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(54) **HEAT EXCHANGE PLATE AND HEAT EXCHANGER CONTAINING SAME**
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Description

TECHNICAL FIELD

[0001] The present invention relates to heat exchanger technologies, and in particular, to a heat exchange plate according to claim 1, and a heat exchanger including the heat exchange plate

BACKGROUND

[0002] With the development of artificial intelligence technologies and the advent of the big data era, data centers need to process a surge of data, and devices used for data processing release more heat energy. How to reduce heat of a data center becomes a problem that urgently needs to be resolved.

[0003] In a conventional technology, a plate heat exchanger is usually used to implement exchange between a hot air flow released by a device in a data center and an external cold air flow. In the plate heat exchanger, surface characteristics (for example, a surface pattern and pattern arrangement) of a heat exchange plate affect heat exchange efficiency of air passages on two sides of the heat exchanger.

[0004] In a related technology, convex hull structures are usually formed on a surface of the heat exchange plate to increase a heat transfer coefficient of the heat exchange plate. The convex hull structures usually include vertical-bar-shaped convex hulls or circular convex hulls arranged in an array. The convex hull structures are usually arranged in a sparse or dense manner. When the convex hull structures are arranged in a sparse arrangement manner, air flow distribution is usually uneven, and a utilization rate of the heat exchange plate is reduced. When the convex hull structures are arranged in the dense manner, flow resistance of air flows is increased, and consequently, a flow speed of the air flows is reduced. Further, flow efficiency is reduced. In conclusion, how to improve heat exchange efficiency of a heat exchanger for air flows becomes a problem. US 2019/226771 discloses a heat exchanger plate having the features of the preamble of claim 1.

[0005] Document EP 1 106 729 A2 discloses a cross flow heat exchanger for a condensation washer-drier, comprises numerous flat heat exchanger plates which are arranged in parallel as a packet, and a damp air channel composed of a thermoplastic or heat conducting metal. The heat exchanger plates have numerous slats which run laterally w.r.t the damp air channel. The slats consist of cooling laminae and have an open pocket section.

[0006] Document US 4 384 611 A discloses a heat exchanger core formed from a single foil strip folded into successive U-bends to define alternate fluid passages, with even-numbered passages being for hot fluid and odd-numbered passages being for cold fluid. The folded foil thus defines three walls of each passage with the remaining fourth side open. Top and bottom plates cover

and close the open sides of all the hot and cold passages respectively. The ends of certain passages remain open; the ends of other passages are selectively closed by pinching together the ends of adjacent foil walls which define the passages. A pre-formed end plate has apertures between deformable ribs; the apertures are aligned with the ends of open passages, and the ribs overlie and are joined with the pinched ends of the closed passages.

[0007] Document EP 0 567 393 A1 discloses a high thermal-performance plate evaporator working in nucleate boiling conditions, in which the flow ducts of the hot fluid and of the liquid to be evaporated are defined by the compartments of a structure of juxtaposed plane and parallel metal plates, wherein on at least part of their extent, the ducts of the liquid to be evaporated comprise confined spaces, located from place to place, the restricted thickness of which afforded to the flow is at the most equal to the diameter of a vapour bubble forming on the wall of a hot plate during nucleate boiling.

SUMMARY

[0008] Embodiments of the present invention are defined by the independent claims. Additional features of embodiments of the invention are presented in the dependent claims. In the following, parts of the description and drawings referring to former embodiments which do not necessarily comprise all features to implement embodiments of the claimed invention are not represented as embodiments of the invention but as examples useful for understanding the embodiments of the invention.

[0009] According to a heat exchange plate provided in this application, heat exchange efficiency of the heat exchange plate for air flows can be improved by disposing first flow guiders or a combination of the first flow guiders and second flow guiders.

[0010] To resolve the foregoing technical problems, the following technical solutions are used in this application.

[0011] The present invention concerns a heat exchanger plate as defined in claim 1.

[0012] According to the heat exchange plate provided in this application, by forming the first flow guiders and the supporting structures on a surface of the base board, air passing through a heat exchanger can be guided, so that air flows flow along a flow guide direction. In addition, the heat exchange plate can be further evenly separated into a plurality of cavities, so that the air flows can be evenly limited in the cavities, to avoid uneven distribution of the air flows on the heat exchange plate, and improve a utilization rate of the heat exchange plate, thereby improving heat exchange efficiency.

[0013] With reference to the first aspect, in a possible implementation, the heat exchange plate further includes second flow guiders disposed on the base board; and the first flow guiders and the second flow guiders are arranged along the first direction at intervals into one column, to form a plurality of columns of flow guider groups

arranged along the second direction, where location arrangements of the first flow guiders and the second flow guiders in each column of the flow guider groups are the same.

[0014] According to the heat exchange plate shown in this application, the flow guider groups including the first flow guiders and the second flow guiders are disposed, so that the air flows can form vortexes at some positions of the heat exchange plate, thereby increasing a contact area between the air flows and the heat exchange plate. In this way, heat exchange between the air flows and the heat exchange plate can be performed sufficiently, thereby improving an air flow exchange effect.

[0015] With reference to the first aspect, in a possible implementation, along the second direction, the flow guider groups are axis-symmetrically arranged in pairs; and in the flow guider groups in pairs, first flow guiders and second flow guiders in one column of the flow guider groups extend along a third direction, and first flow guiders and second flow guiders in the other column of the flow guider groups extend along a fourth direction, and the first direction, the second direction, the third direction, and the fourth direction are different directions.

[0016] In this application, the flow guider groups are axis-symmetrically arranged in pairs, so that the air flows can flow along a same direction, to avoid uneven distribution of the air flows in flow passages and between third convex hulls caused by the air flows flowing along a plurality of directions, thereby improving evenness of air flow distribution, and further improving a heat exchange effect.

[0017] With reference to the first aspect, in a possible implementation, the flow guider groups in pairs and the supporting structures are arranged alternately along the second direction at intervals.

[0018] With reference to the first aspect, in a possible implementation, the heat exchange plate further includes third flow guiders disposed on the base board; and the first flow guiders and the third flow guiders are arranged along the first direction at intervals into one column, to form a plurality of columns of flow guider groups arranged along the second direction, where location arrangements of the first flow guiders and the second flow guiders in adjacent columns of the flow guider groups are different.

[0019] According to the heat exchange plate shown in this application, the flow guider groups including the first flow guiders and the third flow guiders are disposed, so that the air flows can form vortexes when flowing through gaps between the convex hulls, to increase the contact area between the air flows and the heat exchange plate, thereby improving the heat exchange efficiency.

[0020] With reference to the first aspect, in a possible implementation, the first flow guiders extend along the first direction, the third flow guiders extend along a third direction, and the first direction and the third direction are different directions.

[0021] With reference to the first aspect, in a possible implementation, a reinforcing structure is connected be-

tween every two of the first flow guiders arranged at intervals.

[0022] The reinforcing structure is disposed between every two flow guiders, so that the first flow guiders are more stable. This helps improve stability of the heat exchange plate, and further helps improve heat exchange performance of the heat exchange plate.

[0023] With reference to the first aspect, in a possible implementation, positioning bosses are further disposed on the base board.

[0024] With reference to the first aspect, in a possible implementation, the heat exchange plate further includes a plurality of positioning bosses configured to assemble the heat exchange plate with an adjacent heat exchange plate, and the plurality of positioning bosses are disposed on the base board.

[0025] In this application, the positioning bosses are disposed on the base board, so that assembly between the heat exchange plates can be facilitated, thereby further improving stability between the heat exchange plates, and making the heat exchanger more secure.

[0026] With reference to the first aspect, in a possible implementation, a pattern formed by an orthographic projection of the first flow guider onto the base board includes at least one of the following: a circle, an oval, a water drop, a strip, and a triangle.

[0027] With reference to the first aspect, in a possible implementation, the base board, the first flow guiders, and the supporting structures are integrally formed; and a material forming the heat exchange plate includes at least one of the following: a metal material and a non-metal material.

[0028] According to a second aspect, an embodiment of this application provides a heat exchanger, including a plurality of heat exchange plates according to the first aspect.

BRIEF DESCRIPTION OF DRAWINGS

[0029] To describe the technical solutions in embodiments of this application more clearly, the following briefly describes the accompanying drawings for describing embodiments of this application. It is clear that the accompanying drawings in the following description show merely some embodiments of this application, and a person of ordinary skill in the art may derive other drawings from these accompanying drawings without creative efforts.

FIG. 1a and FIG. 1b are schematic diagrams of structures of two heat exchange plates in a conventional technology;

FIG. 2 is a schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application;

FIG. 3 is a cross-sectional view of the heat exchange plate shown in FIG. 2 according to an embodiment of this application;

FIG. 4 is another cross-sectional view of the heat

exchange plate shown in FIG. 2 which does not fall under the scope of the claims;

FIG. 5 is another schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application;

FIG. 6 is a schematic diagram of a pattern formed by an orthographic projection of a convex hull onto a base board according to an embodiment of this application;

FIG. 7 is a schematic diagram of a structure of an oval convex hull according to an embodiment of this application;

FIG. 8 is another schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application;

FIG. 9a is a partial enlarged schematic diagram of a third convex hull according to an embodiment of this application;

FIG. 9b is a schematic sectional structural view of a third convex hull according to an embodiment of this application;

FIG. 10 is another schematic diagram of a surface structure of a heat exchange plate which does not fall under the scope of the claims;

FIG. 11 is another schematic diagram of a surface structure of a heat exchange plate which does not fall under the scope of the claims;

FIG. 12 is another schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application;

FIG. 13 is another schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application;

FIG. 14 is another schematic diagram of a surface structure of a heat exchange plate which does not fall under the scope of the claims;

FIG. 15 is a schematic diagram of a structure of a heat exchanger according to an embodiment of this application;

FIG. 16 is a schematic diagram of a relative position between heat exchange plates in a heat exchanger according to an embodiment of this application;

FIG. 17(a) is a cross-sectional view of a heat exchange plate 161 shown in FIG. 16 along a position bb' according to an embodiment of this application;

FIG. 17(b) is a cross-sectional view of a heat exchange plate 162 shown in FIG. 16 along a position cc' according to an embodiment of this application;

FIG. 17(c) is a schematic diagram of assembly between two heat exchange plates according to an embodiment of this application;

FIG. 17(d) is a schematic diagram of assembly between four heat exchange plates which does not fall under the scope of the claims;

FIG. 18(a) is another cross-sectional view of the heat exchange plate 161 shown in FIG. 16 along a position bb' according to an embodiment of this application;

FIG. 18(b) is another cross-sectional view of the heat exchange plate 162 shown in FIG. 16 along a position cc' according to an embodiment of this application;

FIG. 18(c) is a schematic diagram of assembly between two heat exchange plates which does not fall under the scope of the claims; and

FIG. 18(d) is a schematic diagram of assembly between four heat exchange plates which does not fall under the scope of the claims.

DESCRIPTION OF EMBODIMENTS

[0030] The following clearly and completely describes the technical solutions in embodiments of this application with reference to the accompanying drawings in embodiments of this application. It is clear that the described embodiments are some but not all of embodiments of this application. All other embodiments obtained by a person of ordinary skill in the art based on embodiments of this application without creative efforts shall fall within the protection scope of this application.

[0031] To make the objectives, technical solutions, and advantages of this application clearer, the following clearly and completely describes the technical solutions in this application with reference to the accompanying drawings in this application. It is clear that the described embodiments are merely a part rather than all of embodiments of this application. All other embodiments obtained by a person of ordinary skill in the art based on embodiments of this application without creative efforts shall fall within the protection scope of this application.

[0032] FIG. 1a is a schematic diagram of a surface structure of a heat exchange plate in a conventional technology. As shown in FIG. 1a, the heat exchange plate in the conventional technology includes elongated convex hulls 101 and convex hulls 102 that are arranged in a crisscross manner. The convex hulls 101 form protrusions on a first surface S1 shown in FIG. 1a, and form recesses in a second surface opposite to the first surface S1. The convex hulls 102 form recesses in the first surface S1 shown in FIG. 1a, and form protrusions on the second surface opposite to the first surface S1. It can be learned from FIG. 1a that, the elongated convex hulls 101 and 102 are arranged densely. The densely arranged convex hulls can enable heat exchange to be performed sufficiently between air flows and the heat exchange plate, to increase a heat transfer coefficient of the heat exchange plate. However, because the convex hulls are arranged densely, flow resistance of the air flows greatly increases, further limiting a fluid flow speed. Consequently, an air flow heat exchange speed of a data center is reduced.

[0033] FIG. 1b is a schematic diagram of a surface structure of another heat exchange plate in the conventional technology. As shown in FIG. 1b, a surface of the heat exchange plate includes a plurality of circular convex hulls arranged in an array. It can be learned from

FIG. 1b that, there are large intervals between rows or columns of the convex hulls. The surface of the heat exchange plate is usually designed with convex hulls of this shape, so that the fluid flow speed can be increased. However, sparse convex hulls reduce a heat transfer coefficient of the surface of the heat exchange plate. Consequently, heat exchange efficiency between cold air flows and hot air flows is reduced.

[0034] Based on problems of the surface structures of the foregoing existing heat exchange plates, this application provides a heat exchange plate and a heat exchanger including the heat exchange plate. Air flows are guided by disposed first flow guiders and supporting structures, to improve heat exchange efficiency of the heat exchanger, and reduce air flow resistance.

[0035] It should be noted first that, the flow guider in this application may include one convex hull (for example, a convex hull 2011 shown in FIG. 2 or a convex hull 20131 shown in FIG. 8), or may further include a plurality of convex hulls (for example, a flow guider 201 shown in FIG. 2) along a second direction in embodiments shown in FIG. 2, FIG. 5, and FIG. 14, or may include a pair of convex hulls (for example, a third convex hull 2013 shown in FIG. 8) along a first direction in embodiments shown in FIG. 8, FIG. 10, FIG. 11, and FIG. 12, or may include a plurality of convex hull pairs (for example, a flow guider 201 shown in FIG. 8) along a second direction in embodiments shown in FIG. 8, FIG. 10, FIG. 11, and FIG. 12.

[0036] FIG. 2 is a schematic diagram of a surface structure of a heat exchange plate according to an embodiment of this application. In FIG. 2, the heat exchange plate 20 includes a base board 21 and flow guiders 201 and supporting structures 202 that are formed on the base board 21.

[0037] The base board 21 includes a first edge B1 and a second edge B2 that are along a first direction x and a third edge B3 and a fourth edge B4 that are along a second direction y. The first direction x is a horizontal direction, and the second direction y is a vertical direction. The base board 21 further includes a first surface S1 and a second surface opposite to the first surface S1. The second surface is not shown in FIG. 2.

[0038] The flow guider 201 includes a plurality of convex hulls 2011 arranged along the second direction y at intervals. Specifically, a pattern formed by an orthographic projection of the convex hull 2011 onto the base board 21 may include but not limited to an oval, a water drop, a strip, and a triangle. The plurality of convex hulls 2011 may have same or different shapes, or may have same or different sizes. FIG. 2 schematically shows a case in which the pattern formed by the orthographic projection of the convex hull 2011 onto the base board 21 is an oval.

[0039] The supporting structure 202 extends along the second direction y. Herein, the supporting structures may alternatively be referred to as supporting convex hulls because the supporting structures protrude outwards relative to the base board 21. It can be learned from FIG. 2 that, the supporting structure extends from a side on

which the first edge B1 is located to a side on which the second edge B2 is located. By setting the supporting structure 202 into a shape shown in FIG. 2, structural strength of a heat exchanger formed by stacking and assembling a plurality of heat exchange plates 20 can be increased.

[0040] It should be noted herein that, along the second direction y, the supporting structure may alternatively be a plurality of elongated convex hulls arranged at intervals, and an arrangement manner of the plurality of elongated convex hulls included in the supporting structure may be the same as an arrangement manner of the convex hulls in the flow guider 201. In other words, the supporting structure 202 shown in FIG. 2 is divided into three to five sections, and a gap is disposed between every two of the sections. The supporting structure in this case is not shown again in the figure.

[0041] In the heat exchange plate 20 shown in FIG. 2, the flow guiders 201 including a plurality of convex hulls 2011 arranged at intervals and the supporting structures 202 including supporting convex hulls are disposed alternately along the first direction x at intervals. Intervals between the flow guiders along the first direction x may be equal. In this way, the heat exchange plate is evenly separated into a plurality of cavities. Usually, the side on which the second edge B2 of the heat exchange plate 20 is located is an air inlet, and external air flows flow from the side of B2 to the side of B1. By disposing the supporting structures 202, the air flows can be evenly limited in the cavities, to avoid uneven distribution of the air flows on the heat exchange plate, and improve a utilization rate of the heat exchange plate, thereby improving heat exchange efficiency.

[0042] In the heat exchange plate 20 shown in FIG. 2, the flow guiders 201 and the supporting structures 202 may be formed on a same surface, for example, on the first surface S1. In other words, the convex hulls of the flow guiders 201 and the convex hulls of the supporting structures 202 protrude toward a same direction. FIG. 3 shows a cross-sectional view of the heat exchange plate 20 along AA'.

[0043] In a possible implementation, the flow guiders 201 and the supporting structures 202 may be formed on different surfaces. For example, the flow guiders 201 are formed on a second surface S2, and the supporting structures 202 are formed on the first surface S1. FIG. 4 schematically shows another cross-sectional view of the heat exchange plate 20 along AA'.

[0044] In this embodiment, the base board 21, the flow guiders 201, and the supporting structures 202 may be integrally formed. In other words, the base board 21, the flow guiders 201, and the supporting structures 202 are made of a same material. Herein, the material that forms the heat exchange plate 20 may be a metal material, or may be a non-metal material. The metal material includes but is not limited to: aluminum, copper, and an alloy material (for example, an aluminum alloy) obtained by mixing various metal materials based on a specific propor-

tion. The non-metal material includes but is not limited to PP (Polypropylene, polypropylene), PVC (Polyvinylchlorid, polyvinylchlorid), PS (Polystyrene, polystyrene), PC (Polycarbonate, polycarbonate), and a material obtained by mixing various non-metal materials based on a proportion.

[0045] Because the metal material has high hardness, a height of outward protrusion of the formed convex hulls is limited. Usually, in a process of assembling heat exchange plates made of a metal material into a heat exchanger, a large interval is usually provided between every two heat exchange plates, the interval is usually greater than the height of outward protrusion of the convex hulls, and is usually twice the height of outward protrusion of the convex hulls. Therefore, preferably, when the heat exchange plate is made of a metal material, a structure in the cross-sectional view shown in FIG. 4, which does not fall under the scope of the claims, namely, the structure in which the flow guiders 201 are disposed on the second surface S2 and the supporting structures 202 are disposed on the first surface S1, may be preferentially selected. In this way, the structure shown in FIG. 4 may enable the interval between every two heat exchange plates to be approximately twice the height of outward protrusion of the convex hulls. In addition, because both the two surfaces of the heat exchange plate have flow guide structures, outdoor fresh air and indoor hot air can exchange heat alternately on the two surfaces of the heat exchange plate, so that a quantity of heat exchange plates required in the heat exchanger is reduced, and manufacturing costs of the heat exchanger are reduced.

[0046] The non-metal materials PP, PVC, PS, PC, and the like are all polymer materials, and have characteristics of low hardness and high flexibility compared with metal materials. Therefore, convex hulls formed by using the non-metal materials may have a large thickness of protrusion. Therefore, preferably, when the heat exchange plate is made of a non-metal material, the structure in the cross-sectional view shown in FIG. 3 may be used. To be specific, the flow guiders 201 and the supporting structures 202 are disposed on the first surface S1 shown in FIG. 3. The structure shown in FIG. 3 may enable the interval between every two heat exchange plates to be approximately the height of outward protrusion of the convex hulls. In this way, the flow guiders 201 and the supporting structures 202 of the heat exchange plate 20 are more stable.

[0047] In some optional implementations, when the heat exchange plate is manufactured by using a non-metal material, to further improve stability of the heat exchange plate 20, reinforcing structures for connecting the convex hulls 2011 of the flow guiders 201 may be disposed between the convex hulls 2011, where the reinforcing structures are convex hulls 2012. FIG. 5 is a schematic diagram of a surface structure of another heat exchange plate 20 according to an embodiment of this application. A projection of the convex hull 2012 onto a base board 21 is elongated. Herein, the convex hulls 2012

have a supporting function for the convex hulls 2011. By disposing the convex hulls 2012, the convex hulls 2011 are more stable. This helps improve stability of the heat exchange plate 20, and further helps improve heat exchange performance of the heat exchange plate. Herein, to minimize fluid resistance of the heat exchange plate 20, a width of the convex hull 2012 along a first direction x may be less than or equal to a width of the convex hull 2011 along the first direction x, as shown in FIG. 5. Herein, a ratio of the width of the convex hull 2012 along the first direction x to the width of the convex hull 2011 along the first direction x may be within a range of [0.2, 1].

[0048] In some optional implementations, when the heat exchange plate with the cross-sectional structure shown in FIG. 3 is manufactured by using a non-metal material, flow guiders are formed only on one surface of the heat exchange plate 20, namely, single-surface convection heat exchange is performed on the heat exchange plate 20. Therefore, to improve a heat exchange effect of a heat exchanger, several more heat exchange plates are usually added (for example, a quantity of heat exchange plates is doubled) compared with a structure in which flow guiders are formed on two surfaces. In this case, to further improve stability between the heat exchange plates and make the heat exchange plates more secure, bosses 203 may be disposed on the heat exchange plate 20, as shown in FIG. 5. The bosses 203 are disposed on the base board 21. In FIG. 5, the bosses 203 may be disposed at positions shown in FIG. 5. It should be noted that a quantity of the bosses 203 is not fixed, and is set based on a requirement of an application scenario. For example, in some embodiments, the heat exchange plate may include four bosses, and the four bosses may be bosses at four positions: an upper left corner, a lower left corner, an upper right corner, and a lower right corner, as shown in FIG. 5.

[0049] Optionally, the bosses 203 may be disposed on the supporting structures 202.

[0050] The bosses 203 on the heat exchange plate 20 are usually configured to position and assemble the heat exchange plate 20 with an adjacent heat exchange plate 20. On the other surface on which no boss 203 is disposed and that is of the heat exchange plate 20, grooves are further provided at positions the same as the positions of the bosses 203. In a process of assembling the heat exchange plates 20, bosses 203 of a first heat exchange plate are embedded into grooves of a second heat exchange plate adjacent to the first heat exchange plate. Usually, a depth of the groove may be one third to one half of a thickness of the base board, so that the bosses 203 of the first heat exchange plate and bosses 203 of the second heat exchange plate press against each other. A height of unembedded parts of the bosses 203 is the same as a height of outward protrusion of the convex hulls 2011. Therefore, preferably, a height of outward protrusion of the bosses 203 may be a sum of the height of outward protrusion of the convex hulls 2011 and the depth of the grooves.

[0051] In some optional implementations of this embodiment, a thickness of the convex hull 2011 gradually increases from an edge to the middle. In this optional implementation, an orthographic projection of the convex hull 2011 onto the base board 21 is in shapes shown in FIG. 6. It can be learned from FIG. 6 that, the pattern formed by the orthographic projection of the convex hull 2011 onto the base board 21 is nesting of two same shapes.

[0052] A structure of the convex hull 2011 in a projection shape shown in FIG. 6 is specifically described with reference to FIG. 7 by using an oval convex hull as an example. FIG. 7 is a schematic diagram of a structure of an oval convex hull. The oval convex hull includes a first surface a1 and a second surface a2, where the first surface a1 is attached to a first surface S1 of the base board 21, and the second surface a2 is a convex surface. Boundaries of the first surface a1 and the second surface a2 are both ovals having different sizes and same or similar shapes. In other words, the first surface and the second surface have a same shape. It can be learned from FIG. 6 and FIG. 7 that, the oval convex hull gradually protrudes from a bottom part to a top part, so that a cross-sectional view of the oval convex hull is in a shape of a trapezium. In other words, orthographic projections of the surface a1 and the surface a2 onto the base board 21 are similar ovals, and the two ovals have a same axis center, and a long axis of the oval of the surface a1 is greater than a long axis of the oval of the surface a2. By setting the convex hull into this shape, flow resistance of air flows can be reduced and a fluid heat exchange speed can be increased.

[0053] Structures of an elongated convex hull and a water-drop-shaped convex hull are similar to the structure of the oval convex hull, except that shapes of boundaries surrounding the first surface and the second surface are different. Details are not described herein again.

[0054] Continue to refer to FIG. 8. FIG. 8 is a schematic diagram of a surface structure of another heat exchange plate according to an embodiment of this application.

[0055] In FIG. 8, the heat exchange plate 20 includes a base board 21 and flow guiders 201 formed on the base board 21.

[0056] The base board 21 includes a first edge B1 and a second edge B2 that are along a first direction x and a third edge B3 and a fourth edge B4 that are along a second direction y. The first direction x is a horizontal direction, and the second direction y is a vertical direction. The base board 20 further includes a first surface and a second surface opposite to the first surface.

[0057] The flow guider 201 includes third convex hulls 2013. FIG. 8 schematically shows that the flow guider 201 includes a column of third convex hulls 2013 along the second direction y. The third convex hull 2013 includes a convex hull 20131 and a convex hull 20132. The two convex hulls are separated from each other, as shown in FIG. 9a. FIG. 9a is an enlarged schematic diagram of the third convex hull 2013. The convex hull

20131 extends along a third direction m, and the convex hull 20132 extends along a fourth direction 1. Any two of an extending line along the third direction m, an extending line along the fourth direction 1, and an extending line along the first direction x intersect with each other. In this case, a column of convex hulls 20131 arranged along the second direction y may form a flow guider group, and a column of convex hulls 20132 arranged along the second direction y may form a flow guider group.

[0058] The convex hull 20131 and the convex hull 20132 may have same or different shapes. Preferably, orthographic projections of the convex hull 20131 and the convex hull 20132 onto the base board 21 may be in an elongated shape shown in FIG. 9a. The convex hull 20131 and the convex hull 20132 each include two ends, where one end is close to the first edge B1 of the base board 21 and the other end is close to the second edge B2 of the base board 21. It can be learned from FIG. 8 and FIG. 9a that, a splay shape is formed between the convex hull 20131 and the convex hull 20132. To be specific, on a side close to the first edge B1 of the base board 21, two ends of the convex hull 20131 and the convex hull 20132 are close to each other, and on a side close to the second edge B2 of the base board 21, two ends of the convex hull 20131 and the convex hull 20132 are far away from each other.

[0059] In this embodiment, air flows flow from the second edge B2 of the heat exchange plate 20 to the first edge B1 of the heat exchange plate 20. When the air flows pass through the third convex hull 2013, because two ends of the convex hull 20131 and the convex hull 20132 are separated from each other at a position close to the second edge B2 (namely, bottom ends of two convex hulls shown in FIG. 8), the air flows can flow from the bottom ends more easily. Two ends of the convex hull 20131 and the convex hull 20132 are close to each other at a position close to the first edge B1 (namely, top ends of two convex hulls shown in FIG. 8). In this case, when the air flows pass through the position, because an opening is small, the air flows form vortexes at this position. To be specific, a contact area between the air flows and the heat exchange plate is increased. In this way, heat exchange between the air flows and the heat exchange plate can be performed sufficiently, thereby improving an air flow exchange effect.

[0060] In some possible implementations, thicknesses of the convex hulls 20131 and the convex hulls 20132 gradually increase from the position close to the second edge B2 shown in FIG. 8 to the position far from the second edge B2. To be specific, a cross-sectional view of the convex hulls 20131 along the direction m and/or a cross-sectional view of the convex hulls 20132 along the direction 1 present a shape shown in FIG. 9b. In FIG. 9b, f is the position at which the convex hulls 20131 and the convex hulls 20132 are close to the second edge B2, and f is the position at which the convex hulls 20131 and the convex hulls 20132 are far away from the second edge B2. By setting different thicknesses for the convex hulls,

flow resistance of the air flows in the convex hulls 20131 and the convex hulls 20132 shown in FIG. 8 can be reduced, thereby increasing a fluid flow speed.

[0061] In this embodiment, the heat exchange plate 21 includes a plurality of third convex hulls 2013 arranged along the first direction x and the second direction y at intervals. In other words, the plurality of third convex hulls 2013 form a third convex hull array on the base board 21.

[0062] It should be noted herein that, for the third convex hulls 2013 in a same column, the convex hulls 20131 and the convex hulls 20132 are symmetrical about a same symmetry axis. For example, for the third convex hulls 2013 in the first column from the left in FIG. 8, the convex hulls 20131 and the convex hulls 20132 are symmetrically distributed on two sides of a symmetry axis L shown in FIG. 8. In this way, the air flows can flow along a same direction, to avoid uneven distribution of the air flows in flow passages and between the third convex hulls 2013 caused by the air flows flowing along a plurality of directions, thereby improving evenness of air flow distribution, and further improving a heat exchange effect.

[0063] In a heat exchanger plate not covered by the scope of the claims; the convex hull 20131 and the convex hull 20132 included in the third convex hull 2013 may alternatively be in a shape shown in FIG. 10. In FIG. 10, flow guiders 201 are arranged along a first direction x at intervals, and the flow guider 201 includes a plurality of third convex hulls 2013 arranged along a second direction y at intervals. Different from the heat exchange plate shown in FIG. 8, a pattern formed by a projection of the convex hull 20131 and the convex hull 20132 of the heat exchange plate 20 shown in FIG. 10 onto the base board 21 may be an oval, a water drop, or the like. FIG. 10 schematically shows a case in which the pattern is an oval. In some implementations, the convex hull 20131 and the convex hull 20132 gradually protrude from edges to the middle, namely, are in shapes of convex hulls shown in FIG. 6 and FIG. 7.

[0064] By setting the third convex hulls into the shapes shown in FIG. 6 and FIG. 10, fluid resistance can be reduced and a fluid flow speed can be increased when heat exchange efficiency is ensured.

[0065] In this example, the heat exchange plate 20 may be integrally formed by using a metal material, or may be integrally formed by using a non-metal material.

[0066] It can be learned from the heat exchange plates 20 shown in FIG. 8 and FIG. 10 that, the convex hull 20131 shown in FIG. 8 is elongated, and compared with the convex hull 20131 shown in FIG. 10, a length of the convex hull 20131 shown in FIG. 8 along the third direction m is greater than a length of the convex hull 20131 shown in FIG. 10 along the third direction m. Therefore, compared with the shape of the convex hulls in the heat exchange plate 20 shown in FIG. 10, the convex hulls in the heat exchange plate 20 shown in FIG. 8 are arranged more densely and securely, and have stronger bearing force. Therefore, in some implementations, when the heat exchange plate 20 is made of a metal material, be-

cause the metal material has high hardness, in this case, the heat exchange plate may be formed by using the convex hull structures shown in FIG. 10. In the heat exchange plate shown in FIG. 10, the flow guiders 201 may be formed on a same surface, for example, on a first surface S1, or may be formed on different surfaces. In this case, the flow guiders 201 are formed on different surfaces at intervals. Specifically, in a left-to-right direction shown in FIG. 10, the third convex hulls 2013 in the first column are formed on the first surface, the third convex hulls 2013 in the second column are formed on the second surface, the third convex hulls 2013 in the third column are formed on the first surface, and so on. Therefore, a quantity of heat exchange plates in a heat exchanger can be reduced, to reduce costs.

[0067] In some implementations, when the heat exchange plate 20 is made of a non-metal material, because a polymer material forming the non-metal material has low hardness, in this case, the heat exchange plate may be formed by using the convex hull structures shown in FIG. 8. In this case, the flow guiders 201 may be formed on a same surface, to improve bearing force of the heat exchange plate.

[0068] In some possible implementations, the flow guider 201 may include a combination of the third convex hulls 2013 shown in FIG. 8 and the third convex hulls 2013 shown in FIG. 10, as shown in FIG. 11 which does not fall under the scope of the claims. In a flow guider 201 shown in FIG. 11, third convex hulls 2013 in the shape shown in FIG. 8 and third convex hulls 2013 in the shape shown in FIG. 10 are alternately arranged. In this case, the convex hulls 20131 shown in FIG. 8 and the convex hulls 20131 shown in FIG. 10 form flow guider groups along a second direction y, and the convex hulls 20132 shown in FIG. 8 and the convex hulls 20132 shown in FIG. 10 form flow guider groups along the second direction y. It can be learned from FIG. 11 that, the flow guider groups may be axis-symmetrically arranged in pairs. When the heat exchange plate is manufactured by using this structure, both heat exchange efficiency and supporting force of the heat exchange plate can be ensured. The heat exchange plate of this structure is not only suitable to be manufactured by using a metal material, but also suitable to be manufactured by using a non-metal material. This may be selected based on a requirement of an application scenario. For example, this structure may be used when an air flux is small but to-be-exchanged energy is high.

[0069] In some possible implementations, the heat exchange plate 20 includes a combination of the flow guiders 201 shown in any one of FIG. 8, FIG. 10, and FIG. 11 and supporting structures 202. FIG. 12 is a schematic diagram of a surface structure of a heat exchange plate including a combination of the flow guiders 201 shown in FIG. 11 and the supporting structures 202. The supporting structure 202 may have a same structure as the supporting structure 202 shown in FIG. 2. Details are not described herein again. In this way, air flows may be fur-

ther limited in a cavity including two supporting structures 202, so that the air flows are distributed more evenly. In addition, by disposing the supporting structures 202, the heat exchange plate 20 may further be more stable.

[0070] In some possible implementations, convex hulls 2021 may alternatively be disposed on the supporting structures 202 shown in FIG. 12, as shown in FIG. 13. A shape of the convex hull 2021 may be any one shown in FIG. 6. Heat exchange efficiency can be further improved by disposing the convex hulls 2021 on the supporting structures 202.

[0071] Continue to refer to FIG. 14. FIG. 14 is a schematic diagram of a surface structure of another heat exchange plate which does not fall under the scope of the claims.

[0072] In FIG. 14, the heat exchange plate 20 includes a base board 21 and a plurality of flow guiders formed on the base board 21.

[0073] The base board 21 includes a first edge B1 and a second edge B2 that are along a first direction x and a third edge B3 and a fourth edge B4 that are along a second direction y. The first direction x is a horizontal direction, and the second direction y is a vertical direction. The base board 20 further includes a first surface S1 and a second surface opposite to the first surface S1.

[0074] The plurality of flow guiders include flow guiders 201. The flow guider 201 includes fourth convex hulls 2014 and fifth convex hulls 2015. The fourth convex hull 2014 extends along the second direction y, and the fifth convex hull 2015 extends along a third direction z. Herein, an extending line of the third direction z intersects an extending line of the second direction y. Specifically, a range of an included angle between the third direction z and the second direction y is $[-15^\circ, -75^\circ]$. A pattern formed by an orthographic projection of each of the fourth convex hull 2014 and the fifth convex hull 2015 onto the base board 21 may be an oval, a water drop, a strip, or the like.

[0075] In some implementations, the pattern formed by the orthographic projection of each of the fourth convex hull 2014 and the fifth convex hull 2015 onto the base board 21 may alternatively be shown in FIG. 6. For a specific structure, refer to related description corresponding to FIG. 6. Details are not described herein again.

[0076] Still referring to FIG. 14, in FIG. 14, two adjacent convex hulls have different extending directions along the first direction x. The first row of convex hulls in FIG. 14 are used as an example. From left to right, the first row of convex hulls are a fourth convex hull 2014, a fifth convex hull 2015, a fourth convex hull 2014, , respectively. In other words, an extending direction of one convex hull is different from extending directions of both convex hulls adjacent to the convex hull. In this way, air flows form vortexes when flowing through gaps between convex hulls, to increase a contact area between the air flows and the heat exchange plate, thereby improving heat exchange efficiency.

[0077] Further, starting with the 1st flow guider 201 on

the left, every two flow guiders are used as one group, and there is a large distance interval between this group of flow guiders and an adjacent group of flow guiders, to form an air flow passage. That is, in FIG. 15, a flow passage is formed between the second first flow guider and the third first flow guider. In this way, flow resistance of air flows in flow passages of the heat exchange plate can be reduced, and a flow speed of the air flows can be increased.

[0078] Based on the heat exchange plates shown in the foregoing embodiments, an embodiment of this application further provides a heat exchanger. Specifically, FIG. 15 is a schematic diagram of a structure of a heat exchanger 1500. The heat exchanger 1500 includes supporting members 1502 configured to structurally support the heat exchanger, barriers 1501 configured to protect heat exchange plates, and a plurality of stacked heat exchange plates 1503. It can be learned from FIG. 15 that there are a total of four supporting members 1502 distributed on a periphery of the heat exchanger 1500, to support the heat exchanger 1500 and form a space for accommodating the heat exchange plates 1503. The barriers 1501 are disposed opposite to each other on two opposite surfaces of the heat exchanger 1500. The heat exchange plates can be supported and protected by disposing the supporting members 1502 and the barriers 1501.

[0079] The plurality of heat exchange plates 1503 shown in FIG. 15 may be the heat exchange plates shown in any one of the foregoing embodiments.

[0080] The heat exchange plate shown in FIG. 5 is used as an example below, and a manner of assembling heat exchange plates is described in detail with reference to FIG. 16, FIG. 17(a) to FIG. 17(c), and FIG. 18(a) to FIG. 18(c). To describe more clearly the manner of assembling heat exchange plates shown in this application, FIG. 16 schematically shows two adjacent heat exchange plates. It may be understood that, a quantity of heat exchange plates included in the heat exchanger is not limited in this application, and is set based on a requirement of an application scenario.

[0081] As shown in FIG. 16, a schematic diagram of a surface structure of a heat exchange plate 161 is the same as the schematic diagram of the surface structure of the heat exchange plate 20 shown in FIG. 5, and a schematic diagram of a surface structure of a heat exchange plate 162 is rotated to the right by 90 degrees compared with the schematic diagram of the surface structure of the heat exchange plate 161. In a specific mounting process of the heat exchanger, positioning bosses 1611, 1612, 1613, 1614, 1615, and 1616 of the heat exchange plate 161 are correspondingly mounted in one-to-one correspondence with positioning bosses 1621, 1622, 1623, 1624, 1625, and 1626 of the heat exchange plate 162. In FIG. 16, a first flow guider in the heat exchange plate 161 includes a plurality of convex hulls 1618, and a second flow guider in the heat exchange plate 161 includes a supporting convex hull 1617; and a

first flow guider in the heat exchange plate 162 includes a plurality of convex hulls 1628, and a second flow guider in the heat exchange plate 162 includes supporting convex hulls 1627.

[0082] When first flow guiders and second flow guiders in the heat exchange plates are located on a same surface and protrude toward a same direction, cross-sectional views of the heat exchange plate 161 and the heat exchange plate 162 are shown in FIG. 17(a) and FIG. 17(b), respectively. Specifically, FIG. 17(a) is a cross-sectional view of the heat exchange plate 161 shown in FIG. 16 along a position bb', and FIG. 17(b) is a cross-sectional view of the heat exchange plate 162 shown in FIG. 16 along a position cc'. In FIG. 17(a), bosses 1614, 1615, and 1616 are disposed on a first surface S1 of the heat exchange plate 161, and grooves 1619 are provided in a second surface S2 of the heat exchange plate 161 at positions the same as positions of the bosses 1614, 1615, and 1616. In FIG. 17(b), bosses 1624, 1625, and 1626 are disposed on a first surface S3 of the heat exchange plate 162, and grooves 1629 are provided in a second surface S4 of the heat exchange plate 162 at positions the same as positions of the bosses 1624, 1625, and 1626, where a depth of each of the groove 1619 and the groove 1629 is less than a thickness of the base board. Optionally, the depth of the groove may be one third to one half of the thickness of the base board. In a process of assembling the heat exchange plates, the bosses 1614, 1615, and 1616 disposed on the first surface S1 of the heat exchange plate 161 are respectively embedded into the grooves 1629 in the second surface S4 of the heat exchange plate 162. FIG. 17(c) is a schematic diagram of assembly between two heat exchange plates according to an embodiment of this application. A height of outward protrusion of the foregoing bosses is usually a sum of the depth of the grooves and a height of outward protrusion of the convex hulls 1618. Herein, the convex hulls 1618 and the supporting convex hulls 1617 may have a same height, so that when the bosses 1614, 1615, and 1616 are respectively embedded into the grooves 1629, convex surfaces of the convex hulls 1618 and the supporting convex hulls 1617 in the heat exchange plate 161 exactly press against a back surface of the heat exchange plate 162, to form a plurality of air flow passages, and evenly limit air flows into the flow passages, so that the air flows are distributed in the flow passages more evenly. In addition, the heat exchange plates may be further enabled to support each other, to improve stability and firmness of the heat exchange plates. It should be noted herein that, other bosses in the heat exchange plate 161 are all embedded into the grooves in the second surface S4 of the heat exchange plate 162 in the foregoing embedding manner. It may be understood that every two adjacent heat exchange plates in the heat exchanger 1500 shown in FIG. 15 may be assembled in the assembly manner shown in FIG. 17(c).

[0083] When the first flow guiders and the second flow guiders in the heat exchange plates are located on dif-

ferent surfaces, the cross-sectional views of the heat exchange plate 161 and the heat exchange plate 162 are shown in FIG. 18(a) and FIG. 18(b), respectively. Specifically, FIG. 18(a) is a cross-sectional view of the heat exchange plate 161 shown in FIG. 16 along the position bb', and FIG. 18(b) is a cross-sectional view of the heat exchange plate 162 shown in FIG. 16 along the position cc'. The convex hulls 1618 are located on the first surface S1 of the heat exchange plate 161, and the supporting convex hulls 1617 are located on the second surface S2 of the heat exchange plate 161. The convex hulls 1628 are located on the first surface S3 of the heat exchange plate 162, and the supporting convex hulls 1627 are located on the second surface S4 of the heat exchange plate 162. When the cross-sectional views of the heat exchange plate 161 and the heat exchange plate 162 are shown in FIG. 18(a) and FIG. 18(b), respectively, an assembly manner between the heat exchange plate 161 and the heat exchange plate 162 is the same as an assembly manner between the cross-sectional views shown in FIG. 17(a) and FIG. 17(b). For specific description, refer to the related description of FIG. 17(a) and FIG. 17(b). Details are not described herein again. A cross-sectional view obtained after the heat exchange plate 161 and the heat exchange plate 162 are stacked and assembled is shown in FIG. 18(c). It should be noted herein that the height of outward protrusion of the foregoing bosses is usually a sum of the depth of the grooves, the height of outward protrusion of the supporting convex hulls 1617 (or 1627), and the height of outward protrusion of the convex hulls 1618 (or 1628). In this way, after the bosses 1614, 1615, and 1616 are respectively embedded into the grooves 1629, convex surfaces of the convex hulls 1618 located on the first surface S1 of the heat exchange plate 161 exactly press against convex surfaces of the supporting convex hulls 1627 located on the second surface S4 of the heat exchange plate 162, to form a plurality of air flow passages, and evenly limit air flows into the flow passages, so that the air flows are distributed in the flow passages more evenly. In addition, the heat exchange plates may be further enabled to support each other, to improve stability and firmness of the heat exchange plates. It may be understood that every two adjacent heat exchange plates in the heat exchanger 1500 shown in FIG. 15 may be assembled in the assembly manner shown in FIG. 18(c).

[0084] It should be noted herein that, when no boss is disposed on the heat exchange plates, mutually pressing force between the convex hulls in the heat exchange plates may be used for assembly. This method is a common manner of assembling existing heat exchange plates. Details are not described herein.

[0085] In FIG. 15, the heat exchanger 1500 includes a first surface T1, a second surface T2 opposite to the first surface T1, a third surface T3, and a fourth surface T4 opposite to the third surface that are formed by stacking a plurality of heat exchange plates 1503. The second surface T2 and the fourth surface T4 are not shown. A

side on which the first surface T1 is located is a cold air inlet, a side on which the second surface T2 is located is an air outlet of hot air obtained after heat exchange of cold air, a side on which the third surface T3 is located is a hot air inlet, and a side on which the fourth surface T4 is located is an air outlet of air obtained after heat exchange and cooling of hot air. An edge B1 of the heat exchange plate 161 shown in FIG. 16 and an edge B1 of the heat exchange plate 162 shown in FIG. 16 are located on the side of the first surface T1. An edge B2 of the heat exchange plate 162 and an edge B2 of the heat exchange plate 162 are located on the side of the second surface T2. An edge B3 of the heat exchange plate 161 and an edge B3 of the heat exchange plate 162 are located on the side of the third surface T3. An edge B4 of the heat exchange plate 161 and an edge B4 of the heat exchange plate 162 are located on the side of the fourth surface T4.

[0086] When the heat exchanger 1500 shown in FIG. 15 is formed in the assembly manner between two heat exchange plates that is shown in FIG. 17(c), a heat exchange principle of the heat exchanger 1500 is described with reference to FIG. 15, FIG. 16, and FIG. 17(a) to FIG. 17(d). FIG. 17(d) is a schematic diagram of a structure of stacking four heat exchange plates. A structure and an assembly direction of heat exchange plates d1 and d3 may be the same as a structure and an assembly direction of the heat exchange plate 162 in FIG. 16, FIG. 17(b), and FIG. 17(c). A structure and an assembly direction of heat exchange plates d2 and d4 may be the same as a structure and an assembly direction of the heat exchange plate 161 in FIG. 16, FIG. 17(a), and FIG. 17(c).

[0087] External cold air enters the heat exchanger 1500 from the first surface T1, to be specific, enters the heat exchanger 1500 from an air flow passage n formed between the heat exchange plates d1 and d2 shown in FIG. 17(d), and from an air flow passage n formed between the heat exchange plates d3 and d4 shown in FIG. 17(d). In the heat exchanger 1500, the external cold air exchanges heat with the heat exchange plates d1, d2, d3, and d4 in a contact manner, and after performing air flow heat exchange with air in the air flow passages, the external cold air is converted into hot air, and the hot air is output from the second surface T2 of the heat exchanger 1500. Hot air generated by devices in a data center enters the heat exchanger 1500 from the third surface T3, to be specific, enters the heat exchanger 1500 from an air flow passage formed between the heat exchange plate d1 shown in FIG. 17(d) and a heat exchange plate (not shown in the figure) at an upper layer of the heat exchange plate d1, and from an air flow passage formed between the heat exchange plate d2 and the heat exchange plate d3 shown in FIG. 17(d) (because the air flow passage is blocked by supporting convex hulls in FIG. 17(d), the air flow passage is not shown in the figure). In the heat exchanger 1500, the hot air exchanges heat with the heat exchange plates d1, d2, and d3 in a contact

manner, and after performing air flow heat exchange with air in the air flow passages, the hot air is converted into cooled air, namely, fresh air required by the data center, and the fresh air is output from the fourth surface T4 of the heat exchanger 1500. Therefore, the heat exchanger 1500 implements exchange between the hot air and the cold air, and reduces an air temperature of the data center. In other words, air flow passages of the external cold air and the hot air that is generated by the devices of the data center are separately disposed in different layers, and the external cold air and the hot air that is generated by the devices of the data center enter the heat exchanger 1500 by using the air flow passages in the different layers, and flow out after exchanging heat with the heat exchange plates and the air in the air flow passages.

[0088] When the heat exchanger 1500 shown in FIG. 15 is formed in the assembly manner between two heat exchange plates that is shown in FIG. 18(c), a heat exchange principle of the heat exchanger 1500 is described with reference to FIG. 15, FIG. 16, and FIG. 18(a) to FIG. 18(d). FIG. 18(d) is a schematic diagram of a structure of stacking four heat exchange plates. A structure and an assembly direction of heat exchange plates d1 and d3 may be the same as a structure and an assembly direction of the heat exchange plate 162 in FIG. 16, FIG. 18(b), and FIG. 18(c). A structure and an assembly direction of heat exchange plates d2 and d4 may be the same as a structure and an assembly direction of the heat exchange plate 161 in FIG. 16, FIG. 18(a), and FIG. 18(c).

[0089] External cold air enters the heat exchanger 1500 from the first surface T1, to be specific, enters the heat exchanger 1500 from an air flow passage n formed between the heat exchange plates d1 and d2 shown in FIG. 18(d), from an air flow passage n formed between the heat exchange plates d2 and d3 shown in FIG. 18(d), and from an air flow passage n formed between the heat exchange plates d3 and d4 shown in FIG. 18(d). In the heat exchanger 1500, the external cold air exchanges heat with the heat exchange plates d1, d2, d3, and d4 in a contact manner, and after performing air flow heat exchange with air in the air flow passages, the external cold air is converted into hot air, and the hot air is output from the second surface T2 of the heat exchanger 1500. The hot air generated by the devices in the data center enters the heat exchanger 1500 from the third surface T3, to be specific, enters the heat exchanger 1500 from the air flow passage formed between the heat exchange plates d1 and d2 shown in FIG. 18(d), from the air flow passage formed between the heat exchange plates d2 and d3 shown in FIG. 18(d), and from the air flow passage formed between the heat exchange plates d3 and d4 shown in FIG. 18(d) (the air flow passages of the hot air are not shown in FIG. 18(d)). In the heat exchanger 1500, the hot air exchanges heat with the heat exchange plates d1, d2, d3, and d4 in a contact manner, and after performing air flow heat exchange with air in the air flow passages, the hot air is converted into cooled air, namely,

fresh air required by the data center, and the fresh air is output from the fourth surface T4 of the heat exchanger 1500. Therefore, the heat exchanger 1500 implements exchange between the hot air and the cold air, and reduces an air temperature of the data center. In other words, air flow passages of the external cold air and the hot air that is generated by the devices of the data center may be disposed in a same layer, and the external cold air and the hot air that is generated by the devices of the data center may enter the heat exchanger 1500 by using the air flow passages in the same layer, and flow out after exchanging heat with the heat exchange plates and the air in the air flow passages.

Claims

1. A heat exchange plate, comprising:

a base board (21), wherein the base board (21) comprises a first edge (B1, B2) along a first direction and a second edge (B3, B4) along a second direction, and the first direction and the second direction are different directions;
first flow guiders (201), wherein the first flow guiders (201) are disposed on the base board (21), and are configured to guide flowing of air flows, wherein a plurality of the first flow guiders (201) are arranged along the first direction at intervals into one column, and a plurality of columns of the first flow guiders (201) are arranged along the second direction at intervals; and
supporting structures (202), wherein the supporting structures (202) are disposed on the base board (21), the supporting structures (202) extend along the first direction, and the supporting structures (202) and each column of the first flow guiders (201) are arranged alternately along the second direction at intervals;
characterized in that the first flow guiders (201) and the supporting structures (202) are disposed on a first surface of the base board (21).

2. The heat exchange plate according to claim 1, wherein

the heat exchange plate further comprises second flow guiders disposed on the base board (21); and
the first flow guiders (201) and the second flow guiders are arranged along the first direction at intervals into one column, to form a plurality of columns of flow guider groups arranged along the second direction, wherein location arrangements of the first flow guiders (201) and the second flow guiders in each column of the flow guider groups are the same.

3. The heat exchange plate according to claim 2, wherein

along the second direction, the flow guider groups are axis-symmetrically arranged in pairs; and
in the flow guider groups in pairs, first flow guiders (201) and second flow guiders in one column of the flow guider groups extend along a third direction, and first flow guiders (201) and second flow guiders in the other column of the flow guider groups extend along a fourth direction, and the first direction, the second direction, the third direction, and the fourth direction are different directions.

4. The heat exchange plate according to claim 3, wherein the flow guider groups in pairs and the supporting structures (202) are arranged alternately along the second direction at intervals.

5. The heat exchange plate according to claim 1, wherein

the heat exchange plate further comprises third flow guiders disposed on the base board (21); and
the first flow guiders (201) and the third flow guiders are arranged along the first direction at intervals into one column, to form a plurality of columns of flow guider groups arranged along the second direction, wherein location arrangements of the first flow guiders (201) and the third flow guiders in adjacent columns of the flow guider groups are different.

6. The heat exchange plate according to claim 5, wherein the first flow guiders (201) extend along the first direction, the third flow guiders extend along a third direction, and the first direction and the third direction are different directions.

7. The heat exchange plate according to claim 1 or 6, wherein a reinforcing structure is connected between every two of the first flow guiders (201) arranged at intervals.

8. The heat exchange plate according to claim 1, wherein positioning bosses are further disposed on the base board (21).

9. The heat exchange plate according to claim 1, wherein a pattern formed by an orthographic projection of the first flow guider onto the base board (21) comprises

at least one of the following: a circle, an oval, a water drop, a strip, and a triangle.

10. The heat exchange plate according to claim 1, wherein 5
- the base board (21), the first flow guiders (201), and the supporting structures (202) are integrally formed; and 10
- a material forming the heat exchange plate comprises at least one of the following: a metal material and a non-metal material.
11. A heat exchanger, comprising a plurality of heat exchange plates according to any one of claims 1 to 10. 15

Patentansprüche

1. Wärmetauscherplatte, umfassend: 20
- eine Basisplatte (21), wobei die Basisplatte (21) einen ersten Rand (B1, B2) entlang einer ersten Richtung und einen zweiten Rand (B3, B4) entlang einer zweiten Richtung umfasst, und wobei die erste Richtung und die zweite Richtung unterschiedliche Richtungen sind; 25
- erste Strömungsenker (201), wobei die ersten Strömungsenker (201) auf der Basisplatte (21) angeordnet sind und ausgestaltet sind, um das Strömen der Luftströmungen zu lenken, wobei eine Vielzahl der ersten Strömungsenker (201) entlang der ersten Richtung in Intervallen zu einer Spalte angeordnet sind, und eine Vielzahl von Spalten der ersten Strömungsenker (201) in Intervallen entlang der zweiten Richtung angeordnet ist; und 30
- Stützstrukturen (202), wobei die Stützstrukturen (202) auf der Basisplatte (21) angeordnet sind, die Stützstrukturen (202) sich entlang der ersten Richtung erstrecken, und die Stützstrukturen (202) und jede Spalte der ersten Strömungsenker (201) alternierend in Intervallen entlang der zweiten Richtung angeordnet sind; **dadurch gekennzeichnet, dass** 35
- die ersten Strömungsenker (201) und die Stützstrukturen (202) auf einer ersten Oberfläche der Basisplatte (21) angeordnet sind. 40
2. Wärmetauscherplatte nach Anspruch 1, wobei 50
- die Wärmetauscherplatte des Weiteren zweite Strömungsenker umfasst, die auf der Basisplatte (21) angeordnet sind; und
- die ersten Strömungsenker (201) und die zweiten Strömungsenker in Intervallen entlang der ersten Richtung zu einer Spalte angeordnet sind, um eine Vielzahl von Spalten von Strö-

mungsenkergruppen zu bilden, die entlang der zweiten Richtung angeordnet sind, wobei Positionsanordnungen der ersten Strömungsenker (201) und der zweiten Strömungsenker in jeder Spalte der Strömungsenkergruppen die gleichen sind.

3. Wärmetauscherplatte nach Anspruch 2, wobei
- die Strömungsenkergruppen entlang der zweiten Richtung achsensymmetrisch in Paaren angeordnet sind; und
- erste Strömungsenker (201) und zweite Strömungsenker in einer Spalte der Strömungsenkergruppen sich in den Strömungsenkergruppen in Paaren entlang einer dritten Richtung erstrecken, und erste Strömungsenker (201) und zweite Strömungsenker in der anderen Spalte der Strömungsenkergruppen sich entlang einer vierten Richtung erstrecken, und die erste Richtung, die zweite Richtung, die dritte Richtung und die vierte Richtung unterschiedliche Richtungen sind.
4. Wärmetauscherplatte nach Anspruch 3, wobei die Strömungsenkergruppen in Paaren und die Stützstrukturen (202) alternierend in Intervallen entlang der zweiten Richtung angeordnet sind. 25
5. Wärmetauscherplatte nach Anspruch 1, wobei
- die Wärmetauscherplatte des Weiteren dritte Strömungsenker umfasst, die auf der Basisplatte (21) angeordnet sind; und
- die ersten Strömungsenker (201) und die dritten Strömungsenker in Intervallen entlang der ersten Richtung zu einer Spalte angeordnet sind, um eine Vielzahl von Spalten von Strömungsenkergruppen zu bilden, die entlang der zweiten Richtung angeordnet sind, wobei Positionsanordnungen der ersten Strömungsenker (201) und der dritten Strömungsenker in benachbarten Spalten der Strömungsenkergruppen unterschiedlich sind. 30
6. Wärmetauscherplatte nach Anspruch 5, wobei die ersten Strömungsenker (201) sich entlang der ersten Richtung erstrecken, die dritten Strömungsenker sich entlang einer dritten Richtung erstrecken, und die erste Richtung und die dritte Richtung unterschiedliche Richtungen sind. 35
7. Wärmetauscherplatte nach Anspruch 1 oder 6, wobei eine Verstärkungsstruktur zwischen jeweils zwei der ersten Strömungsenker (201) verbunden ist, die in Intervallen angeordnet sind. 40
8. Wärmetauscherplatte nach Anspruch 1, wobei des

Weiteren Positionierungsvorsprünge auf der Basisplatte (21) angeordnet sind.

9. Wärmetauscherplatte nach Anspruch 1, wobei ein Muster, das durch eine orthographische Projektion der ersten Strömungsenker auf die Basisplatte (21) gebildet ist, mindestens eines der folgenden umfasst: einen Kreis, ein Oval, einen Wassertropfen, einen Streifen und ein Dreieck.

10. Wärmetauscherplatte nach Anspruch 1, wobei

die Basisplatte (21), die ersten Strömungsenker (201) und die Stützstrukturen (202) integral gebildet sind; und ein Material, das die Wärmetauscherplatte bildet, mindestens eines der folgenden umfasst: ein Metallmaterial und ein Nichtmetallmaterial.

11. Wärmetauscher, umfassend eine Vielzahl von Wärmetauscherplatten gemäß einem der Ansprüche 1 bis 10.

Revendications

1. Plaque d'échange de chaleur, comprenant :

un substrat (21), le substrat (21) comprenant un premier bord (B1, B2) suivant une première direction et un deuxième bord (B3, B4) suivant une deuxième direction, et la première direction et la deuxième direction étant des directions différentes ;

des premiers guides d'écoulement (201), les premiers guides d'écoulement (201) étant agencés sur le substrat (21) et étant configurés pour guider l'écoulement d'écoulements d'air, une pluralité des premiers guides d'écoulement (201) étant agencés à intervalles suivant la première direction en formant une colonne, et une pluralité de colonnes des premiers guides d'écoulement (201) étant agencées à intervalles suivant la deuxième direction ; et

des structures de support (202), les structures de support (202) étant agencées sur le substrat (21), les structures de support (202) s'étendant suivant la première direction, et les structures de support (202) et chaque colonne des premiers guides d'écoulement (201) étant agencées en alternance à intervalles suivant la deuxième direction ;

caractérisée en ce que

les premiers guides d'écoulement (201) et les structures de support (202) sont agencés sur une première surface du substrat (21).

2. Plaque d'échange de chaleur selon la revendication

1,

la plaque d'échange de chaleur comprenant en outre des deuxièmes guides d'écoulement agencés sur le substrat (21) ; et les premiers guides d'écoulement (201) et les deuxièmes guides d'écoulement étant agencés à intervalles suivant la première direction en formant une colonne, pour former une pluralité de colonnes de groupes de guides d'écoulement agencées suivant la deuxième direction, les agencements d'emplacement des premiers guides d'écoulement (201) et des deuxièmes guides d'écoulement dans chaque colonne des groupes de guides d'écoulement étant identiques.

3. Plaque d'échange de chaleur selon la revendication 1,

suivant la deuxième direction, les groupes de guides d'écoulement étant agencés par paires de façon axisymétrique ; et dans les groupes de guides d'écoulement par paires, des premiers guides d'écoulement (201) et des deuxièmes guides d'écoulement dans une colonne des groupes de guides d'écoulement s'étendant suivant une troisième direction, et des premiers guides d'écoulement (201) et des deuxièmes guides d'écoulement dans l'autre colonne des groupes de guides d'écoulement s'étendant suivant une quatrième direction, et la première direction, la deuxième direction, la troisième direction et la quatrième direction étant des directions différentes.

4. Plaque d'échange de chaleur selon la revendication 3, les groupes de guides d'écoulement par paires et les structures de support (202) étant agencés en alternance à intervalles suivant la deuxième direction.

5. Plaque d'échange de chaleur selon la revendication 1,

la plaque d'échange de chaleur comprenant en outre des troisièmes guides d'écoulement agencés sur le substrat (21) ; et les premiers guides d'écoulement (201) et les troisièmes guides d'écoulement étant agencés à intervalles suivant la première direction en formant une colonne, pour former une pluralité de colonnes de groupes de guides d'écoulement agencées suivant la deuxième direction, les agencements d'emplacement des premiers guides d'écoulement (201) et des troisièmes guides d'écoulement dans des colonnes adjacentes des groupes de guides d'écoulement étant différents.

6. Plaque d'échange de chaleur selon la revendication 5,
les premiers guides d'écoulement (201) s'étendant
suivant la première direction, les troisièmes guides
d'écoulement s'étendant suivant une troisième di- 5
rection, et la première direction et la troisième direc-
tion étant des directions différentes.
7. Plaque d'échange de chaleur selon la revendication
1 ou 6, 10
une structure de renfort étant connectée entre tous
les deux premiers guides d'écoulement (201) agen-
cés à intervalles.
8. Plaque d'échange de chaleur selon la revendication 1, 15
des bossages de positionnement étant en outre
agencés sur le substrat (21).
9. Plaque d'échange de chaleur selon la revendication 1, 20
un motif formé par une projection orthographique du
premier guide d'écoulement sur le substrat (21)
comprenant : un cercle et/ou un ovale et/ou une
goutte d'eau et/ou une bande et/ou un triangle. 25
10. Plaque d'échange de chaleur selon la revendication 1,

le substrat (21), les premiers guides d'écoule- 30
ment (201) et les structures de support (202)
étant formés d'un seul tenant ; et
un matériau formant la plaque d'échange de
chaleur comprenant : un matériau métallique
et/ou un matériau non métallique. 35
11. Échangeur de chaleur, comprenant une pluralité de
plaques d'échange de chaleur selon l'une quelcon-
que des revendications 1 à 10. 40

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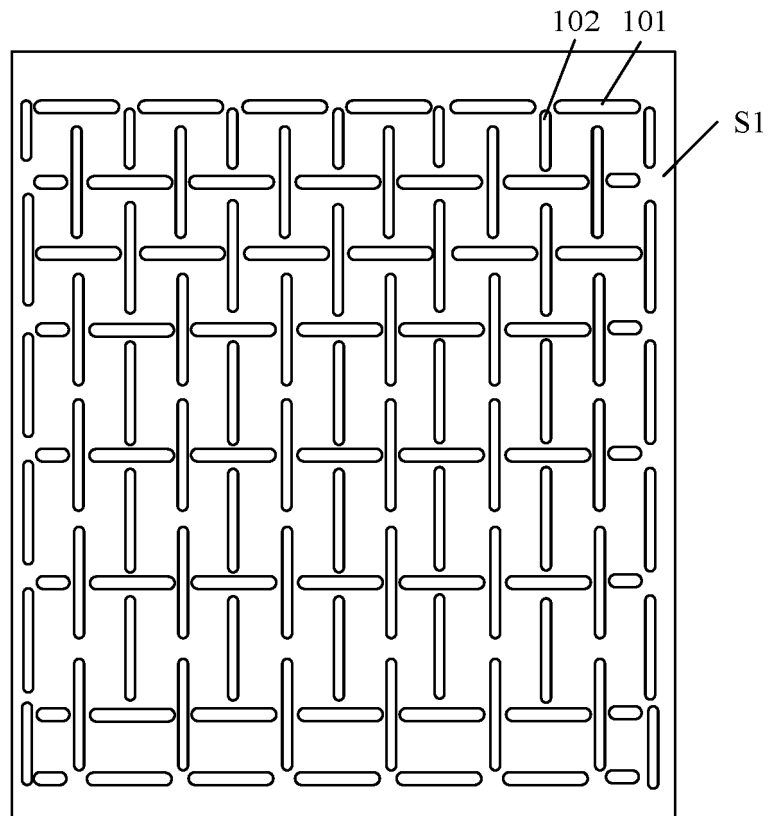


FIG. 1a

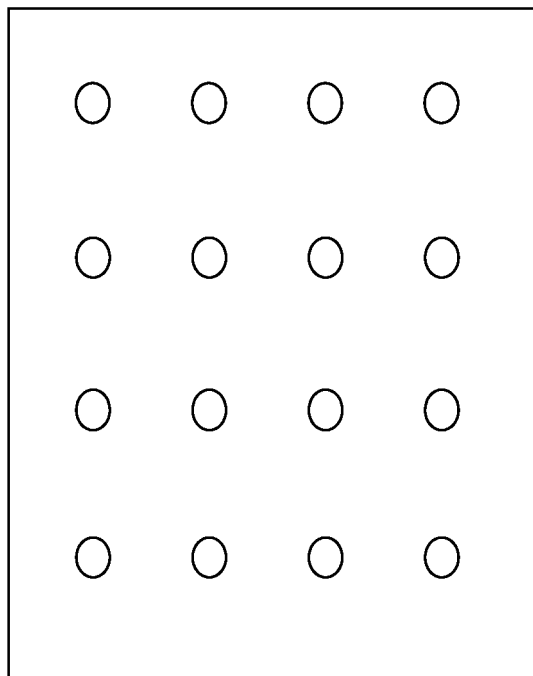


FIG. 1b

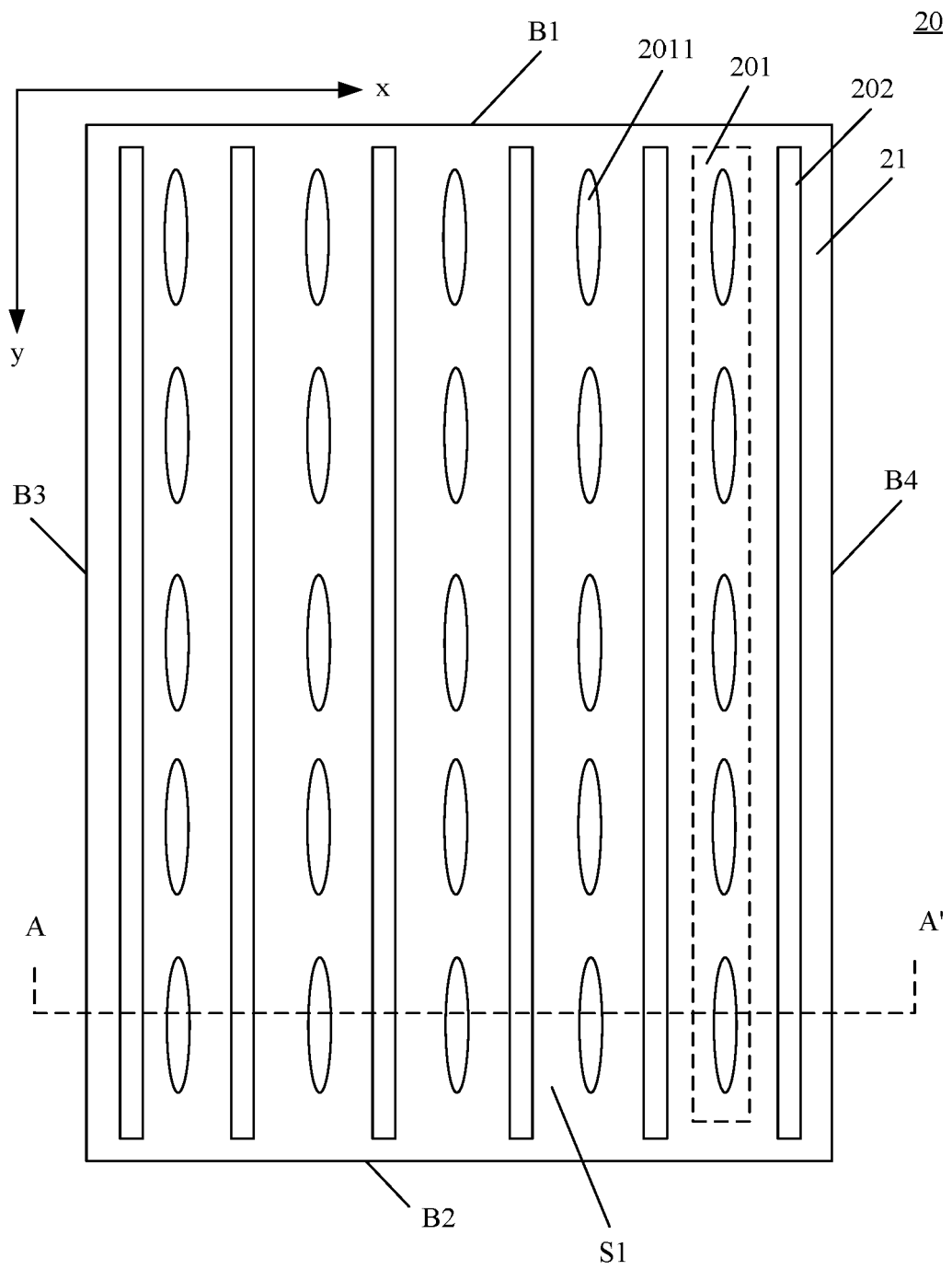


FIG. 2

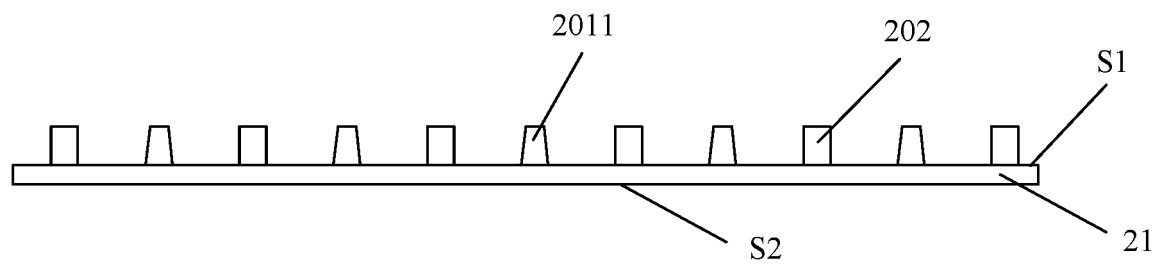


FIG. 3

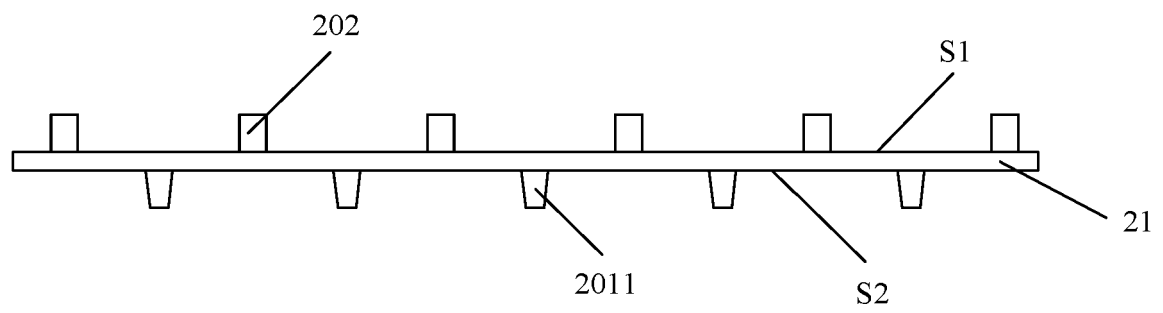


FIG. 4

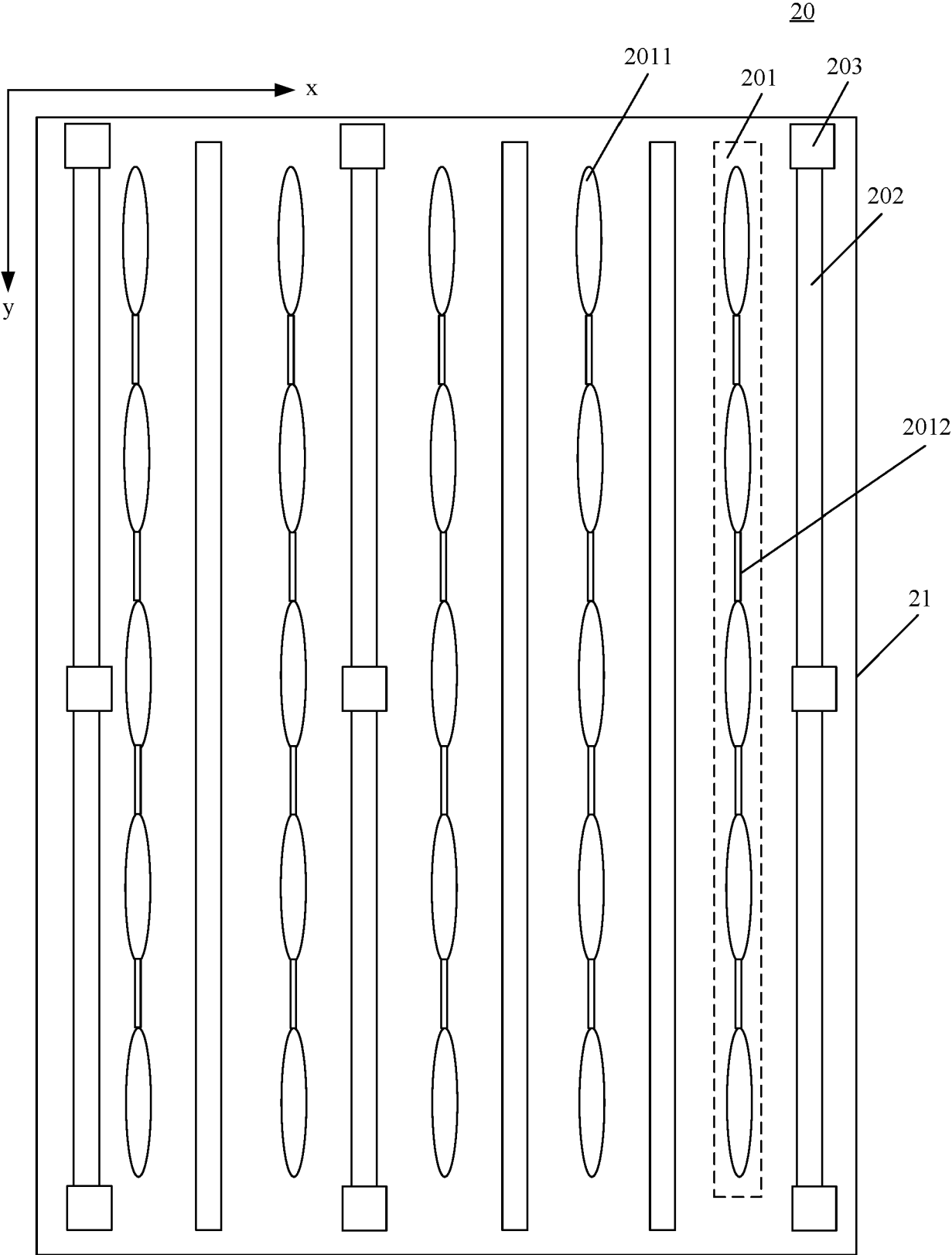


FIG. 5

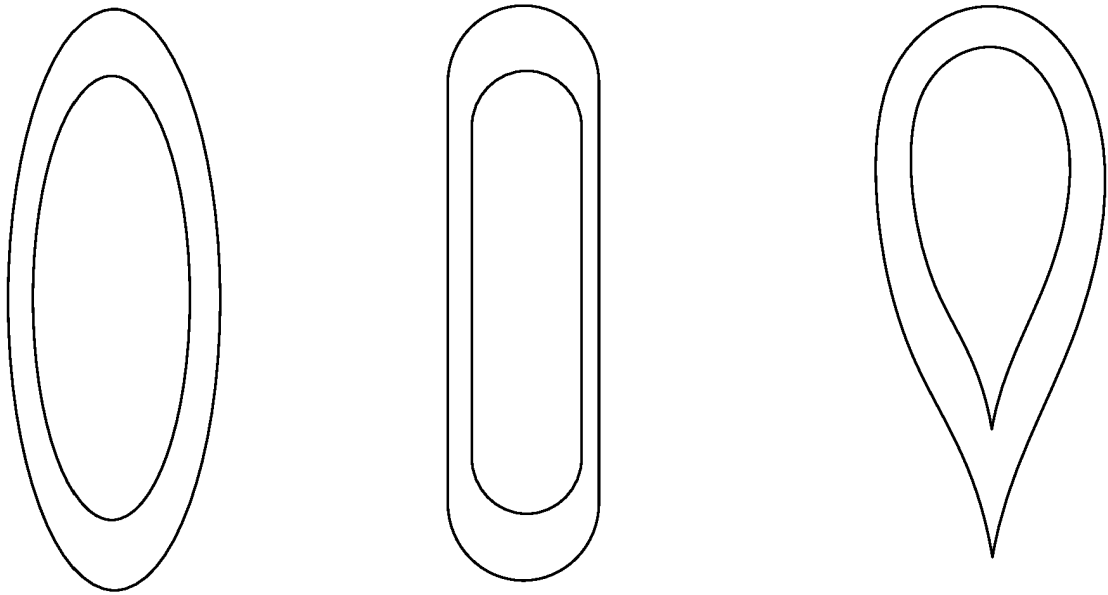


FIG. 6

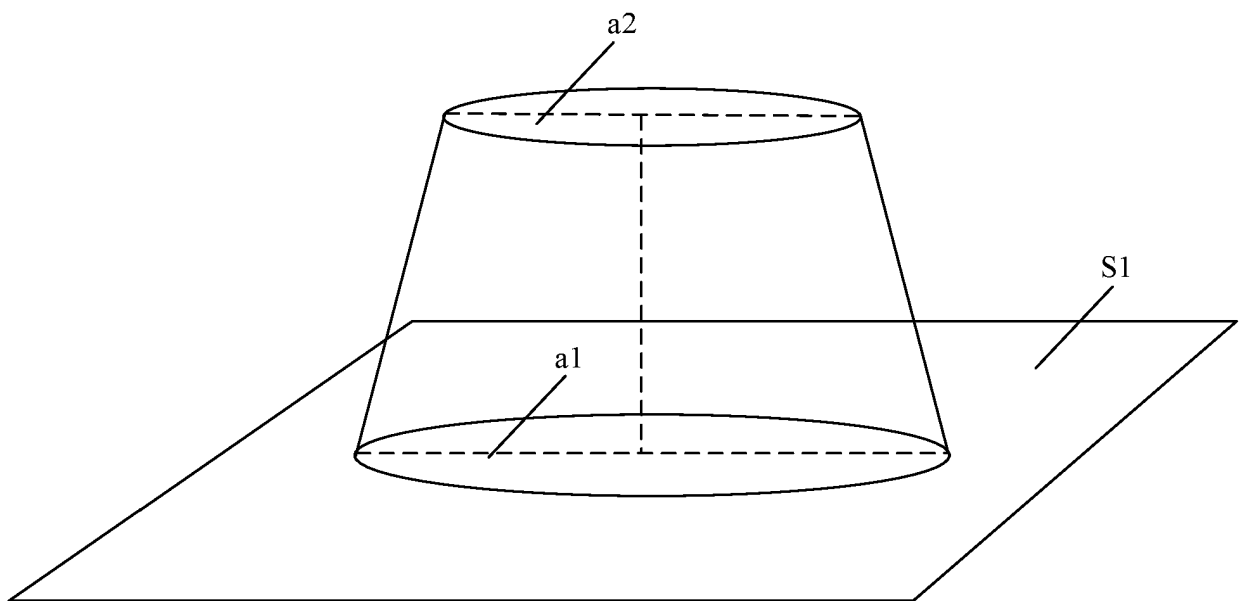


FIG. 7

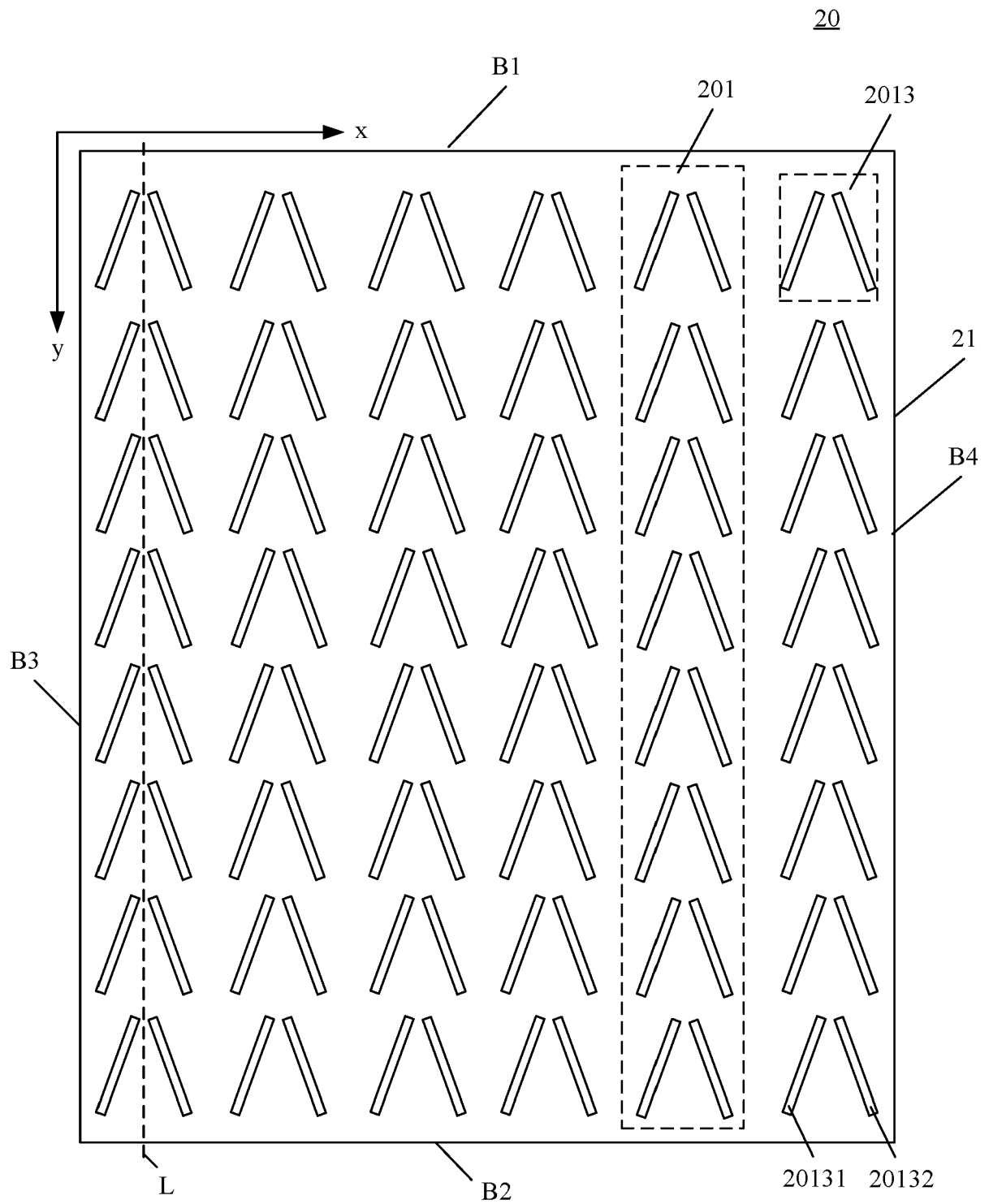


FIG. 8

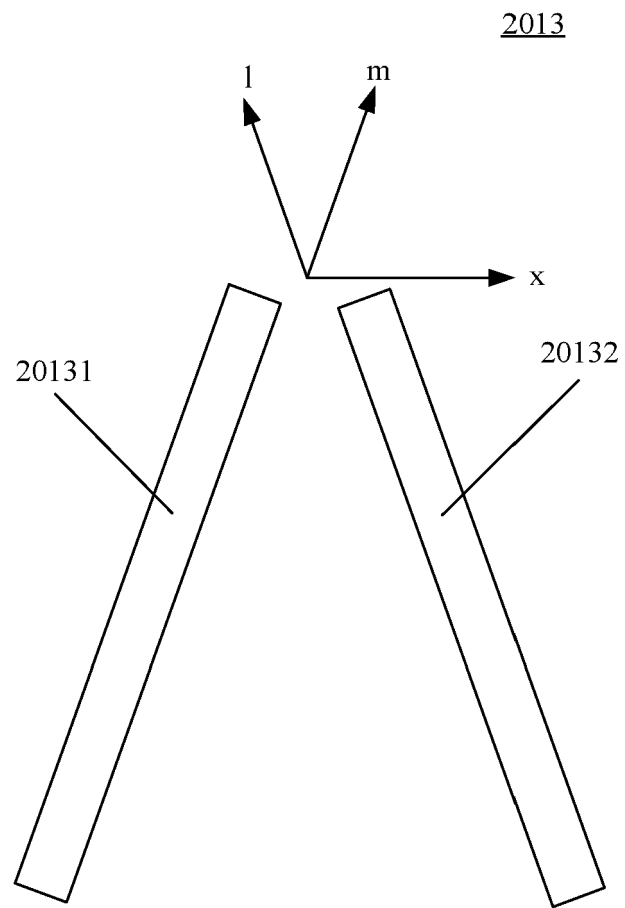


FIG. 9a



FIG. 9b

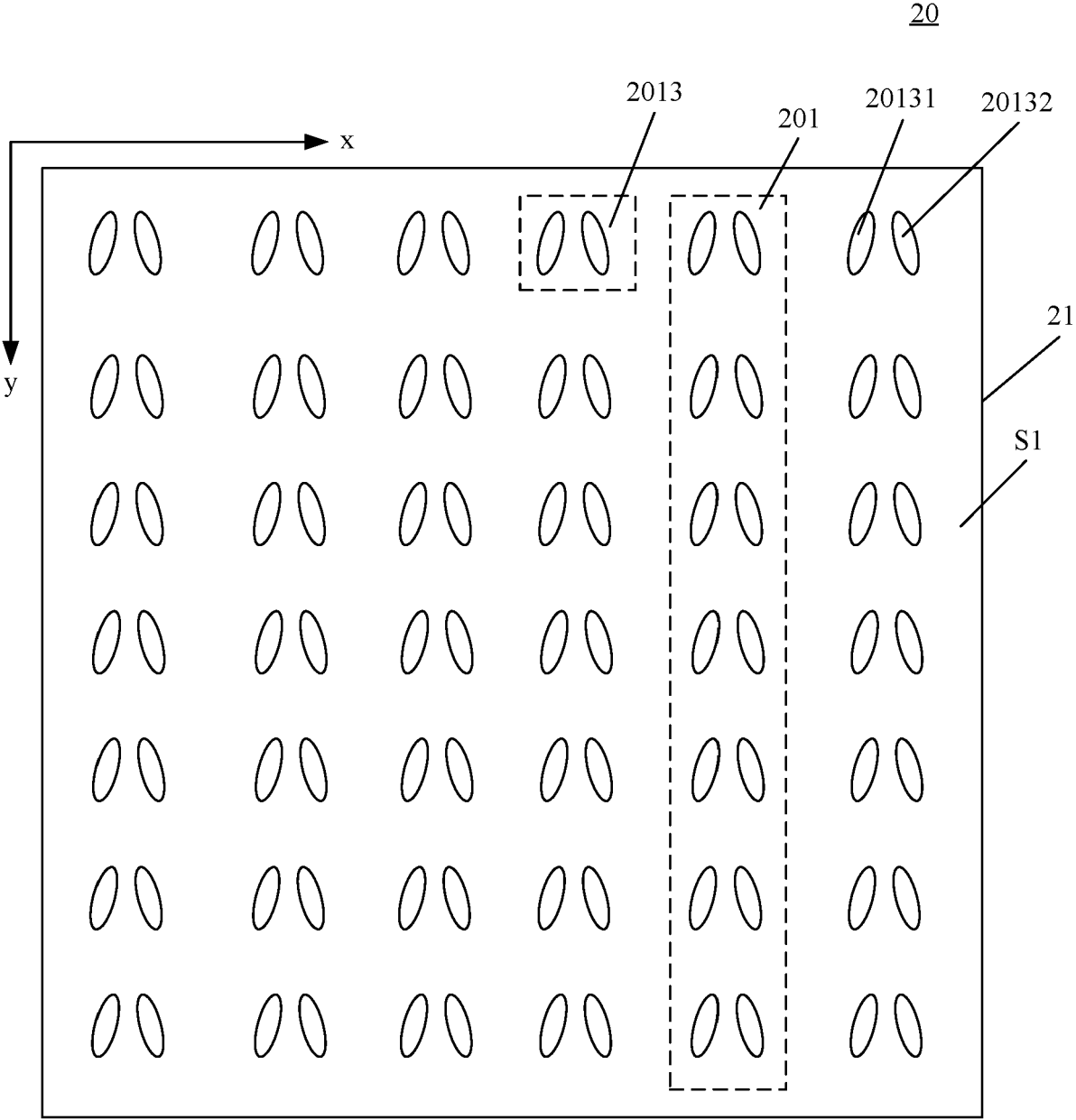


FIG. 10

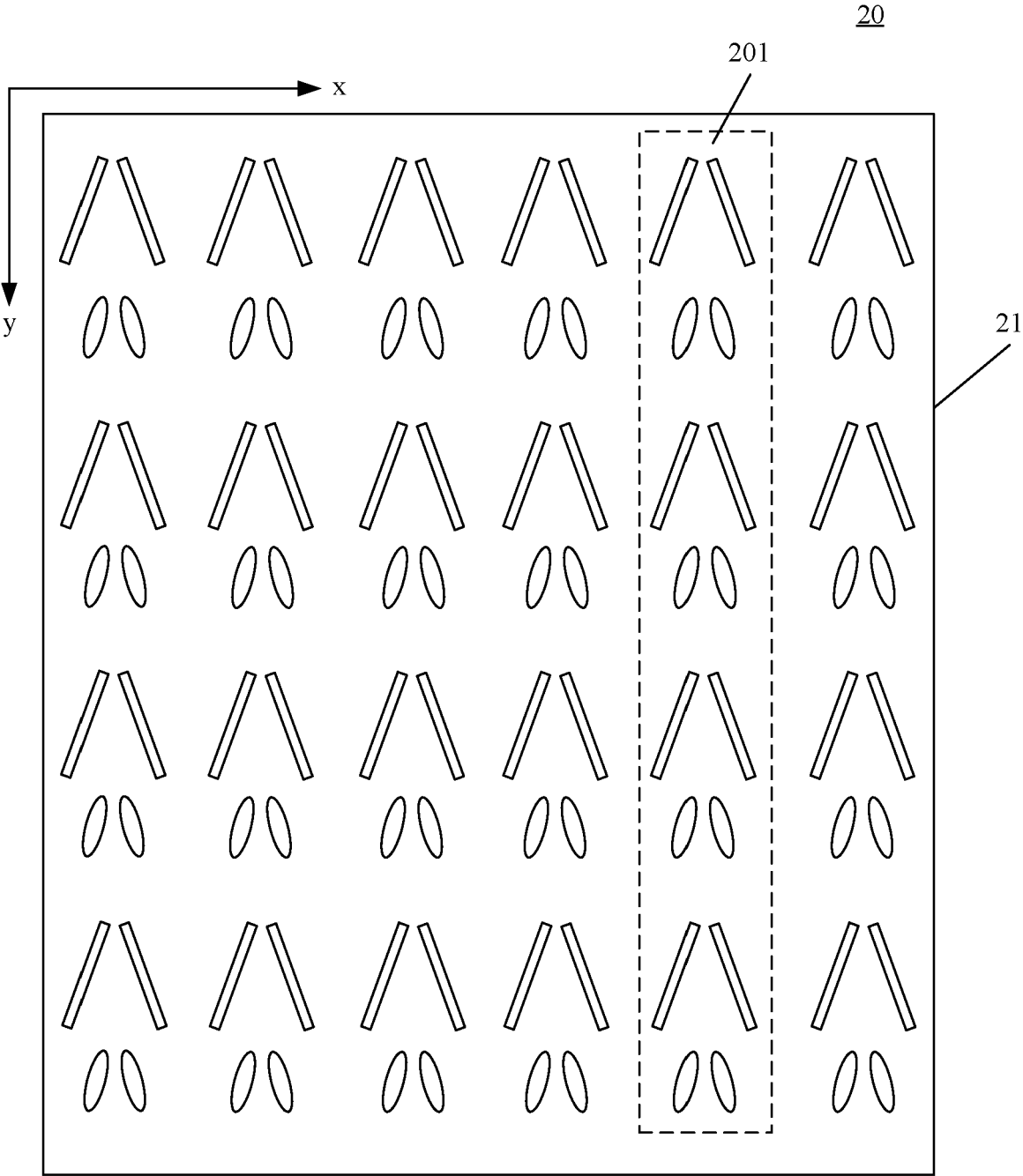


FIG. 11

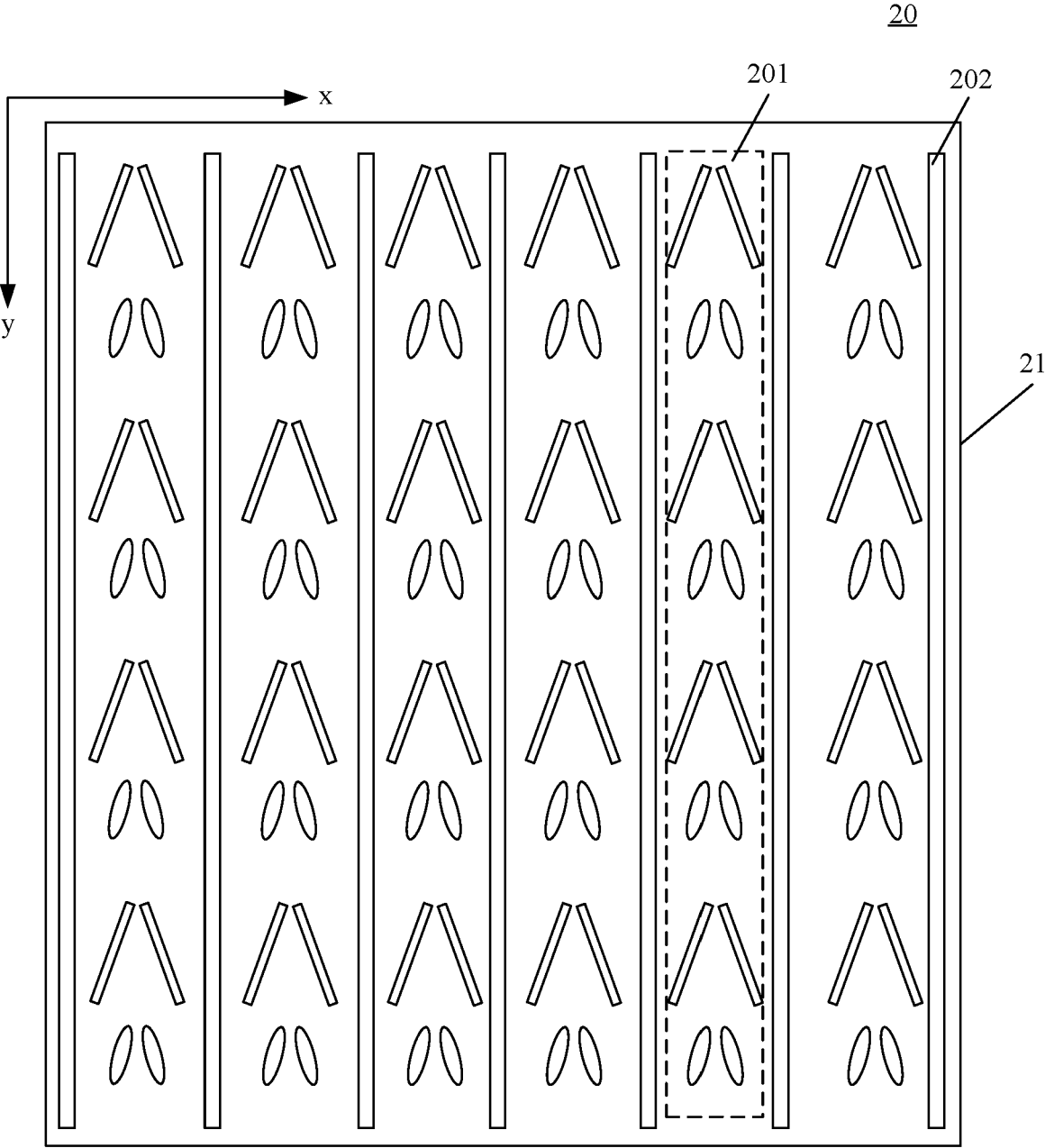


FIG. 12

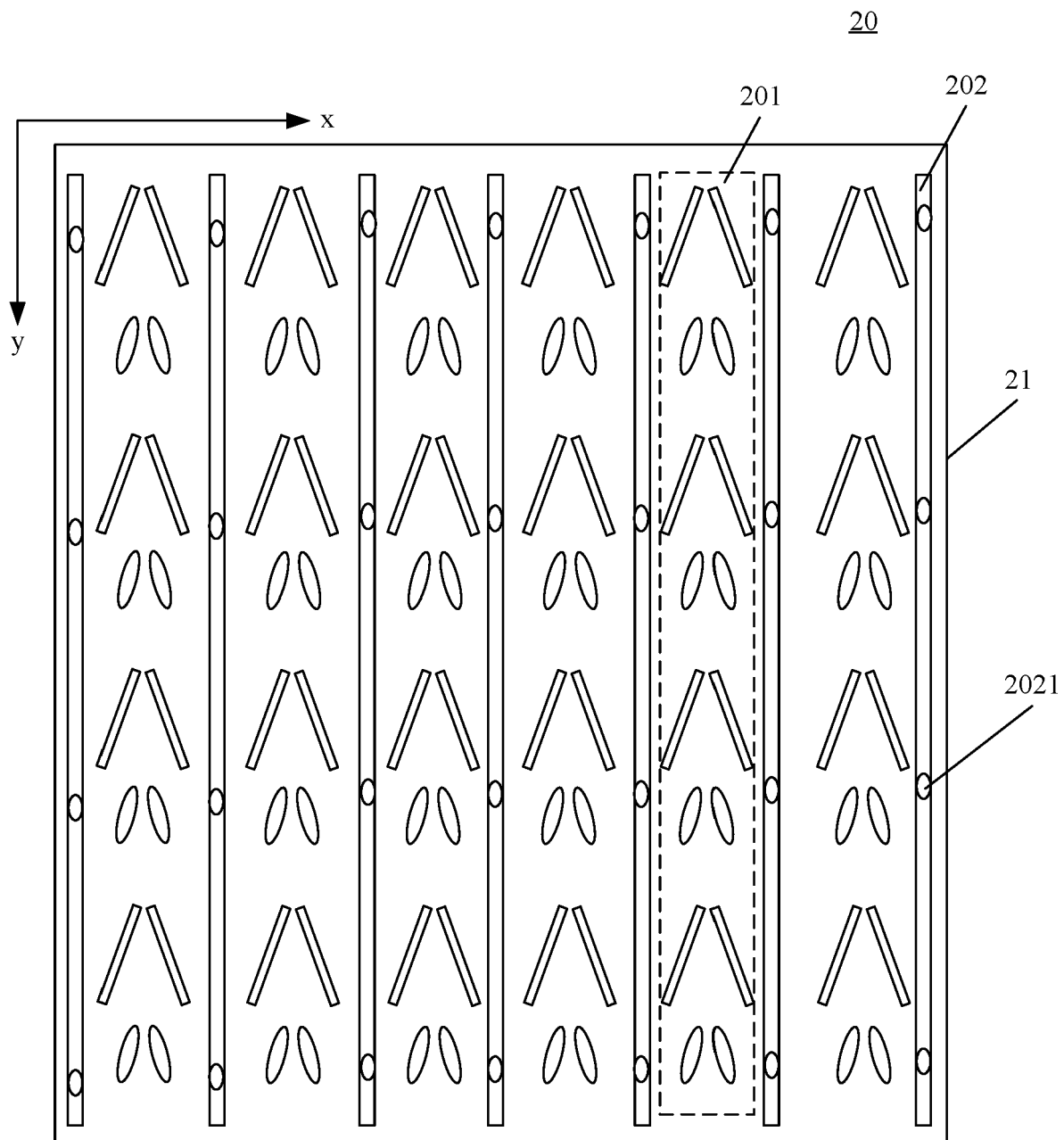


FIG. 13

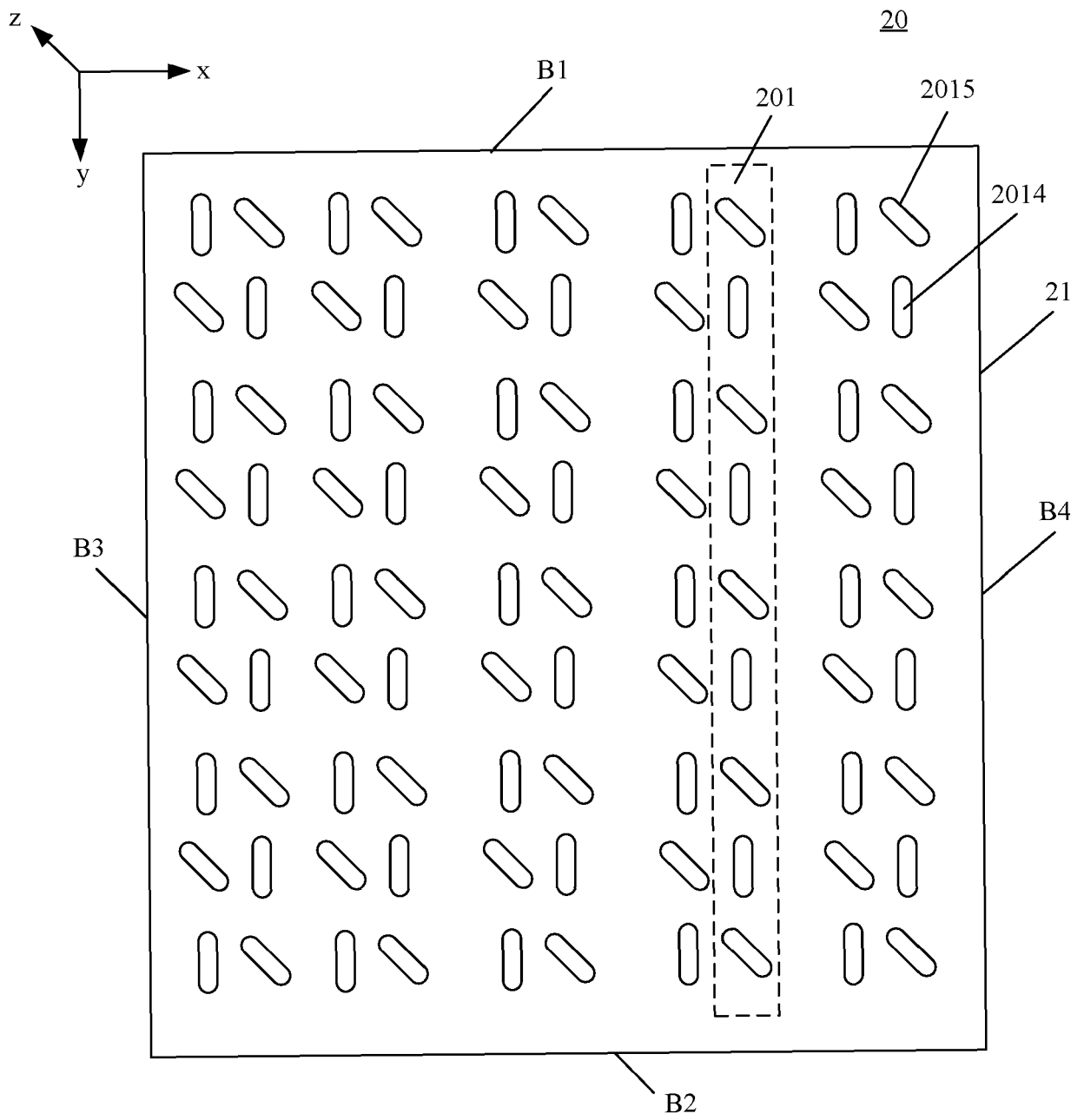


FIG. 14

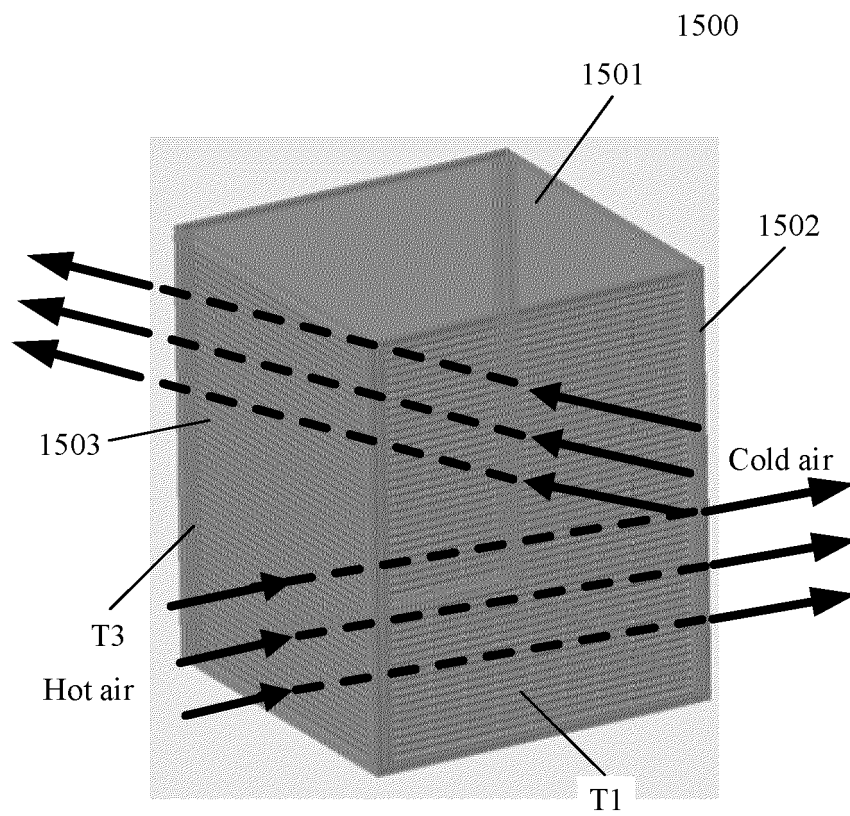


FIG. 15

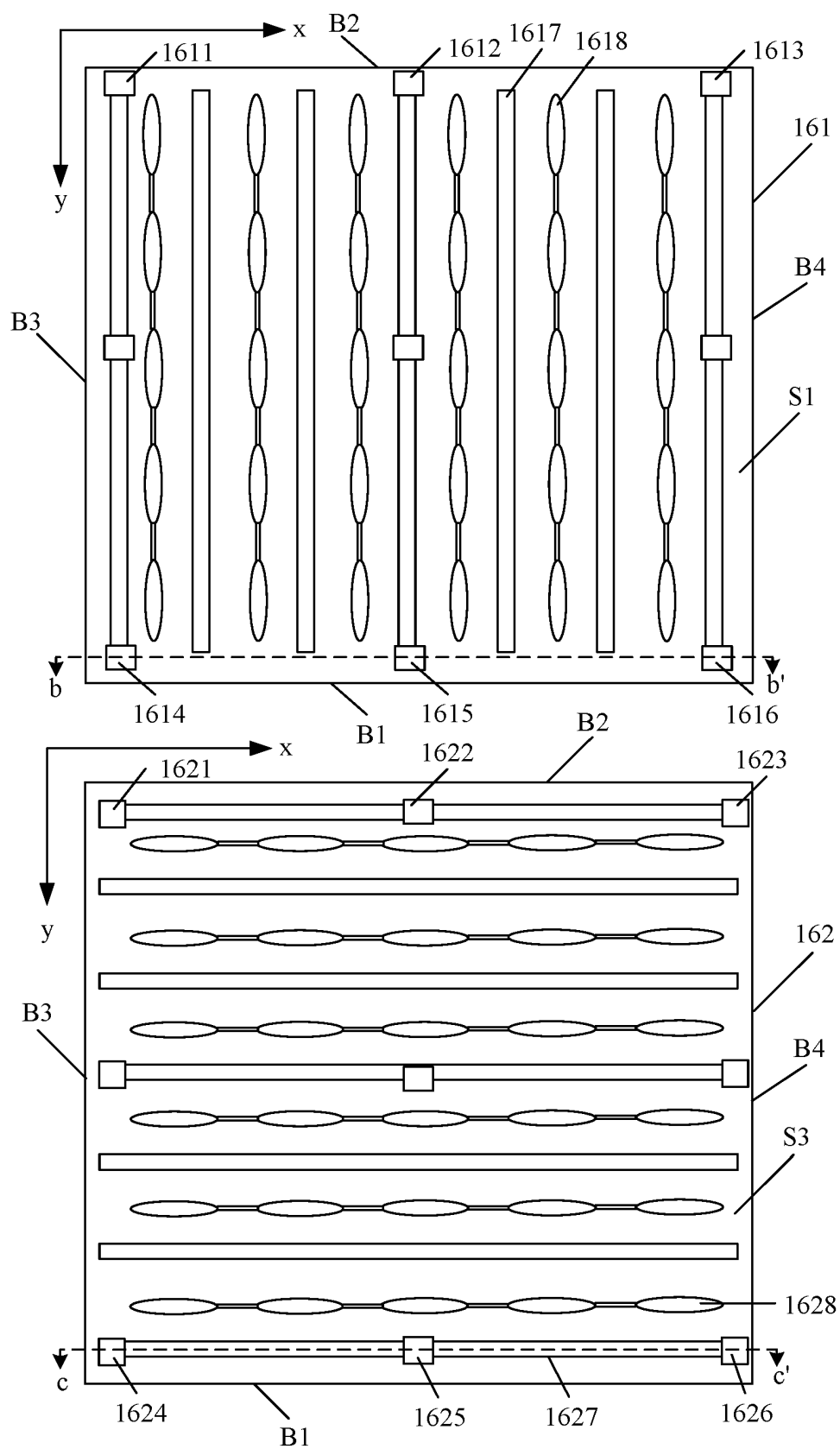


FIG. 16

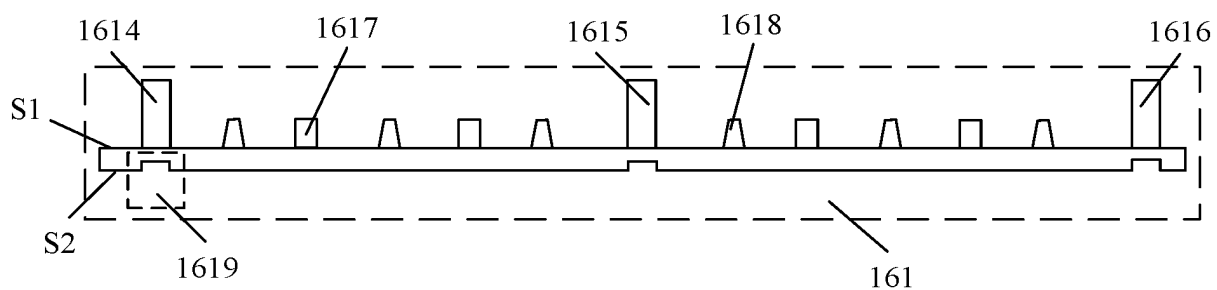


FIG. 17(a)

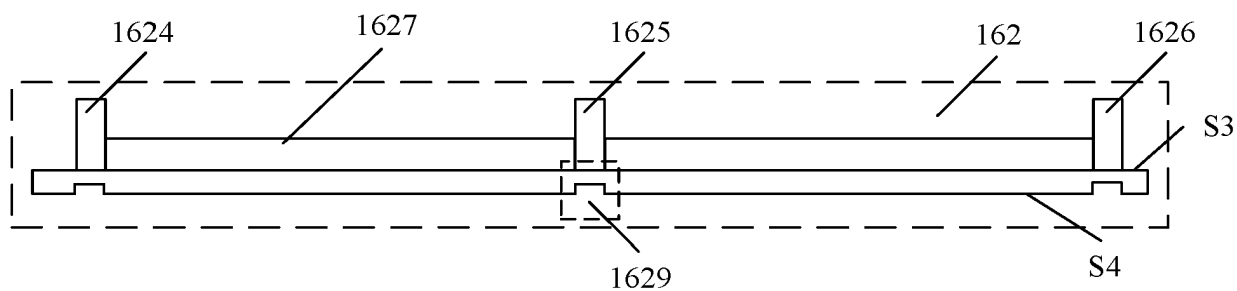


FIG. 17(b)

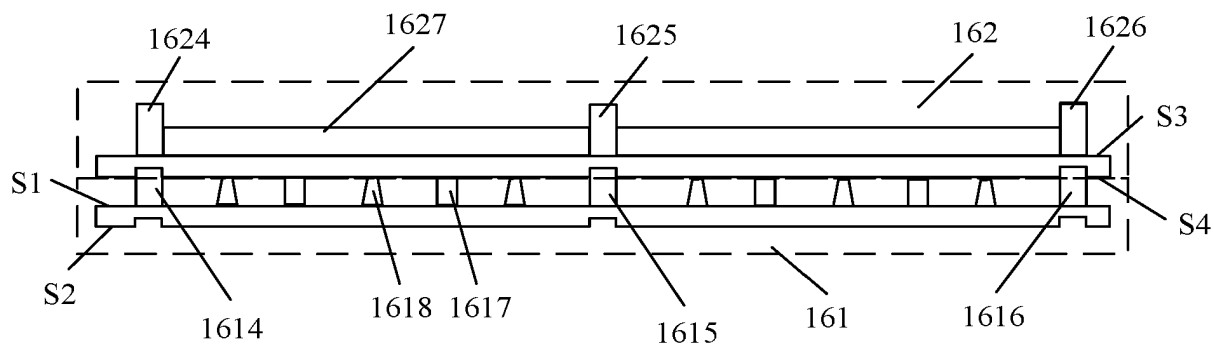


FIG. 17(c)

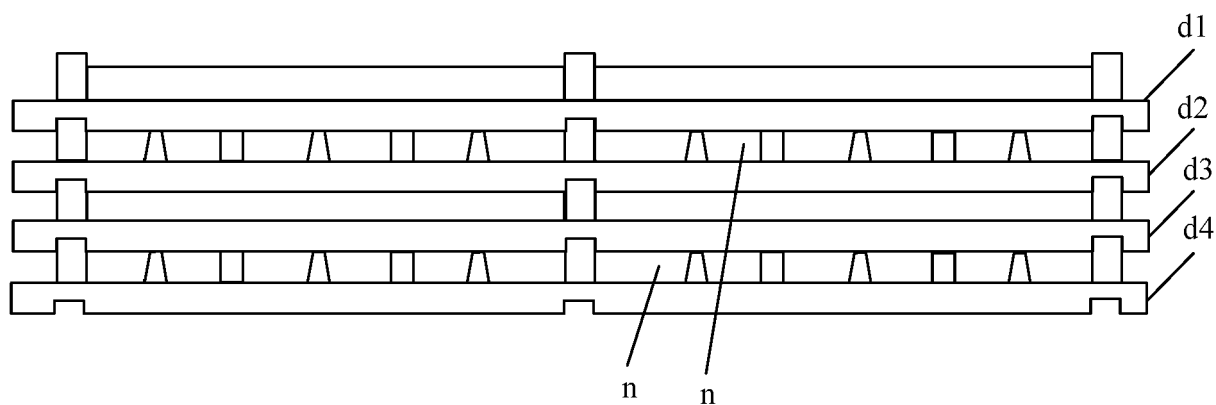


FIG. 17(d)

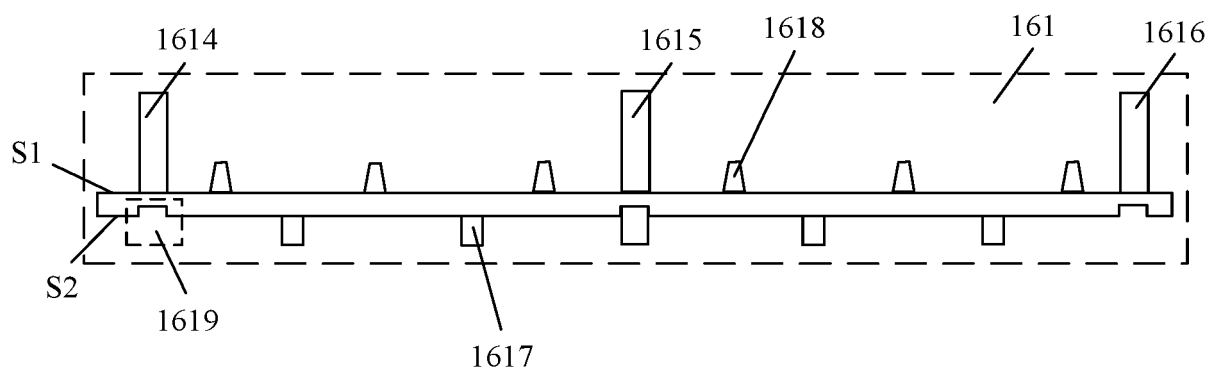


FIG. 18(a)

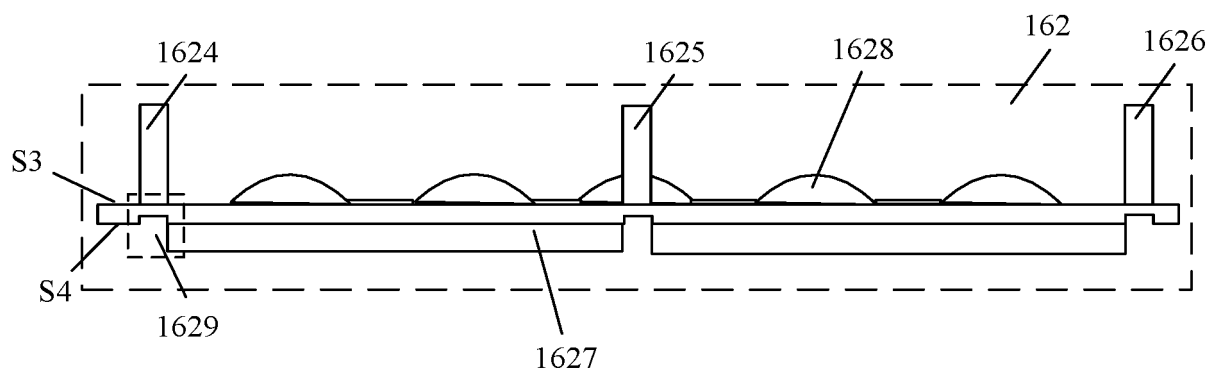


FIG. 18(b)

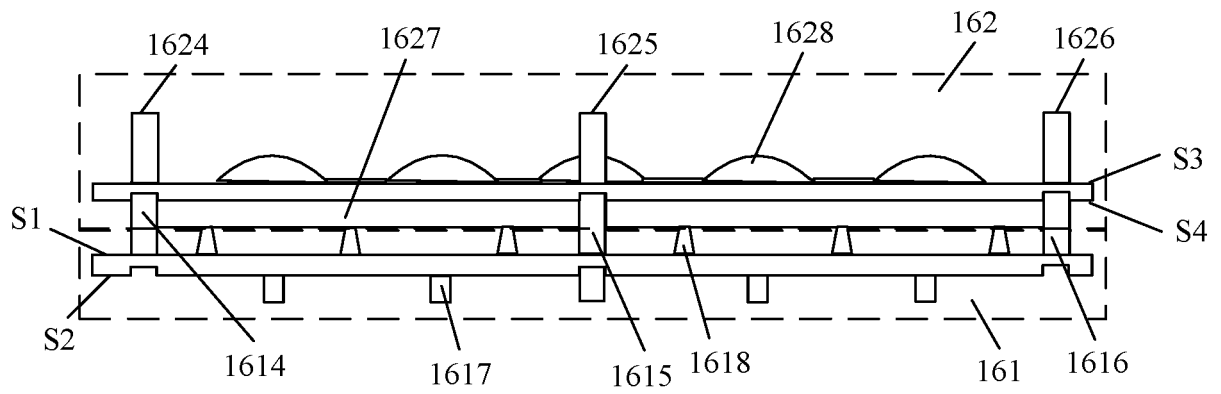


FIG. 18(c)

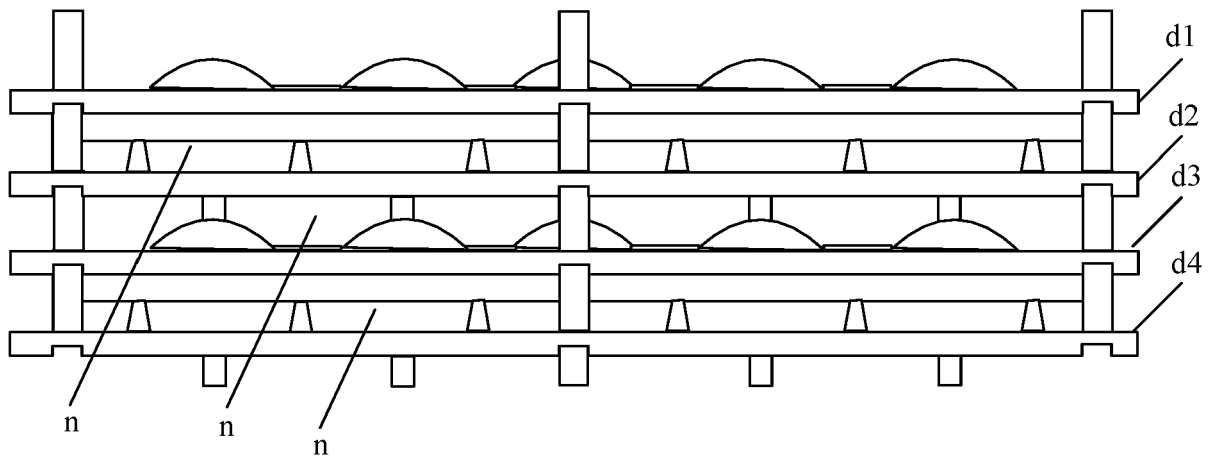


FIG. 18(d)

REFERENCES CITED IN THE DESCRIPTION

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