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(54) **CONDENSER, AIR CONDITIONER
 OUTDOOR UNIT, AND AIR-CONDITIONING
 SYSTEM**

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(57) **ABSTRACT**

A condenser, an air conditioner outdoor unit, and an air-conditioning system. The condenser includes at least one row of heat exchange tubes and a plurality of fins arranged along the heat exchange tubes, where any fin is provided with at least one column of through holes, which correspond to the number of rows of the heat exchange tubes, for the heat exchange tubes to pass through; the fins are evenly divided, in the width direction, into at least one basic unit corresponding to the number of rows of the heat exchange tubes; the width of any basic unit is greater than 18.2 mm; and the center distance between two adjacent through holes from among any column of through holes is less than 21 mm. As a result, the heat exchange efficiency can be improved, and the energy efficiency can also be improved.

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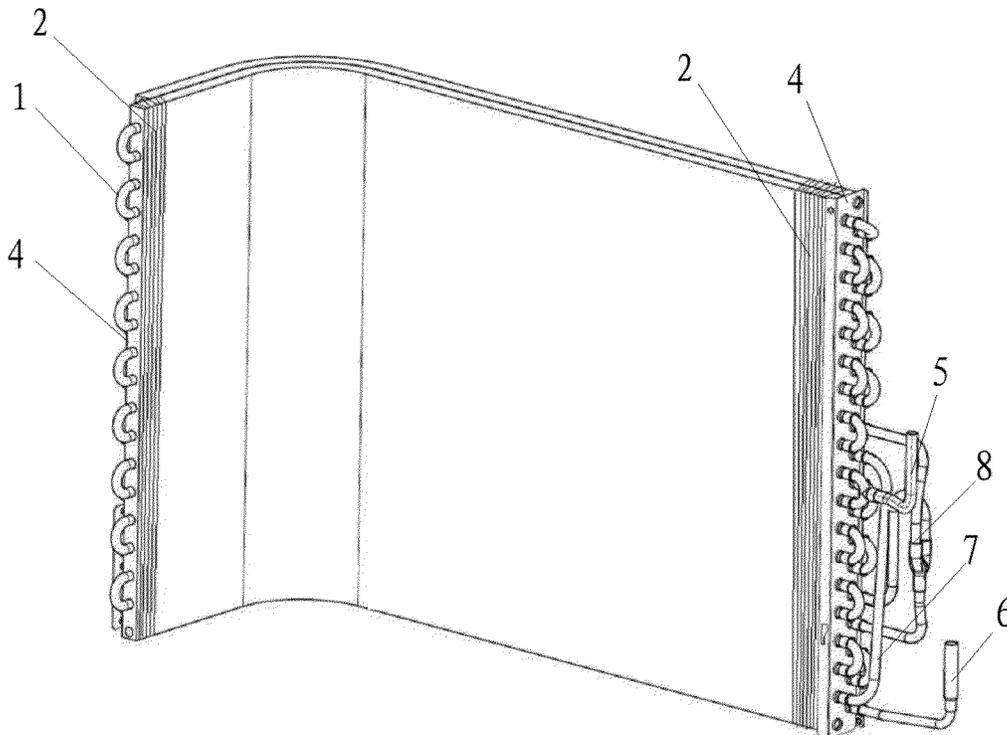
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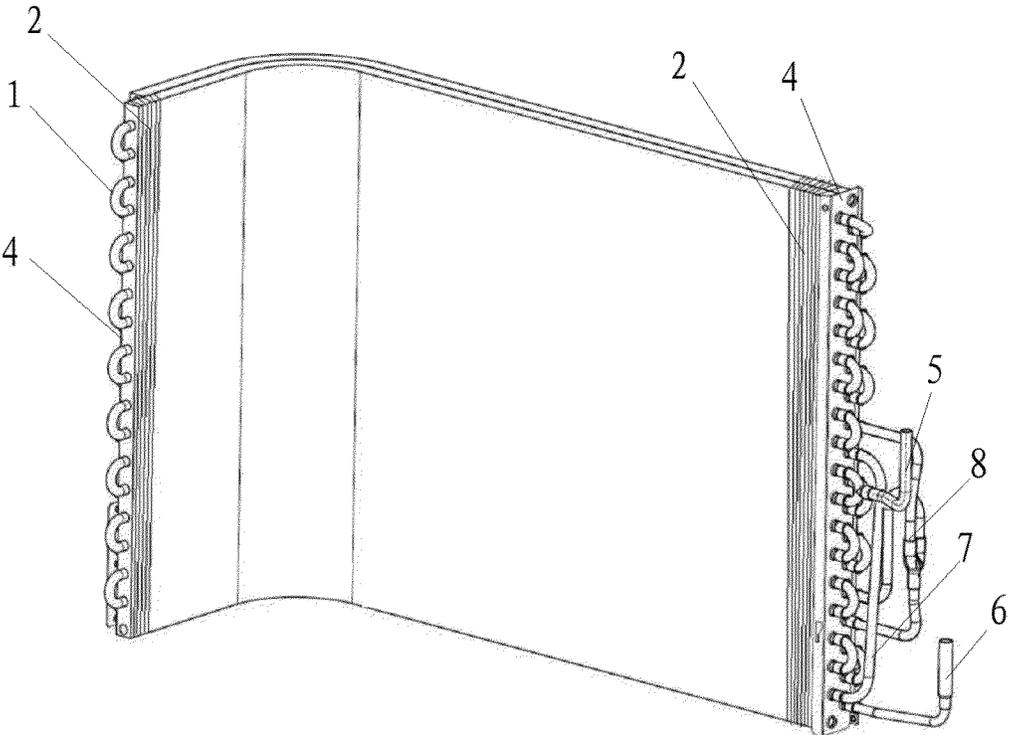


FIG.1

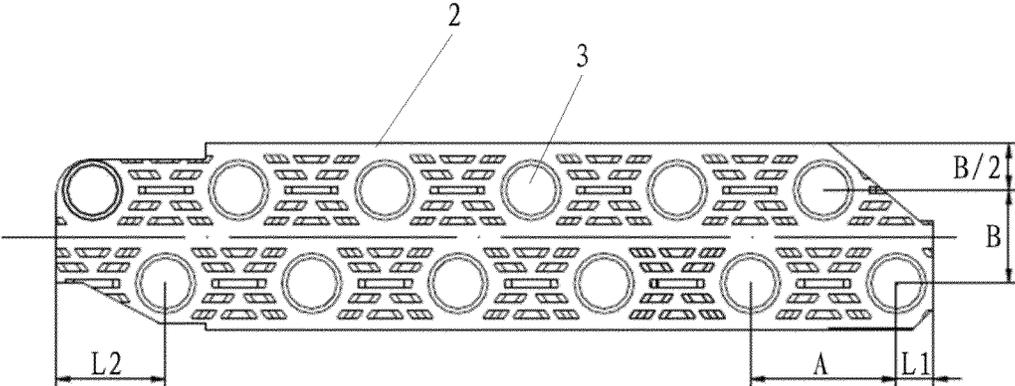


FIG.2

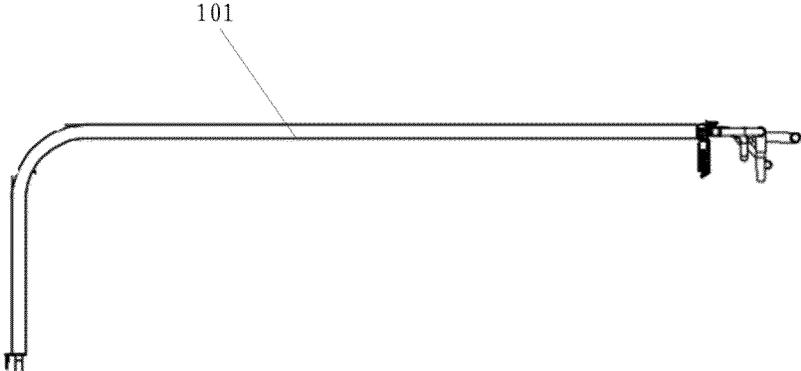


FIG.3

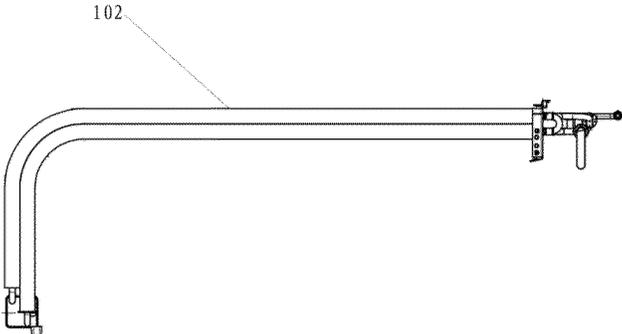


FIG.4

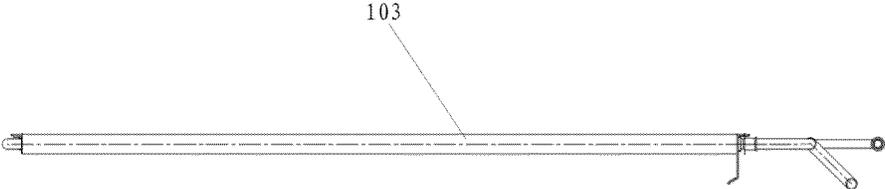


FIG.5

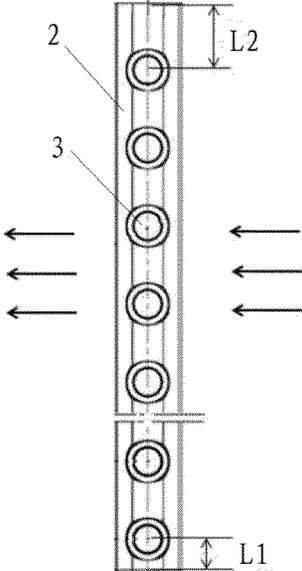


FIG.6

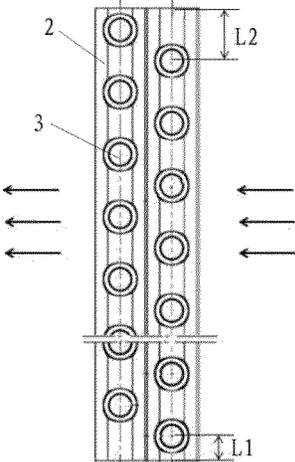


FIG.7

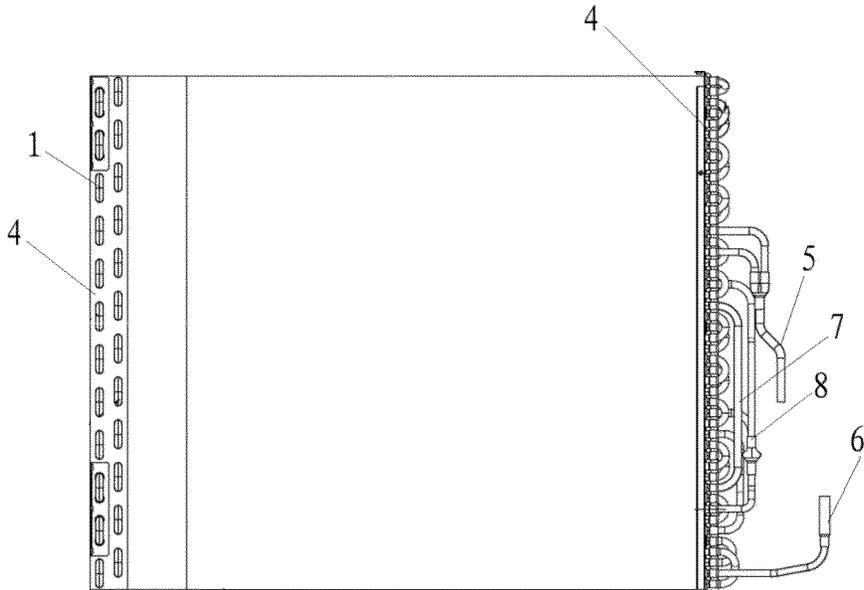


FIG. 8

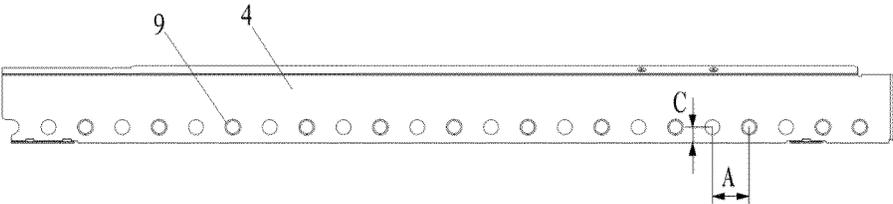


FIG. 9

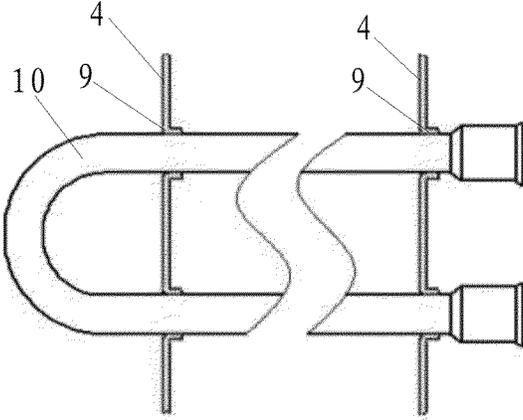


FIG. 10

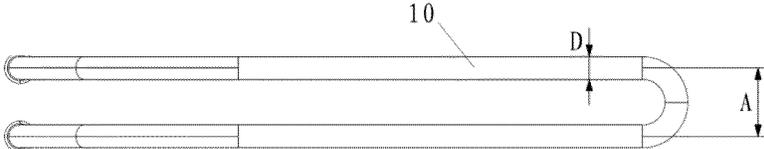


FIG.11

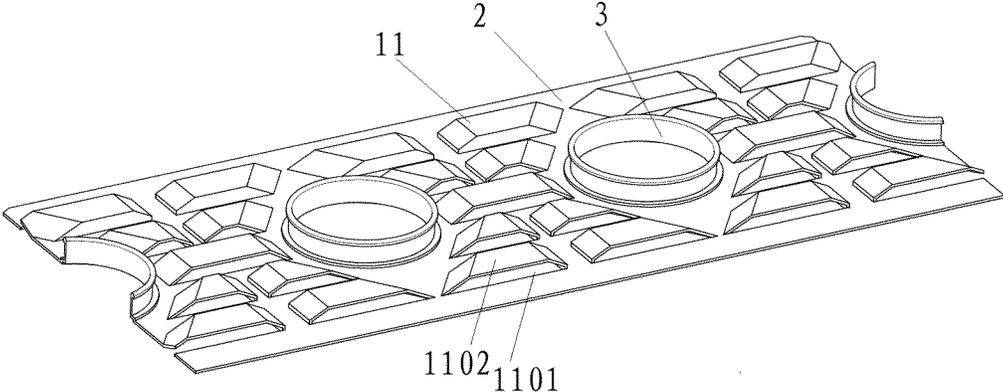


FIG.12

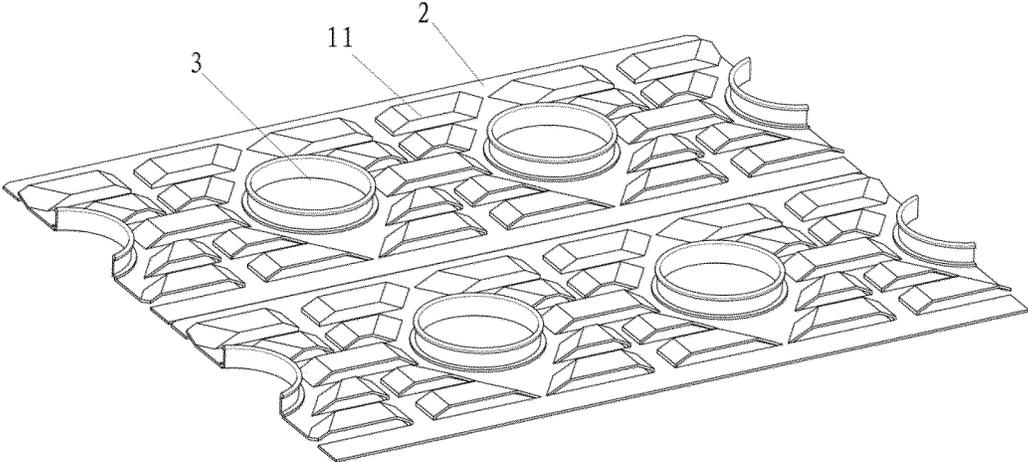


FIG.13

CONDENSER, AIR CONDITIONER OUTDOOR UNIT, AND AIR-CONDITIONING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority from Chinese patent application No. 202021056769.2, titled “CONDENSER, AIR CONDITIONER OUTDOOR UNIT, AND AIR-CONDITIONING SYSTEM” filed on Jun. 10, 2020, the entire disclosure of which is incorporated herein by reference.

FIELD

[0002] The present application relates to the technical field of air conditioning, and in particular to a condenser, an air conditioner outdoor unit and an air conditioning system.

BACKGROUND

[0003] A condenser, as a part of a cooling system, forms a cooling cycle system together with a compressor, a throttle valve, an evaporator and other components. A main working process of the cooling cycle system is described as follows: a liquid refrigerant absorbs heat in the evaporator, and then vaporizes into a low-temperature and low-pressure gas, which is sucked in by the compressor so as to be compressed into a high-temperature and high-pressure gas which is then discharged into the condenser; the high-temperature and high-pressure gas releases heat to a cooling medium (water or air) in the condenser, and is condensed into a high pressure liquid; the high pressure liquid, after being throttled by the throttle valve, becomes a low-pressure and low-temperature refrigerant which enters the evaporator again for heat absorption and vaporization, so as to achieve the purpose of circulated cooling. At present, in the heat release process of the condenser, mainly, the high-temperature and high-pressure refrigerant flows through heat exchange pipes and releases heat to the outside (i.e., the cooling medium (water or air)) through fins which are in close contact with the heat exchange pipes.

[0004] Since the structure of air conditioner outdoor unit is produced by using molds, once the structure is determined, a total height of the entire condenser cannot be changed. A heat exchange efficiency of the current 7 mm condenser needs to be improved under the premise that the length and height remain unchanged.

SUMMARY

[0005] Embodiments of the present application provide a condenser, an air conditioner outdoor unit and an air conditioning system, aiming at solving or partially solving the problem of poor heat exchange efficiency of current condensers under the limitation of fixed outdoor unit size.

[0006] An embodiment of the present application provides a condenser, which includes at least one row of heat exchange pipes and a plurality of fins arranged along the heat exchange pipes; any of the fins is provided with at least one column of perforations corresponding to the number of rows of the heat exchange pipes, which are configured for the heat exchange pipes to pass through; the fins are evenly divided into at least one basic unit in a width direc-

tion, which corresponds to the number of rows of the heat exchange pipes; a width of any of the basic units is larger than 18.2 mm, and a center-to-center distance between two adjacent perforations in any column of the perforations is smaller than 21 mm.

[0007] On the basis of the above solution, the width of any of the basic units is 21-22 mm, and the center-to-center distance between two adjacent perforations in any column of the perforations is 17-18 mm.

[0008] On the basis of the above solution, a distance between two adjacent fins is 1.2-1.4 mm.

[0009] On the basis of the above solution, two adjacent columns of perforations are staggered; a first spacing L1 between the center of a perforation on the fin at a bottom end and a bottom edge of the fin is smaller than a second spacing between the center of a perforation at a top end in the column of perforations where the perforation is located and a top edge of the fin.

[0010] On the basis of the above solution, the first spacing is $\frac{1}{4}$ of the center-to-center distance between two adjacent perforations in any column of the perforations, and the second spacing is $\frac{3}{4}$ of the center-to-center distance between two adjacent perforations in any column of the perforations.

[0011] On the basis of the above solution, both ends of the heat exchange pipes are respectively connected with a pipe plate, the pipe plates are provided with holes corresponding to the heat exchange pipes, and at least one of two adjacent holes on any of the pipe plates is configured as a flanged hole.

[0012] On the basis of the above solution, a pipe group assembly connected with the heat exchange pipe at the pipe plates at one end is further included; the pipe group assembly includes a liquid inflow pipe, a liquid outflow pipe, a bend pipe and a manifold; the liquid inflow pipe and the liquid outflow pipe are respectively connected with the heat exchange pipes, the bend pipe is configured to communicate two non-adjacent heat exchange pipes with each other, and the manifold is configured to communicate at least three heat exchange pipes with each other.

[0013] On the basis of the above solution, any of the basic units of the fin is provided with a window assembly between two adjacent perforations; the window assembly includes a plurality of windows distributed symmetrically with respect to a center line of the perforations, and a length of the window close to the center line is smaller than a length of the window away from the center line.

[0014] An embodiment of the present application also provides an air conditioner outdoor unit, which includes the condenser described above.

[0015] An embodiment of the present application also provides an air conditioning system, which includes the condenser described above.

[0016] The condenser, the air conditioner outdoor unit and the air conditioning system provided by the embodiments of the present application propose that under the same size of the outdoor unit, the heat exchange effect of the condenser can be further improved by optimizing the size of the fins and the spacing between the heat exchange pipes, and a new size of fins and a new spacing between the heat exchange pipes are further designed. As compared with the existing condensers with the same pipe diameter of the heat exchange pipes, in the condenser of the present embodiment, the fin width is increased, and the spacing between the heat exchange pipes is reduced, so that for the condenser

of the same height, the number of pipes will increase due to the reduction of pipe spacing; at the same time, the heat exchange area will further increase due to the widening of the fins, so that the heat exchange efficiency and energy efficiency can be improved without changing a housing of the air conditioner outdoor unit.

BRIEF DESCRIPTION OF DRAWINGS

[0017] In order to more clearly describe the embodiments of the present application or technical solutions in the prior art, drawings required to be used in the description of the embodiments or the prior art will be introduced briefly below. Obviously, the drawings in the following description illustrate some embodiments of the present application, and for those skilled in the art, other drawings can also be obtained based on these drawings without creative efforts.

[0018] FIG. 1 is an overall schematic view of a condenser in an embodiment of the present application;

[0019] FIG. 2 is a schematic view showing an arrangement of fins and perforations in the embodiment of the present application;

[0020] FIG. 3 is a schematic top view of a single-row L-shaped heat exchange pipe in the embodiment of the present application;

[0021] FIG. 4 is a schematic top view of a dual-row L-shaped heat exchange pipe in the embodiment of the present application;

[0022] FIG. 5 is a schematic top view of a single-row linear heat exchange pipe in the embodiment of the present application;

[0023] FIG. 6 is a schematic view showing an arrangement of one column of perforations on the fin in the embodiment of the present application;

[0024] FIG. 7 is a schematic view showing an arrangement of two adjacent columns of perforations on the fins in the embodiment of the present application;

[0025] FIG. 8 is a schematic view showing an arrangement of a pipe plate in the embodiment of the present application;

[0026] FIG. 9 is a schematic view showing an arrangement of holes on the pipe plate in the embodiment of the present application;

[0027] FIG. 10 is a schematic view showing an arrangement of a flanged hole on the pipe plate in the embodiment of the present application;

[0028] FIG. 11 is a schematic view of a hairpin pipe in the embodiment of the present application;

[0029] FIG. 12 is a schematic view of a window assembly on a basic unit in the embodiment of the present application; and

[0030] FIG. 13 is a schematic view of window assemblies on two basic units in the embodiment of the present application.

LIST OF REFERENCE SIGNS

[0031] 1: heat exchange pipe; 101: single-row L-shaped heat exchange pipe; 102: dual-row L-shaped heat exchange pipe; 103: single-row linear heat exchange pipe; 2: fin; 3: perforation; 4: pipe plate; 5: liquid inflow pipe; 6: liquid outflow pipe; 7: bend pipe; 8: manifold; 9: flanged hole; 10: hairpin pipe; 11: window; 1101: opening; 1102: flow guide cover.

DETAILED DESCRIPTION

[0032] In order to make the objects, technical solutions and advantages of the embodiments of the present application clearer, the technical solutions in the embodiments of the present application will be clearly and fully described below in connection with the drawings in the embodiments of the present application. Obviously, the described embodiments are part of the embodiments of the present application, not all of them. Based on the embodiments in the present application, all the other embodiments obtained by those skilled in the art without creative efforts will fall within the scope of protection of the present application.

[0033] In the description of the present application, it should be noted that unless otherwise clearly specified and defined, terms “install”, “connect” and “connection” should be understood in a broad sense; for example, the connection may be a fixed connection, or may also be a detachable connection, or an integral connection; it may be a mechanical connection, or an electrical connection; it may be a direct connection, or an indirect connection implemented through an intermediate medium, or it may be internal communication between two elements. For those skilled in the art, the specific meaning of the above terms in the present application can be interpreted according to specific situations.

[0034] Referring to FIG. 1, an embodiment of the present application provides a condenser, which includes at least one row of heat exchange pipes 1 and a plurality of fins 2 arranged along the heat exchange pipes 1. Referring to FIG. 2, any of the fins 2 is provided with at least one column of perforations 3 corresponding to the number of rows of the heat exchange pipes 1, which are configured for the heat exchange pipes 1 to pass through. The fins 2 are evenly divided into at least one basic unit in a width direction, which corresponds to the number of rows of the heat exchange pipes 1. A width of any of the basic units is larger than 18.2 mm, and a center-to-center distance between two adjacent perforations 3 in any column of the perforations 3 is smaller than 21 mm.

[0035] The number of columns of the perforations 3 on any of the fins 2 is the same as the number of rows of the heat exchange pipes 1, that is, the heat exchange pipes 1 in the same row correspondingly pass through one column of the perforations 3. The number of basic units on any of the fins 2 is the same as the number of rows of the heat exchange pipes 1. One basic unit is provided with one column of perforations 3. Each of the basic units has the same width. A width of the fin 2 is the size of the fin 2 in a direction perpendicular to an extending direction of the heat exchange pipe 1. The center-to-center distance between two adjacent perforations 3 in any column of the perforations 3 is a distance between the centers of two adjacent perforations 3, and this distance is a spacing between two adjacent heat exchange pipes 1 in the same row of heat exchange pipes 1. The width of the basic unit provided in this embodiment is larger than the width of the fin in the existing outdoor unit condensers, and the center-to-center distance between two adjacent perforations provided in this embodiment is smaller than the center-to-center distance of heat exchange pipes in the existing outdoor unit condensers.

[0036] The condenser provided by this embodiment proposes that under the same size of the outdoor unit, the heat exchange effect of the condenser can be further improved by optimizing the size of the fins 2 and the spacing between the

heat exchange pipes 1, and a new size of fins 2 and a new spacing between the heat exchange pipes 1 are further designed. As compared with the existing condensers with the same pipe diameter of the heat exchange pipes 1, in the condenser of the present embodiment, the width of fins 2 is increased, and the spacing between the heat exchange pipes 1 is reduced, so that for the condenser of the same height, the number of pipes will increase due to the reduction of pipe spacing; at the same time, the heat exchange area will further increase due to the widening of the fins 2, so that the heat exchange efficiency and energy efficiency can be improved without changing a housing of the air conditioner outdoor unit.

[0037] On the basis of the above embodiment, further, the width of any of the basic units is 21-22 mm, and the center-to-center distance A between two adjacent perforations 3 in any column of the perforations 3 is 17-18 mm. With reference to FIG. 2, the perforations on any basic unit may be arranged in the middle of this basic unit, so that the width of any basic unit is B, specifically 21-22 mm.

[0038] Furthermore, the heat exchange pipe 1 may be L-shaped as a whole. With reference to FIG. 3, a single-row L-shaped heat exchange pipe 101 is provided. With reference to FIG. 4, a dual-row L-shaped heat exchange pipe 102 is provided, which is advantageous for increasing a length of the heat exchange pipe 1, increasing the heat exchange area and improving the heat exchange effect. Each row of heat exchange pipes 1 is arranged in a row from top to bottom in a height direction. The heat exchange pipe 1 may also be linear as a whole, which can be flexibly set according to the actual situation without specific restrictions. With reference to FIG. 5, a single-row linear heat exchange pipe 103 is provided.

[0039] On the basis of the above embodiment, further, the diameter of the perforation 3 is 7.275-7.325 mm, and the distance between two adjacent fins 2 is 1.2-1.4 mm. That is, when the heat exchange pipe 1 is L-shaped, the fins 2 on each of two linear segments of the L shape are arranged in parallel, and the distance between two adjacent fins 2 on each linear segment is 1.2-1.4 mm. When the heat exchange pipe 1 is linear, the fins 2 on the heat exchange pipe 1 are arranged in parallel, and the distance between two adjacent fins 2 is 1.2-1.4 mm. The spacing between the fins 2 can not only ensure a smooth flow of cooling medium (water or air) between the fins 2 and full contact of the cooling medium with the fins 2, but also can increase the area of the fins 2 as much as possible to guarantee the heat exchange effect.

[0040] On the basis of the above embodiment, further, two adjacent columns of perforations 3 are staggered. That is, the two adjacent columns of perforations 3 are not arranged to be flush with each other, but the perforations 3 in one column can be arranged corresponding to positions of gaps between the perforations 3 in the other column. The two adjacent columns of perforations 3 correspond to two adjacent rows of heat exchange pipes 1. The staggered arrangement can facilitate heat exchange and improve the heat exchange efficiency.

[0041] On the basis of the above embodiment, further, with reference to FIGS. 6 and 7, a first spacing L1 between the center of a perforation 3 on the fin 2 at a bottom end and a bottom edge of the fin 2 is smaller than a second spacing L2 between the center of a perforation 3 at a top end in the column of perforations 3 where the perforation 3 is located and a top edge of the fin 2.

[0042] Specifically, referring to FIG. 6, when one column of perforations 3 is arranged on the fin 2, the distance between the center of a lowermost perforation 3 in the column of perforations 3 and the bottom edge of the fin 2 is the first spacing L1, and the distance between the center of an uppermost perforation 3 in the column of perforations 3 and the top edge of the fin 2 is the second spacing L2. Referring to FIG. 7, when multiple columns of perforations 3 are arranged on the fin 2, the distance between the center of a lowermost perforation 3 in the multiple columns of perforations 3 and the bottom edge of the fin 2 is the first spacing L1, and the distance between the center of an uppermost perforation 3 in a column of perforations 3 where the lowermost perforation 3 is located and the top edge of the fin 2 is the second spacing L2.

[0043] The first spacing is set to be smaller than the second spacing, that is, a heat exchange pipe 1 which is closer to the bottom edge of the fin 2 is provided, so that the medium inside the heat exchange pipe 1 can conduct heat exchange on the components at a bottom end of the condenser, which is advantageous for preventing the components at the bottom end of the condenser from being damaged due to the influence of an external environment. Specifically, for example, under a heating working condition of the air conditioner, an outdoor ambient temperature is low, and the bottom end of the condenser of the outdoor unit is easy to freeze, so arranging the heat exchange pipe 1 to be closer to the bottom end can improve this situation through heat transfer.

[0044] On the basis of the above embodiment, further, the first spacing is $\frac{1}{4}$ of the center-to-center distance between two adjacent perforations 3 in any column of the perforations 3, and the second spacing is $\frac{3}{4}$ of the center-to-center distance between two adjacent perforations 3 in any column of the perforations 3. An overall height of the fin 2 is an integral multiple of the spacing of the heat exchange pipes 1. The height of the fin 2 is set according to the actual situation so as to adapt to the sizes of the condenser and the outdoor unit.

[0045] Further, when multiple columns of perforations 3 are arranged on the fin 2, one column of two adjacent columns of perforations 3 has a lower height and the other column has a higher height; the distance between the lowermost perforation 3 in the column of perforations 3 with a lower height and the bottom edge of the fin 2 is the first spacing, and the distance between the uppermost perforation 3 and the top edge of the fin 2 is the second spacing; the distance between the lowermost perforation 3 in the column of perforations 3 with a higher height and the bottom edge of the fin 2 is the second spacing, and the distance between the uppermost perforation 3 and the top edge of the fin 2 is the first spacing. The staggered arrangement of two columns of perforations 3 is satisfied.

[0046] On the basis of the above embodiment, further, with reference to FIGS. 1 and 8, a condenser with a dual-row L-shaped heat exchange pipe 102 is provided. Two ends of the heat exchange pipe 1 are respectively connected with a pipe plate 4. The pipe plate 4 is provided with holes corresponding to the heat exchange pipes 1, and at least one of two adjacent holes on any pipe plate 4 is configured as a flanged hole 9. The pipe plates 4 are arranged at two ends of the heat exchange pipes 1 to support the heat exchange pipes 1, and limit and fix the fins 2. The heat exchange pipes 1 pass through the holes on the pipe plates 4, and the flanged

holes **9** can increase the contact area with the heat exchange pipes **1**, so as to realize more stable support and fixation for the heat exchange pipes **1**.

[0047] On the basis of the above embodiment, further, with reference to FIG. **8**, the condenser in this embodiment further includes a pipe group assembly connected with the heat exchange pipes **1** at the pipe plate **4** at one end. The pipe group assembly includes a liquid inflow pipe **5**, a liquid outflow pipe **6**, a bend pipe **7** and a manifold **8**. The liquid inflow pipe **5** and the liquid outflow pipe **6** are respectively connected with the heat exchange pipe **1**. The bend pipe **7** is configured to communicate two non-adjacent heat exchange pipes **1** with each other, and the manifold **8** is configured to communicate at least three heat exchange pipes **1** with each other.

[0048] The liquid inflow pipe **5** and the liquid outflow pipe **6** respectively communicate with an external pipeline. The liquid inflow pipe **5** is a medium inlet of the condenser, and the liquid outflow pipe **6** is a medium outlet of the condenser. Further, when multiple rows of heat exchange pipes **1** are provided, the liquid inflow pipe **5** can communicate with multiple heat exchange pipes **1** at the same time, so that the medium can flow into multiple rows of heat exchange pipes **1** at the same time, thus improving the heat exchange efficiency. The liquid outflow pipe **6** can be connected with one heat exchange pipe **1**, and multiple rows of heat exchange pipes **1** can converge at this heat exchange pipe **1**; then the medium flows out through the liquid outflow pipe **6**.

[0049] The flowing position of the medium in the heat exchange pipe **1** can be changed through the bend pipe **7**, and mixing of the medium in the heat exchange pipe **1** at different positions can be realized through the manifold **8**, which is advantageous for improving a heat exchange uniformity of the condenser and the heat exchange efficiency. Further, the specific arrangement positions of the liquid inflow pipe **5** and the liquid outflow pipe **6** can be flexibly set according to the actual situation without restrictions. The number and connection positions of the bend pipe **7** as well as the number and connection positions of the heat exchange pipes connected by the manifold **8** can each be flexibly set according to the actual situation without restrictions.

[0050] On the basis of the above embodiment, further, with reference to FIGS. **12** and **13**, any basic unit of the fin **2** is provided with a window assembly between two adjacent perforations **3**. The window assembly includes a plurality of windows **11** distributed symmetrically with respect to a center line of the perforations **3**, and a length of the window **11** close to the center line is smaller than a length of the window **11** away from the center line. The window **11** includes an opening **1101** arranged on the fin **2**, and a flow guide cover **1102** arranged at the opening **1101**. The flow guide cover **1102** is formed with a passage penetrating in the width direction of the fin **2**.

[0051] The center line of perforations **3** on any basic unit is a connecting line of the centers of a column of perforations **3** on the basic unit. On both sides of the center line, the lengths of the windows **11** increase gradually from the center to the boundaries of the fin **2**. The length of the window **11** is the length of the window **11** in the height direction of the fin **2**. This arrangement is consistent with the size of the parts other than the perforations **3** on the fin **2**, which can make full use of the parts other than the perforations **3** on the fin **2**. The windows **11** can also be arranged on the center line, and the length of the windows **11** on the center line is

set according to the gap between two adjacent perforations **3**.

[0052] The arrangement of the window **11** assembly can disturb the flow of the cooling medium (water or air). Specifically, the arrangement of the opening **1101** can make the cooling medium flow alternately on both sides of the fin **2**, and the arrangement of the flow guide cover **1102** can disturb the flow of the cooling medium on one side of the fin **2**, which can improve the heat exchange efficiency of the cooling medium with the fin **2** and improve the heat exchange effect.

[0053] Further, the perforations **3** on the fin **2** may also be configured as the flanged hole structure. The specific shape of the window **11** may be any regular or irregular shape, which can be flexibly set according to the actual situation without restrictions.

[0054] On the basis of the above embodiment, further, this embodiment provides an air conditioner outdoor unit, which includes the condenser provided by any of the above embodiments. The air conditioner outdoor unit further includes a housing, a fan for driving an air flow, and other components.

[0055] On the basis of the above embodiment, further, this embodiment provides an air conditioning system, which includes the condenser provided by any of the above embodiments. The air conditioning system further includes an evaporator, a compressor, a throttle valve, a pipeline for connecting various components to form a circuit, and other components.

[0056] On the basis of the above embodiment, further, the outdoor unit condenser is composed of the fins **2**, the heat exchange pipes **1**, the pipe plates **4**, the pipe group, etc. The sizes, gaps and numbers of the fins **2** and the heat exchange pipes **1** affect the heat exchange efficiency of the condenser. For condensers with the same length and height, different pipe diameters and gaps lead to different heat exchange effects. In order to improve the heat exchange effect and increase the heat exchange area, this embodiment proposes a design of fins **2** with a new width and heat exchange pipes **1** with a new spacing.

[0057] This embodiment provides a condenser which is composed of left and right pipe plates **4**, fins **2**, a hairpin pipe **10**, a pipe group, etc. Referring to FIG. **10**, after the hairpin pipe **10** in a U-shape passes through the two pipe plates **4**, it can be connected by a connecting pipe at the right pipe plate **4** to form a continuous flow passage. The fins **2** are placed vertically through the hairpin pipe **10** one column by one column. The spacing between the fins **2** is 1.2-1.4 mm. The left and right pipe plates **4** fix the hairpin pipe **10** and the fins **2**. The condensers can be divided into a single-row condenser and a multi-row condenser, or into a linear condenser and a L-shaped condenser.

[0058] With reference to FIGS. **6** and **7**, the lowest end of the condenser under the heating working condition is easy to freeze. The arrangement of the perforations on the fins of single-row and multi-row condensers is as follows: the perforations at a distance of $\frac{1}{4}$ of the perforation spacing from the fin boundary are arranged at the bottom, and the perforations at a distance of $\frac{3}{4}$ of the perforation spacing from the fin boundary are arranged at the top. The arrow direction in the figures shows the air flow direction when the cooling medium is air.

[0059] The diameter ϕ of perforation **3** of the fin **2** is 7.275-7.325 mm, the perforation spacing is 17-18 mm, and the width of the fin **2** is 21-22 mm. The various sizes of the

fin on the dual-row condenser are shown in FIG. 2 as follows: A is 17-18 mm, B is 21-22 mm, L1 is $\frac{1}{4}$ of A, i.e., 4.25-4.5 mm, L2 is $\frac{3}{4}$ of A, i.e., 12.75-13.5 mm, and the height of the condenser is an integral multiple of A.

[0060] Referring to FIG. 10, the right pipe plate 4 is configured to fix the hairpin pipe 10. The hairpin pipe 10 passes through the holes of the pipe plate 4, and it has to be ensured that one of the two holes passed through by the same U-shaped hairpin pipe 10 is a flanged hole 9. With reference to FIG. 9, as to the specific size, the center-to-center distance between two adjacent holes on the pipe plate 4 is consistent with the center-to-center distance between two perforations, both of which are the pipe spacing of the hairpin pipe 10; FIG. 9 provides a single-row heat exchange pipe, and a spacing between the center of the hole on the pipe plate 4 corresponding to the single-row heat exchange pipe and a side edge on a side closer to the pipe plate is $C=10.8$ mm. The hole diameter ϕ of the flanged hole 9 on the pipe plate 4 may be 7.38 mm, and the hole diameter ϕ of the non-flanged hole may be 8.5 mm. Referring to FIG. 10, the flanging direction of the flanged hole 9 is set along the penetrating direction of the hairpin pipe 10.

[0061] The hairpin pipe 10 is of a U-shaped structure, as shown in FIG. 11. An outer diameter of the hairpin pipe 10 is $D=\phi+7$ mm, and the center-to-center distance of the U-shape is consistent with the pipe spacing, i.e., $A=17-18$ mm. Further, the condenser provided in this embodiment is applicable to a heat exchange pipe 1 with a pipe diameter of 7 mm, i.e., a heat exchange pipe 1 with an outer diameter of 7 mm.

[0062] At present, under the premise of adopting the outdoor unit housing of a project air conditioner, the condenser of the traditional heat exchange pipe with a diameter of 7 mm has fins with a width of 18.186 mm and 13.3 mm, with the pipe spacing being 21 mm. The fins 2 with a new width provided in this embodiment are widened, and the pipe spacing is reduced, so that the number of pipes of the condenser with the same height will increase due to the reduction of the pipe spacing, and meanwhile, the heat exchange area will further increase due to the widening of the fins 2. Furthermore, under the premise of not changing the outdoor unit housing of the air conditioner, the heat exchange efficiency and energy efficiency can be improved through this improvement. By increasing the heat exchange area through wide fins 2 and small pipe spacing, a higher energy efficiency can be achieved without changing the outdoor unit housing of the air conditioner, thus breaking through the energy efficiency limit of the same outdoor unit housing.

[0063] Described above are only preferred embodiments of the present application, which are not intended to limit the present application. Any modification, equivalent replacement, improvement and the like made within the spirit and principles of the present application should be included in the scope of protection of the present application.

1-10. (canceled)

11. A condenser, comprising: at least one row of heat exchange pipes and a plurality of fins arranged along the heat exchange pipes, any of the fins being provided with at least one column of perforations corresponding to the number of rows of the heat exchange pipes, which are configured for the heat exchange pipes to pass through, wherein the fins are evenly divided into at least one basic unit in a width direction which corresponds to the number of rows of the heat exchange pipes, a width of any of the basic units is larger than 18.2 mm, and a center-to-center distance between two adjacent perforations in any column of the perforations is smaller than 21 mm.

12. The condenser according to claim 11, wherein the width of any of the basic units is 21-22 mm, and the center-to-center distance between two adjacent perforations in any column of the perforations is 17-18 mm.

13. The condenser according to claim 11, wherein a distance between two adjacent fins is 1.2-1.4 mm.

14. The condenser according to claim 11, wherein two adjacent columns of perforations are staggered; a first spacing between the center of a perforation on the fin at a bottom end and a bottom edge of the fin is smaller than a second spacing between the center of a perforation at a top end in the column of perforations where the perforation is located and a top edge of the fin.

15. The condenser according to claim 14, wherein the first spacing is $\frac{1}{4}$ of the center-to-center distance between two adjacent perforations in any column of the perforations, and the second spacing is $\frac{3}{4}$ of the center-to-center distance between two adjacent perforations in any column of the perforations.

16. The condenser according to claim 11, wherein both ends of the heat exchange pipes are respectively connected with a pipe plate, the pipe plates are provided with holes corresponding to the heat exchange pipes, and at least one of two adjacent holes on any of the pipe plates is configured as a flanged hole.

17. The condenser according to claim 16, further comprising a pipe group assembly connected with the heat exchange pipes at the pipe plate at one end, wherein the pipe group assembly comprises a liquid inflow pipe, a liquid outflow pipe, a bend pipe and a manifold; the liquid inflow pipe and the liquid outflow pipe are respectively connected with the heat exchange pipes, the bend pipe is configured to communicate two non-adjacent heat exchange pipes with each other, and the manifold is configured to communicate at least three heat exchange pipes with each other.

18. The condenser according to claim 11, wherein any of the basic units of the fin is provided with a window assembly between two adjacent perforations; the window assembly comprises a plurality of windows distributed symmetrically with respect to a center line of the perforations, and a length of the window close to the center line is smaller than a length of the window away from the center line.

19. An air conditioner outdoor unit, comprising the condenser according to claim 11.

20. An air conditioning system, comprising the condenser according to claim 11.

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