A spiral-curved refrigerant coil set of a refrigerant condenser, especially a coil set which each coil winded of a streamlined cross-sectioned metal tube used in a non cooling-fin outdoor condenser apparatus for a separating air conditioning system. The purpose of using spiral-curved refrigerant coil is to save a plurality of U-turn connectors which eliminate a plurality of welding seams for U-turn connectors to promises no leakage threat, and therefore reduce of the labor, and manufacturing costs. More particularly avoid the gradualness of "pressure drop" which occurs while the refrigerant passing through each U-turn connector due to friction so as to increase the E.E.R value therefore.
FIG. 5
SPECIAL SPIRAL-CURVED REFRIGERANT COIL FOR A NON COOLING-FIN CONDENSER OF AN AIR CONDITIONING SYSTEM

FIELD OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a refrigerant coil of a non cooling-fin condenser, especially relates to a spiral curved refrigerant coil for a condenser.

[0003] 2. Description of the Related Art

[0004] The conventional refrigerant coil for a condenser, no matter what it uses, the circular or ellipse-cross-sectional metal tube, water-cooled or air-cooled method, both use the same architecture. FIG. 1 illustrating a connectional refrigerant coil 70, the cooling-fins 80 are passed through by straight-tubes toward the same and parallel direction, both sides are fixed on two relative separate supporting-frames 82, then applying a plurality of U-turn connectors 74, respectively weld to two ports of adjacent straight-tubes 72, then connecting all refrigerant coil to constitute a cuboid-reciprocating refrigerant coil set 70. No doubt, the above architecture is a conventional air conditioning system. Even if non cooling-fins evaporative-condenser was invented, (According to Taiwan Patent No 497704, The design of wrapping a water absorption material sleeve tube on refrigerant coil) as well as the inventor’s streamlined-sectional design for bare-copper-coil (Taiwan Patent Application No. 9126512, filed on Nov. 18, 2002) and so on, but the inventions are still adopting the conventional reciprocating-parallel-coil which is constituted by a plurality of U-turn welding connectors. As a matter of fact, a great number of U-turn connectors cause too many problems, wherein the main reason is, that the refrigerant fluid passing through each U-turn connector, the increasing friction causes the "pressure drop"; thus greatly increasing the load for refrigerant to liquefy which cause E.E.R. to fall. Secondly, a plurality of welded joints from U-turn connectors causes some weak points. This kind of weak point can’t find any slight defects in a test phase, but it may cause a leakage of refrigerant after a period of time for using due to either vibrates or corrodes. Another more serious problem is that it is difficult to remove dirt of small particle sediments which accumulated between crevices of fins and the surface of refrigerant coil.

[0005] Moreover, owing to the conventional refrigerant coils for a refrigerant condenser, which are all formed in rectangular type, but a wind flow for calling conventional refrigerant coil is a hollow center-cone type which provides the air current by a fan, according to FIG. 2, wherein the wind power section of central-angular-circular cone 90 blown by fans, therefore causes the center 702 without wind, all four corners 704 without wind, wind area 902 of wind power cross sectional area 90 and wind area 904, both wind power spreads to outside area of refrigerant coil 70, cause the wind power to be entirely useless.

SUMMARY OF THE INVENTION

[0006] Owing to accumulated working experience of the non cooling-fins evaporative condenser with streamlined-cross-sectional tube, the present invention is made in the light of providing solutions to the above-described problems. Accordingly, an object of the present invention is to omit the defect of U-turn connectors for straight-reciprocating coil, and to save a plurality of U-turn connectors so as to increase the EER value.

[0007] In order to achieve the object mentioned above, a special spiral-curved refrigerant coil should be winded of streamline cross-sectional metal tube for a non cooling-fins condenser according to the present invention comprises a refrigerant coil set, a water supply system and a wind power system.

[0008] The refrigerant coil set includes a plurality of spiral-curved refrigerant coil set which is separated and overlapped from top to bottom, and passing through a supporting-frame then fastened. Wherein each winding spiral-curved refrigerant coil is to form a unified refrigerant coil by a metal tube and each spiral-curved refrigerant coil being used and connected together in parallel, as an independent refrigerant channel;

[0009] The water supply system includes a water pump and a plurality of spray-nozzles which provides a water membrane on the surface of spiral-curved refrigerant coil in order to have an evaporating effect.

[0010] The wind power system has at least one fan to provide wind power to circulate the spaces between refrigerant coils, to evaporate water membrane from the streamlined cross-sectional surface of each spiral-curved refrigerant coil at the normal atmospheric temperature and to absorb a great amount of evaporate heat so as to liquefy refrigerant under a normal atmosphere temperature.

[0011] Explanation for the described above:

[0012] 1. As described above, each spiral-curved refrigerant coil is made of a streamlined-cross-sectional tube, multi-layer spiral-curved refrigerant coils constitute the whole winding refrigerant condenser set.

[0013] In order to improve the effect, the refrigerant coil set of multi-layer spiral-curved refrigerant coils comprises a plurality of odd-layer refrigerant coils and a plurality of even-layer refrigerant coils which are overlapped and intermeshed each others with a space between each refrigerant coil, therefore providing sufficient wind power blowing over the surface of each refrigerant coil, among the multi-layer winding spiral-curved refrigerant coils, wherein the inlet manifold port of gas-phase refrigerant for odd-layer refrigerant coil located on an outside of the refrigerant coils, and a liquid refrigerant collecting tube for the odd-layer refrigerant coil located at an inside opposite to the manifold tube to connect the odd lager refrigerant coils in a parallel connection. The liquid-phase refrigerant is sucked into collection the tube. The inlet manifold and the liquid refrigerant collecting tube of even-layer and refrigerant coils are located in the opposite symmetrical position to those of odd-layer refrigerant coils.

[0014] 2. As described above, a refrigerant coil supporting-frame includes a base rank which has an outer-ring and an inner-ring disposed in parallel having four beams connect two rings together into four quadrants; four outer-props of channel iron with a narrow slot separately mounted on the outer-junction where outer-ring and four beams welded together, wherein its narrow slot is toward inside; a plurality of outer-hoops weld-mounted on outer edge of four outer-
props with suitable spacing; four inner-props of channel iron with narrow slot, separately mounted on the inner junction of inner-ring and four beams with the narrow slot is toward outside. The slot of inner-prop and outer-prop, which set on an opposite position to formed a slide way there between; a plurality of inner-hoops welded on inner edge of four inner-props, wherein inner-hoops and the outer-hoops set within a definite space; a plurality of arc-reinforce-strips separately weld-mounted between every two outer-hoops and every two inner-hoops to strengthen the whole supporting-frame for steadiness.

3. As described above, the supporting-frame of refrigerant coils, which in adjacent coils have four notch plates inserted into four slide way for using to set a spiral-curved refrigerant coil in position, the thickness of each notch plate is slightly smaller than slot-width of the channel of inner and outer-props; the length of the notch plate can be slot into the the way, and the height of the plate is equal to the spacing of two adjacent coils set; the upper edge of the notch plate equipped with a pack of equidistant upper notches, the shape of the upper notches fit in the lower portion of streamlined-tubes; the lower edge of notch plates equipped with lower notches which fits in the upper portion of streamlined-tubes; interlaced with the upper notches as cog shape. When installed. Respectively put a piece of notch plate into each slide way between inner and outer slot notches then put a spiral-curved refrigerant coil onto supporting-frame and fit into upper notch evenly with four quadrants. After it is steady, puts the second plate into each slide way again, causing the lower notches of the second plate to hold the upper portion of the refrigerant coil fixed in position, then repeat the procedure firmly to constitute an entire refrigerant coil set.

4. As described above, further includes an outside case having a fan system at a top and a pack of shutters surround the lower portion of the case in a downward-blow-type the fan system provides the canyon wind. The air pass through the space in the refrigerant coil to discharge the heat and waste-gases through the lower shutter; while in a upward-blow-type the fan system which discharges heat and waste-gases upwardly, the wind power is absorbed from the shutter at the lower portion surround the outside case.

5. As described above, the water supply system, include a water pump, a water distribution-tube, and at least a set of water-mist-spray-nozzles installed to fit the refrigerant coil quadrant area. If it is downward-blow-type then each set of spray-nozzles located on the upper portion over refrigerant coil, spray the water-mist downward. If it is upward-blow-type then each group of spray-nozzles located on lower portion below refrigerant coil, spray the water-mist upward.

6. As described above, the spiral-curved refrigerant coil become a flat spiral-curved type on same surface or becomes a long-waist-circular type, wherein its both sides are spiral-curved-semicircular-shaped; In the middle is a group of parallel-straight tubes or three-dimensional curved-spring-shaped for winding conical shape.

To achieve the described above goal, the technical plan of this present invention relates to spiral-curved refrigerant coil. The refrigerant coil is an unified refrigerant coil which is winding to a spiral curved spring from a metal tube.
[0034] FIG. 4 is a sectional view illustrating a multi-layer spiral-curved refrigerant coil which constitutes an entire refrigerant coil set according to the present invention.

[0035] FIG. 5 is a schematic diagram illustrating a refrigerant coil supporting-frame for the refrigerant condenser according to the present invention.

[0036] FIG. 6 is a schematic diagram illustrating a multi-layer spiral-curved refrigerant coil installed on a supporting-frame according to the present invention.

[0037] FIG. 7 is a schematic diagram of preferred embodiment illustrating a spiral-curved refrigerant coil for downward-blow type refrigerant condenser according to the present invention.

[0038] FIG. 8 is another schematic diagram of preferred embodiments illustrating a spiral-curved refrigerant coil for upward-blow type refrigerant condenser according to the present invention.

[0039] FIG. 9 is schematic diagram of another preferred embodiment illustrating a spiral-curved refrigerant coil which transforms to a spiral-curved spring-type refrigerant coil according to the present invention.

[0040] FIG. 10 is schematic diagram of still another preferred embodiments illustrating a spiral-curved refrigerant coil transforms to a long-waist-shaped refrigerant coil in accordance with the present invention.

**DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0041] Referring to FIG. 3, a preferred embodiment of the present invention illustrates streamlined cross-sectional tubes for flat bottom type spiral-curved refrigerant coil 10, wherein the peripheral inlet port connects to a manifold tube 12. Gas-phase refrigerant flows into the refrigerant coil 10 through manifold tube 12, then inner outlet port of each coil connects to a collection tube 14, for gathering liquid-phase refrigerant, those skilled in the art will understand the scope of the invention as disclosed in the accompanying claims not limited to this embodiment only.

[0042] FIG. 4 is a sectional diagram of multi-layer spiral-curved refrigerant coils 10 and 10' which constitutes a refrigerant coil set 100, wherein manifold tube 12 of odd layer refrigerant coils 10 for distributing gas-phase refrigerant is located at an outside of right tube; and the manifold of even-layer coils distributing gas-phase refrigerant in to coils 10' inlet tube 12' is located at an outside opposite to odd layer manifold tube 12, collection tube 14 and 14' of liquid-phase refrigerant collecting are located respectively at an inside opposite to its manifold tube at left side of chamber. In fact, even-layer refrigerant coil 10' and odd-layer refrigerant coil 10 have the same shape, only 180 degree inversely (FIG. 3 180 degree rotate), refrigerant coil 10 intermesh refrigerant coil 10' with cog shape (referring to FIG. 4) so as to let air current passing through.

[0043] As shown in FIG. 5 illustrating a refrigerant coil supporting-frame 20, for assembling a plurality of spiral-curved refrigerant coil 10 and 10' as a unified unit which comprises a round-shaped base rack 22. The base-rack 22 comprises an outer-ring 222 and an inner-ring 224, as well as four beams 226, both separately connects to outer-ring 222 and inner-ring 224 with 4 quadrants as a unified body.

Four outer-props 24 and four inner-props 26 both are made of narrow channel iron, separately mounted on the junction of four beams 226 of the base-rack 22 as well as outer-ring 222 and inner-ring 226, causing each pair of channel slot 242 and 262 of prop 24 and 26 towards oppositely to form a slide way therebetween. Also weld a plural of outer-loop 224 on outside of four outer-prop 24, installing arc-strengthen-strip 246 between two adjacent outer-loop 224, similarly, uses a plural of inner-loop 264 weld on four inner-props 26 inside, then adds slant-strip 266 weld to two inner-loop 264, so as to strengthen and make the entire supporting-frame 20 steadfastness.

As shown in FIG. 6, illustrating the situations of each pair of prop 24 and 26 for slot 242 and 262 which place in multi-layer notch plates 30 in FIG. 5. The thickness of each notch plate 30 is slightly smaller than the width of the slot 242 and 262, wherein the length of notch plate can be slide in two relative slots 242, 262, and the height of a notch plate is equal to the spacing between two adjacent refrigerant coils set 10 and 10', the upper edge of a notch plate 30 is equipped with a pack of equidistant upper notches 32. The shape of each upper notch 32 fits in the lower portion of a streamlined cross-sectional-tube; the lower edge of a notch plate 30 is equipped with a plurality of lower notch 34 which opposite to in upper notches 32, each shape of the lower notch 34 fits in the upper part of streamlined cross-sectional-tube.

When each of refrigerant coil 10 or 10' is placed into supporting-frame 20. Respectively put four pieces of notch plate 30 between each four sets of inner and outer slot 242 and 262, then put a spiral-curved refrigerant coil into the supporting-frame 20 and fit into upper notch evenly with four quadrants. After fastened, put plate onto the first layer refrigerant coil 10, then each lower portion of a streamlined cross-section of refrigerant coil 10 can be placed in the upper notch 32 of plate 30, then second plate 30 placed into four notch 242 and 262, causing the lower portion notch 34 of the notch plate 30 to hold the upper portion of each refrigerant coil 10. After the first layer 10 fastened between four notch plates 30 and place into second refrigerant coil 10', then place onto notch plate 30. Repeat the procedure firmly to constitute a highly steady refrigerant coil set 100.

FIG. 7 is a preferred embodiment of the present invention which is a downward blow type spiral-curved refrigerant coil, wherein a group of streamlined-cross-sectional for winding spiral-curved coil 100 which large head portion of streamlined-cross-sectional tube disposed upwardly, toward the wind direction multi-layer refrigerant coil 10 and 10' constitutes a refrigerant coil 100 and install on supporting-frame 20 (not shown), a fan set 40 which blow the air from a top. A water supply system 50, including a water pump (without chart), an inlet water distribution-tube 52, and a plurality of water-mist-spray 54, the mist-spray to spray water mist downward and rotated intermitently for creating a water membrane with four quadrant on the surface of refrigerant coil 10 and 10'. To provide sufficient evaporating time to absorb a great quantity of evaporating heat so as to drop refrigerant temperature sharply; An outside case 60 which is a container with round bucket-type or square-type, which has a vent 62 at least, a fan 40 installed in the vent, a plurality of shutter 64 installed around the lower periphery of the case for discharging heat and wind power of steam; the gas-phase refrigerant is sucked into
refrigerant coil 100 through manifold tube 12 and 12', cause liquid-phase refrigerant is sucked into collection tube 14 and 14' for reuse.

[0047] FIG. 8 is a preferred embodiment of the present invention which relates to upward blow type spiral-curved refrigerant coil. The airflow direction is opposite to downward type (referring to FIG. 7), the fan 40 is a ventilator, shutter 64 is an inlet vent, the vent 62 for discharging heat and vapor, refrigerant coil 100 for streamlined cross-sectional 10 and 10' which the large head portion toward bottom to face the wind power. A spray-nozzle set 54 disposed beneath coil 100 for blowing mist upwardly, the remaining structure the same as FIG. 7. Owing to the fact that the wind direction is different, separately is suitable for the different environment. Downward-blow-type is only suitable for installed on a roof or spacious area. Heat and waste steam will cause air pollution, but upward-blow-type only ejects heat and waste steam in an upward direction, only little air pollution, so it is suitable for outdoor side with narrow environment.

[0048] FIG. 9 is another preferred embodiment of the present invention which spiral-curved refrigerant coil 10 is a spiral-curved spring type, and multi-layer spring type coil set 100 simulates the flat bottom type coil, each layer intermeshed with cog shape.

[0049] FIG. 10 is still another preferred embodiment of the present invention which relates to anomalous form of a winding spiral-curved refrigerant coil, wherein the two ports of refrigerant coil 10 are a spiral-curved semicircle-arc-shaped 16, the middle is a section of straight-parallel-shaped tube 18 which still uses one tube for winding long waist and round shaped to save a plurality of U-turn connectors, to avoid the "pressure drop".

[0050] The above described embodiments are for explaining technical concepts and features. Those skilled in the art will appreciate that various modifications, substitutions are possible, without departing from the scope of the invention as disclosed in the accompanying claims.

What is claimed is:

1. A non cooling-fin condenser of an air conditioning system comprising:
   a refrigerant coil set, including a plurality of spiral-curved refrigerant coils which are separated and overlapped with an even distance from a bottom to a top, and fastened on a supporting-frame installed in an outside case, wherein each spiral-curved refrigerant coil wound by one metal tube and each used as an individual and then connect coils together in parallel;
   a water supply system, including a water pump and a plurality of spray-nozzles which continuously provides water membrane on the surface of spiral-curved refrigerant coil in order to have an evaporating effect; and
   a wind power system, having at least one fan to provide wind power to circulate the space which is between each refrigerant coil in a dissection face to the large portion of the streamlined cross-sectional tube, to evaporate water membrane from the surface of the reduced portion of the streamlined cross-sectional tube of a spiral-curved refrigerant coil sender at a normal atmospheric temperature and to absorb a great amount of evaporating heat so as to liquefy the refrigerant in a lower relative pressure.
   2. The condenser according to claim 1, wherein the spiral-curved refrigerant coil is wounded of one streamlined-cross-sectional tube, wherein multi-layer spiral-curved refrigerant coils are connected in parallel to constitute a multi-layer spiral-curved refrigerant coil set.
   3. The condenser according to claim 2, wherein the refrigerant coil set of multi-layer winding spiral-curved refrigerant coils comprising at least one odd-layer refrigerant coil and at least one even-layer refrigerant coil which is overlapped and intermeshed each other, and having a space between each refrigerant coil for providing sufficient wind power over the surface of each refrigerant coil therefore.
   4. The condenser according to claim 3, wherein the multi-layer spiral-curved refrigerant coils, wherein a vertical manifold tube located on an outside for supplying gas-phase refrigerant for odd-layer refrigerant coils; and an outlet collecting tube of liquid-phase refrigerant for the odd-layer refrigerant coils located on the opposite side of the manifold tube, to collect liquid-phase refrigerant therefrom the manifold tube and collecting tube of even-layer refrigerant coils disposed in a symmetrical position opposite to that of the odd-large coils.
   5. The condenser according to claim 1, wherein the supporting-frame for assembling the coils, including a horizontal bass rack having an outer-ring and an inner-ring, connect together with four beams to divided into four quadrants in even distance; four outer-props of rectangular channel mounted vertically standing on four connecting points of the outer-ring and four the beams respectively, which channel slot toward inside; four inner-props of rectangular channel, respectively mounted standing on four connecting points of the inner-ring and four the beams, with the channel slot toward opposite side to the channel slot of the outer-prop, formed four pairs of slide ways therewith; a plurality of outer hoops welded on outer edge of four outer props with suitable spacing; a plurality of inner-hoops welded on inner edge of four inner props and a plurality of arc-reinforce-strips separately welded between every two adjacent outer-hoops and every two inner-hoops to strengthen the whole supporting-frame for rigidity.
   6. The condenser according to claim 5, wherein the refrigerant coil supporting-frame comprising a plurality of notch plates for using to fasten the spiral-curved refrigerant coils having a thickness slightly smaller than a width of the channel slot having a length of which can be just slide into the slide way formed by each pair of the channel slots, and also having a height of the plate being equal to a vertical spacing of two adjacent refrigerant coils; a pack of equidistant upper notches sockets disposed on an upper edge of the notch plate fitted with a lower portion of the streamlined-tubes of a coil; a pack of lower notches disposed on a lower edge of the notch plate which fits in the upper portion of the streamlined-tubes; interlaced with the upper socket as cog shape. When in installing, respectively putting a piece of the notch plate into each of the slide way, then put a spiral-curved refrigerant coil into the supporting-frame let the lower portion of the streamline cross-sectional tubes of the refrigerant coil fitted into the upper notches secured in four quadrants, after steadfastness, respectively putting a second notch plate respectively into each pair of the slide way, causes the lower notch of the socket of the second notch
plate to hold the upper portion of the streamline cross-sectional tubes of a refrigerant coil stably in position, therefore repeating the installation procedure firmly, to constitute an entire refrigerant coil set.

7. The condenser according to claim 1, wherein the outside case which having a vent and a far system on atop and a pack of surround lower portion of the case for wind power to evaporate the water membrane and to discharge heat and vapor either in an upward blow type or a downward blow type, the downward-blow-type fan providing wind pass through the space in the refrigerant coil to discharge heat and waste-gases through the lower shutter; the upward-blow type fan which discharges heat and waste-gases upward, the wind power is absorbed from the shutter at the lower portion of the outside case.

8. The condenser according to claim 1, wherein the spiral-curved refrigerant coil becomes a flat spiral-curved type on the same level or becomes a long-waist-circular type, wherein the refrigerant coils are spiral-curved semi-circle-shaped on both ends. In the middle is a group of parallel-straight tubes or three-dimensional curved spring-type for conical winding.

9. A spiral-curved refrigerant coil, wherein the refrigerant coil is winding to form a unified refrigerant coil by one metal tube from initial to terminal.

10. The condenser according to claim 9, wherein the spiral-curved refrigerant coil uses streamlined-cross-sectional tube for winding spiral-curved refrigerant coil.

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