate-temperature liquid refrigerant flowing in the mid tube 22 perform heat transfer with the high-temperature gaseous refrigerant flowing in the inner tube 21 and the outer tube 23, so that the liquid refrigerant is expanded by heat gain, and thus bubbles of super heat are blocked outside the inlet capillary gap 26 between the mid tube 22 and the inner tube 21 to achieve the flow restrained effect similar to an expansion valve or a capillary tube.

[0021] The liquid refrigerant and oil are not containing any bubbles of super heat flowing out from the output end of the mid tube 22 enters into a fourth link tube line 7. Since the fourth link tube line 7 has a diameter greater than the outlet capillary gap 27 between the mid tube 22 and the inner tube 21, therefore when the intermediate-temperature liquid refrigerant are not containing bubbles of super heat enters and
flows into fourth link tube line 7, the pressure is depressed at once and the temperature is lowered to form a low-pressure intermediate-temperature unsaturated liquid refrigerant flowing, and measurements shows that the temperature of the liquid refrigerant of fourth link tube line 7 is 68 Celsius degree.

[0022] An output end of fourth link tube line 7 is coupled to a conventional liquid-gas separator 8 accomplished with the compressor 1, and the internal diameter of the liquid-gas separator 8 is greater than fourth link tube line 7 for many times. After the unsaturated liquid refrigerant dispersed into the liquid-gas separator 8, the pressure and temperature are depressed again to a lower-pressure with suitable temperature such as a liquid refrigerant at approximately 38 Celsius degree. This temperature will not lower as the refrigeration effect like the lubricating oil passing through the evaporator does, such that the lubricating oil is in a sticky form which is unfavorable for the lubrication of the compressor. After the low-pressure suitable temperature liquid refrigerant and oil dispersed into the liquid-gas separator 8 is sucked by the suction power of the suction end 12 of the compressor 1 and compressed to high-pressure high-temperature gaseous refrigerant discharged by discharge end 11 into first link tube line 4 to define a refrigeration cycle.

[0023] In summation of the description above, the present invention has the following advantages. The high-temperature gaseous refrigerant flowing in the inner and outer tubes of the thermal compensation device transfers heat with the intermediate-temperature liquid refrigerant flowing in the mid tube, so that the liquid refrigerant flowing into the inlet of capillary gap between the mid tube and the inner tube is heated up to expand to achieve the flow restrained effect, and the inlet of capillary gap can stop bubbles of super heat from entering, and suppress the amount of liquid refrigerant to pass through. Therefore, a limited quantity of refrigerant can be sucked into the compressor at a low pressure without having the lubricating oil to return cooled. The present invention eliminates the use of the evaporator or flow restrained device, such that the compressor is the only heat generate device in the air heating unit of the air-conditioning. In addition, the air heating unit of the air-conditioning does not have evaporator, so that its indoor application is not limited by weathers, even in a severe cold weather outdoor. Obviously, this air heating unit of the present invention is one of the innovative greatest designs of this sort.

What is claimed is:
1. An air heating unit of the air-conditioning, comprising: a compressor, with a discharge end coupled to a first link tube line provided for a high-pressure high-temperature gaseous refrigerant and an oil to flow; a thermal compensation device, having an inner tube, a mid tube and an outer tube of different diameters, said mid tube being sheathed with said outer tube therein, and said inner tube being sheathed with said mid tube therein to form a tri-tubing structure, and an output end of said first link tube line being coupled to said inner and outer tubes, for facilitating said high-pressure high-temperature gaseous refrigerant to flow and enter into said inner and outer tubes respectively, and an output end of said inner and outer tubes being coupled to a second link tube line for said high-pressure high-temperature gaseous refrigerant and said oil to flow; an air cooled condenser, including an inner condenser coil installed in series therein and having a bottom inlet end coupled to an output end of said second link tube line, and a fan installed outside said air cooled condenser, such that said high-pressure high-temperature gaseous refrigerant charged into said condenser coil is cooled to change its state to form a high-pressure intermediate-temperature liquid refrigerant containing bubbles of super heat, and said condensed liquid refrigerant and oil flow out from the output end of said condenser coil and flow and enter into a third link tube line, and said third link tube line having a thermostat sensor attached thereon for measuring and detecting whether said liquid refrigerant passing through said third link tube line reaches a predetermined limitation of temperature to control said fan to be turned on or off, and said fan is operated intermittently to blow air to said condenser for heating purpose; and said mid tube, having an intake end and an output end coupled to said third link tube line and a fourth link tube line respectively, such that said intermediate-temperature liquid refrigerant flowing and passing said mid tube performs a heat transfer with said high-temperature gaseous refrigerant flowing in said inner tube and said outer tube, and said intermediate-temperature liquid refrigerant is expanded by heat gain, and said bubbles of super heat of said intermediate-temperature liquid refrigerant are blocked outside the inlet end of capillary gap between said mid tube and said inner tube; if said intermediate-temperature liquid refrigerant and oil containing no air bubbles flowing out from an outlet end of capillary gap between said mid tube and said inner tube flows and enters into said fourth link tube line, the pressure is depressed at once and the temperature is lowered to form a low-pressure intermediate-temperature unsaturated liquid refrigerant; and an output end of said fourth link tube line being coupled to a liquid-gas separator to disperse said low-pressure intermediate-temperature unsaturated liquid refrigerant and depress the pressure and lower the temperature again to form a low-pressure with suitable temperature liquid refrigerant, said low-pressure with suitable temperature liquid refrigerant and oil are sucked from a suction end of said compressor to define a refrigeration cycle.

2. The air heating unit of the air-conditioning according to claim 1, wherein said inner tube, said mid tube and said outer tube are made of copper and have different diameters such as ⅛", ¼" and ⅝" inches respectively.

3. The air heating unit of the air-conditioning according to claim 1, wherein said first link tube line has a discharge end coupled to said inner and outer tubes through a shunt tube for facilitating said high-pressure high-temperature gaseous refrigerant and said oil to be delivered by said shunt tube to flow and enter into said inner tube and said outer tube respectively, and said second link tube line has an intake end coupled to said inner and outer tubes through a manifold tube for facilitating said high-pressure high-temperature gaseous refrigerant to be connected into said second link tube line.

4. The air heating unit of the air-conditioning according to claim 1, wherein said condenser coil is connected in series, and said second link tube line is coupled to the intake end of said condenser coil at the bottom of said condenser, and said third link tube line is coupled to the output end of said condenser coil at the top of said condenser.
5. The air heating unit of the air-conditioning according to claim 1, wherein said predetermined limitation of temperature is 75 Celsius degree.

6. The air heating unit of the air-conditioning according to claim 1, wherein said fourth link tube line has a diameter greater than said outlet of capillary gap between said mid tube and said inner tube, and said liquid-gas separator has an internal diameter greater than the diameter of said fourth link tube line.

7. The air heating unit of the air-conditioning according to claim 1, wherein said condenser coil is surrounded by a plurality of fins.