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(54) HEAT DISSIPATING UNIT AND HEAT DISSIPATING DEVICE HAVING THE HEAT DISSIPATING UNIT

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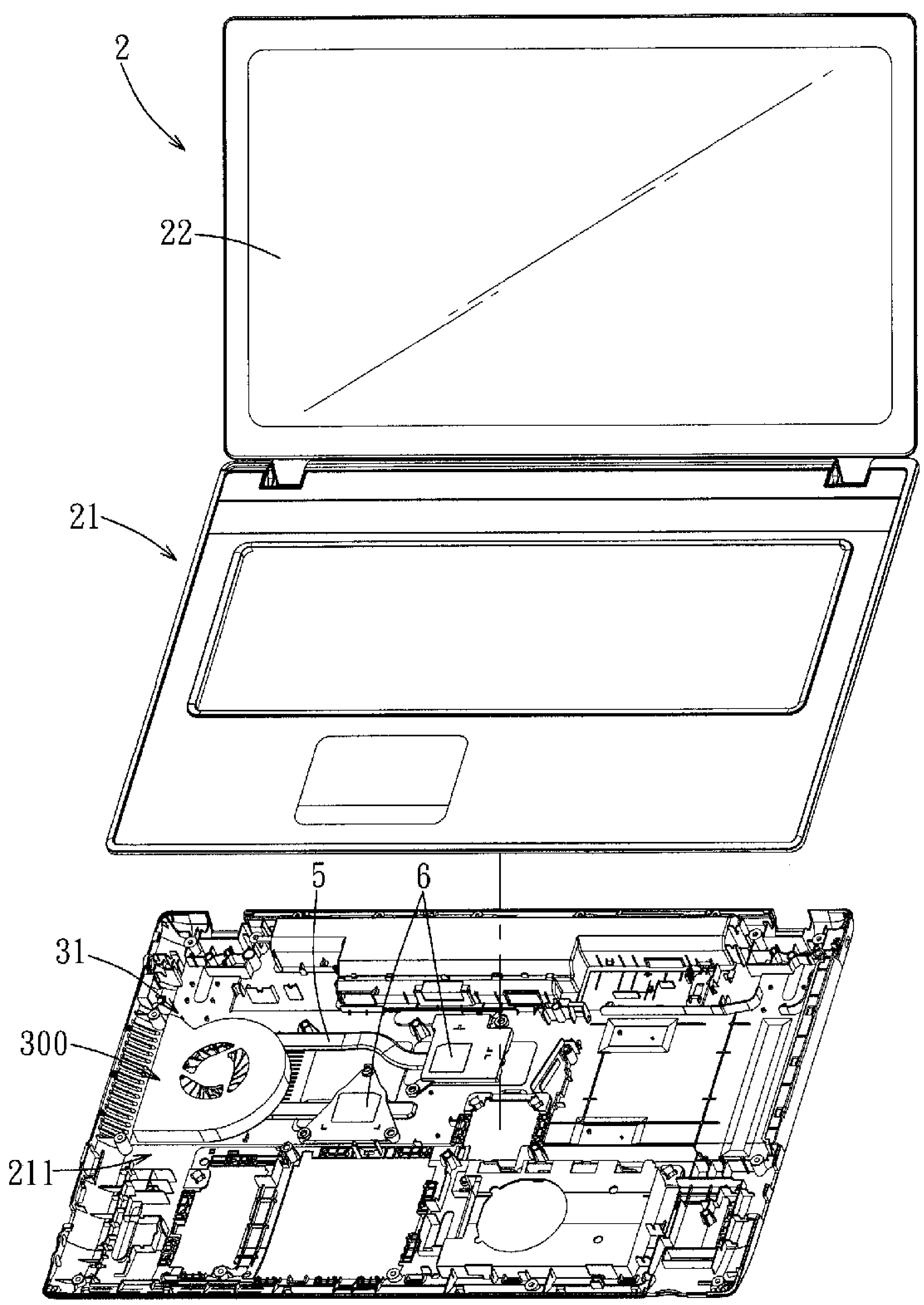
(57) **ABSTRACT**

A heat dissipating unit includes a plurality of heat dissipating fins arranged in an annular array and each including a flow guide plate extending from an inner side to an outer side of the annular array, two connecting plates respectively connected to and forming an angle with two opposite sides of the flow guide plate, and an air inlet and an air channel communicating fluidly with each other. Each connecting plate includes a connecting hole, a slanting edge opposite to the flow guide plate, and a connecting portion projecting from the slanting edge. The connecting portions of the connecting plates of each heat dissipating fin engage respectively the connecting holes in the connecting plates of an adjacent heat dissipating fin. The heat dissipating fins overlap each other so that the air inlets of the heat dissipating fins are arranged in a staggered manner.



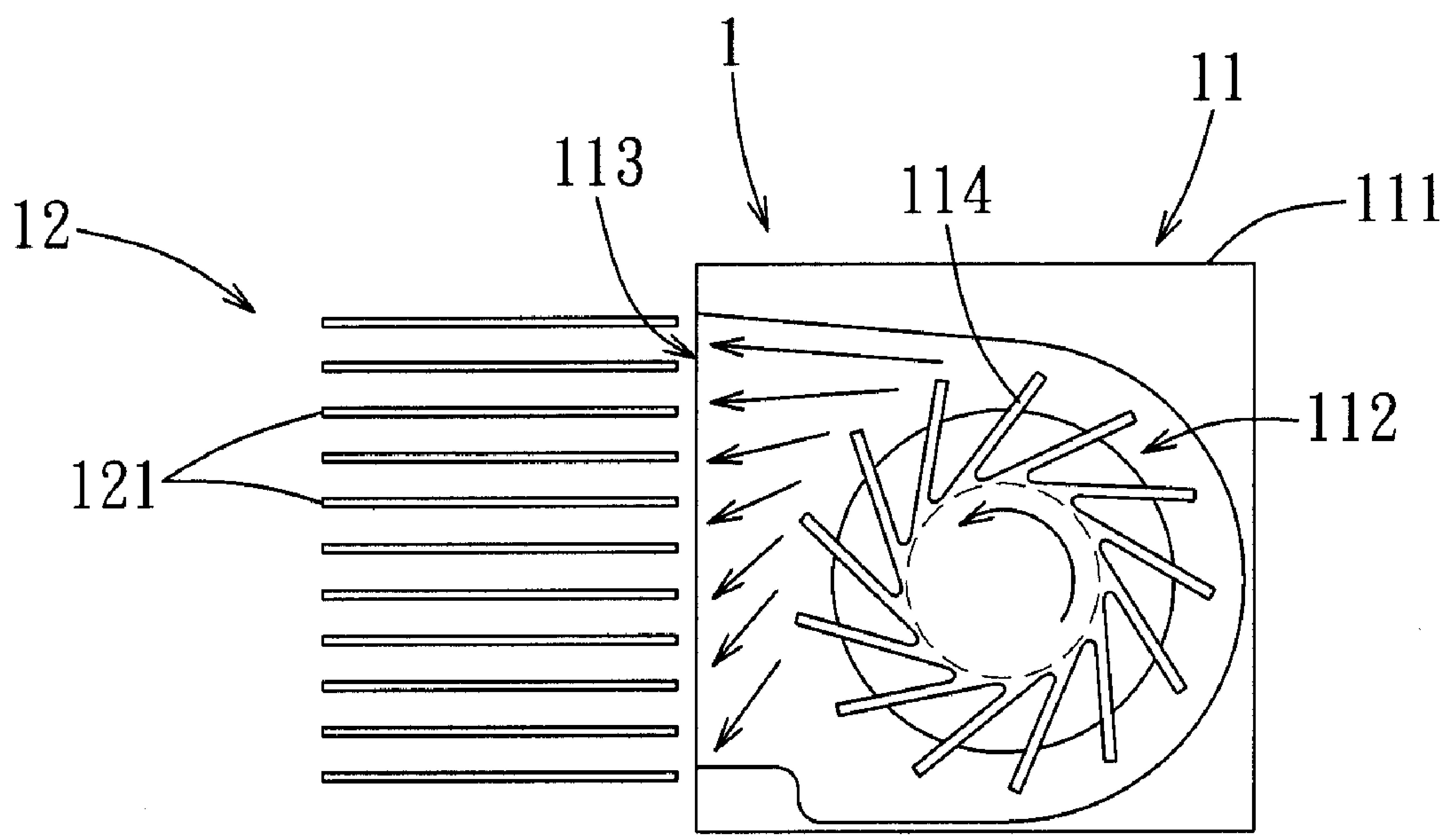


FIG. 1
PRIOR ART

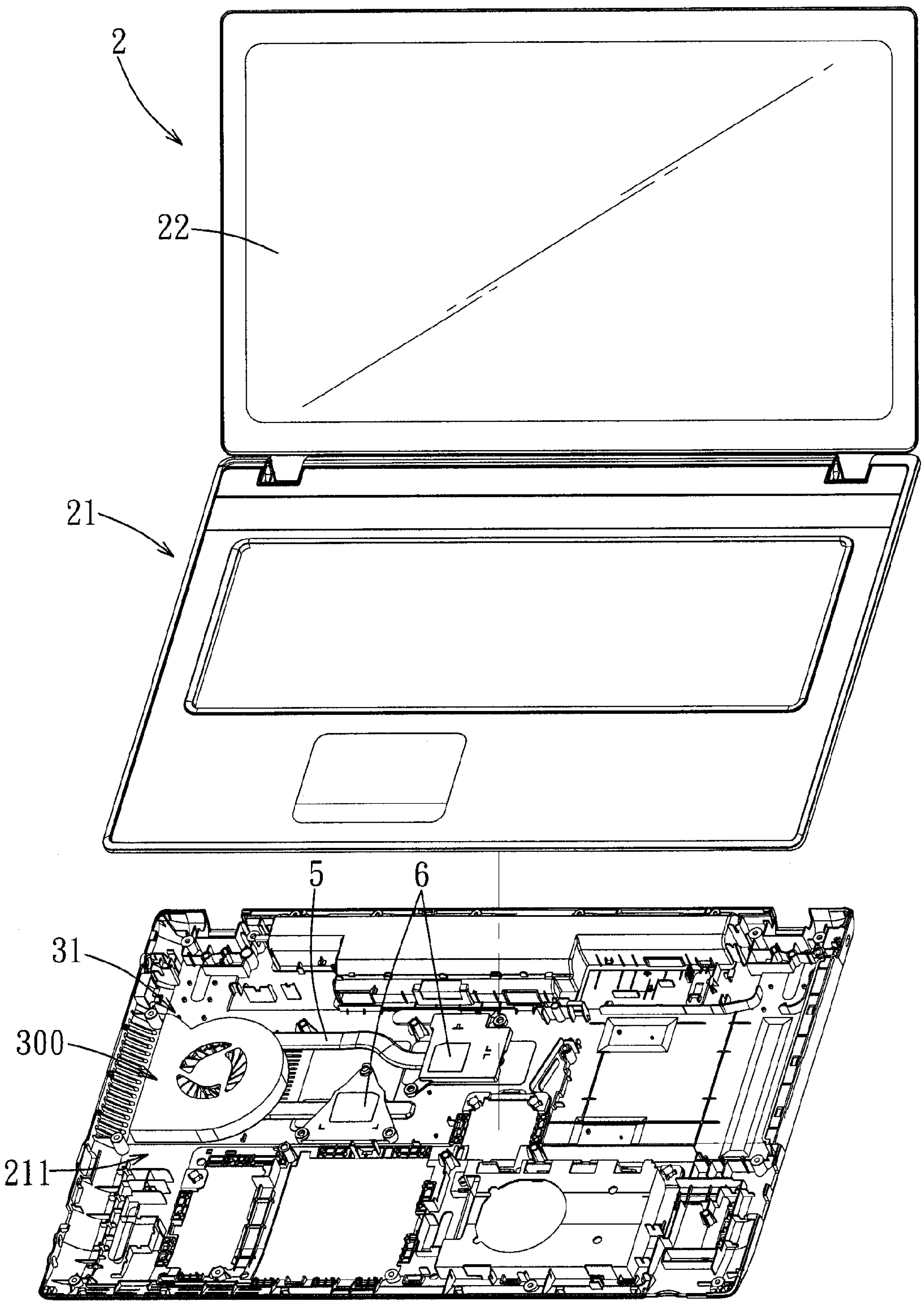


FIG. 2

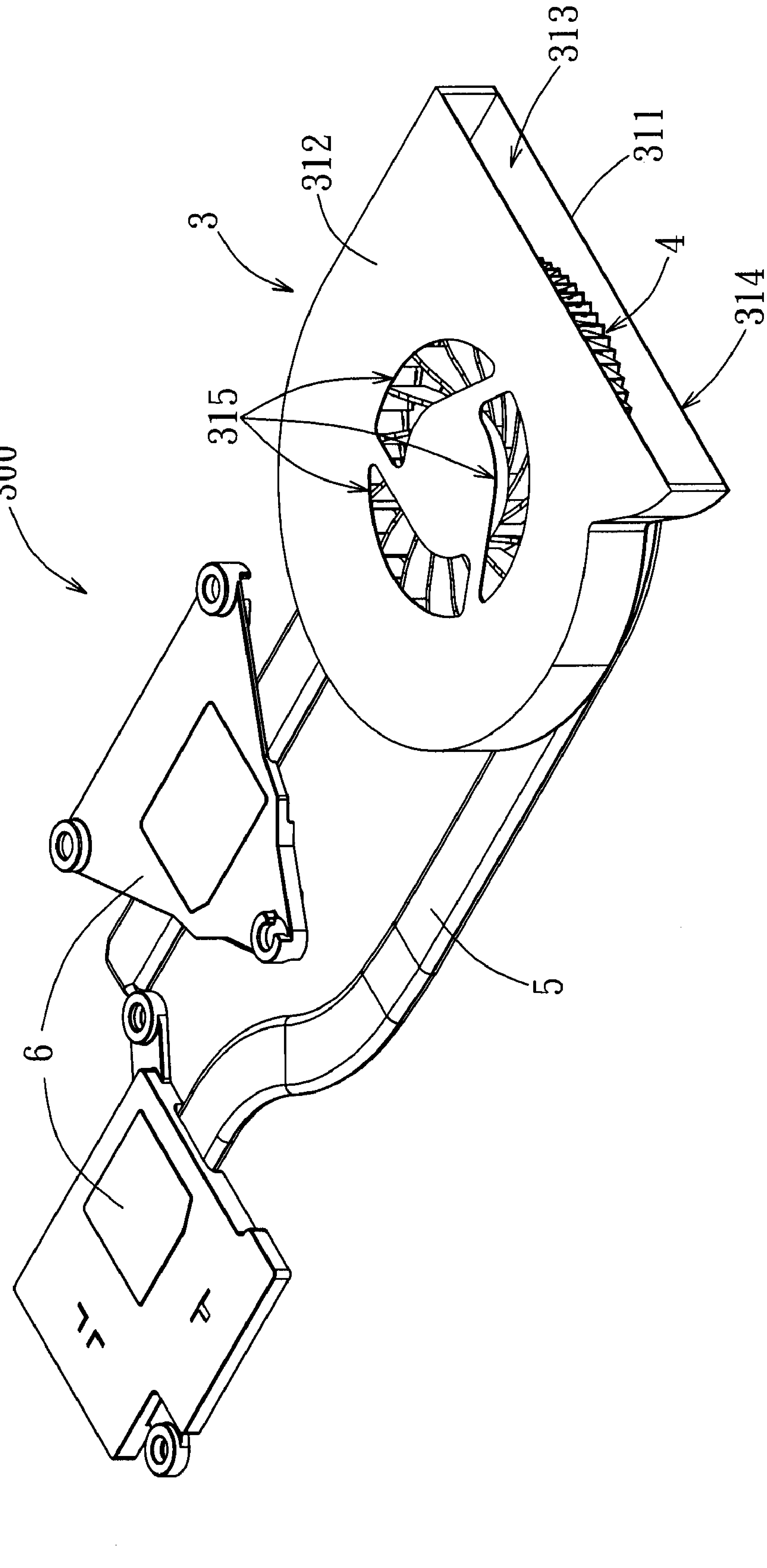


FIG. 3

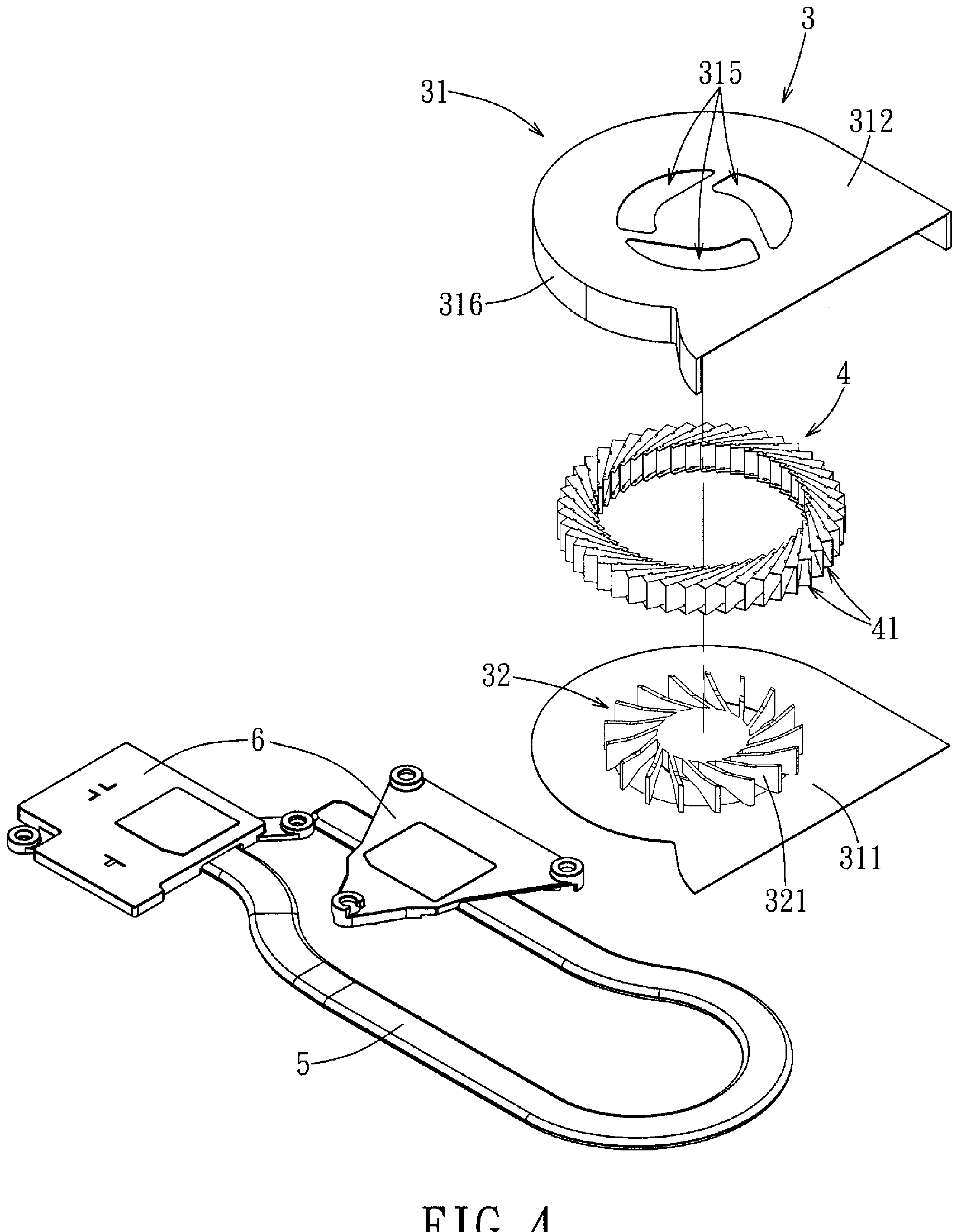


FIG. 4

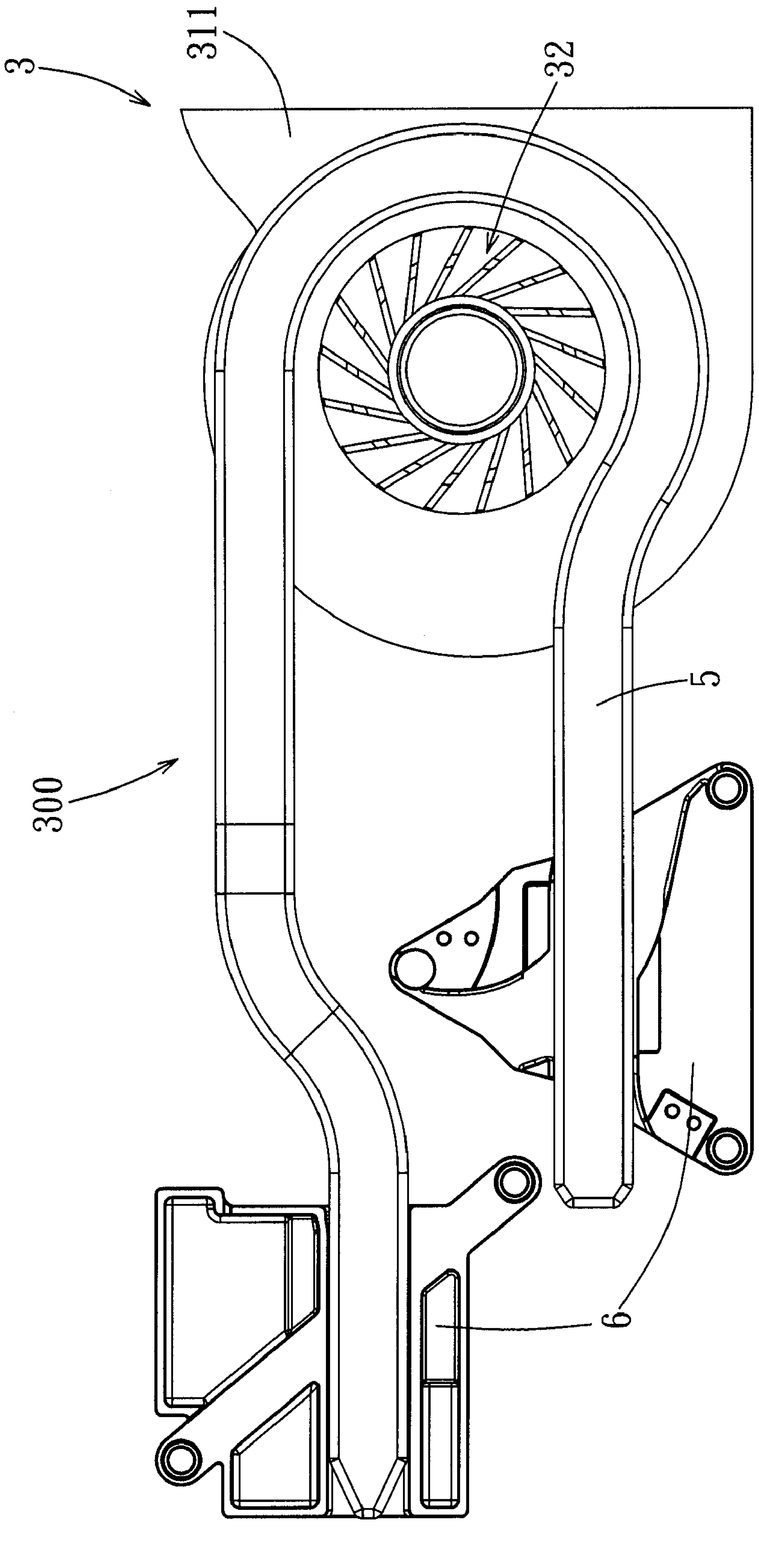
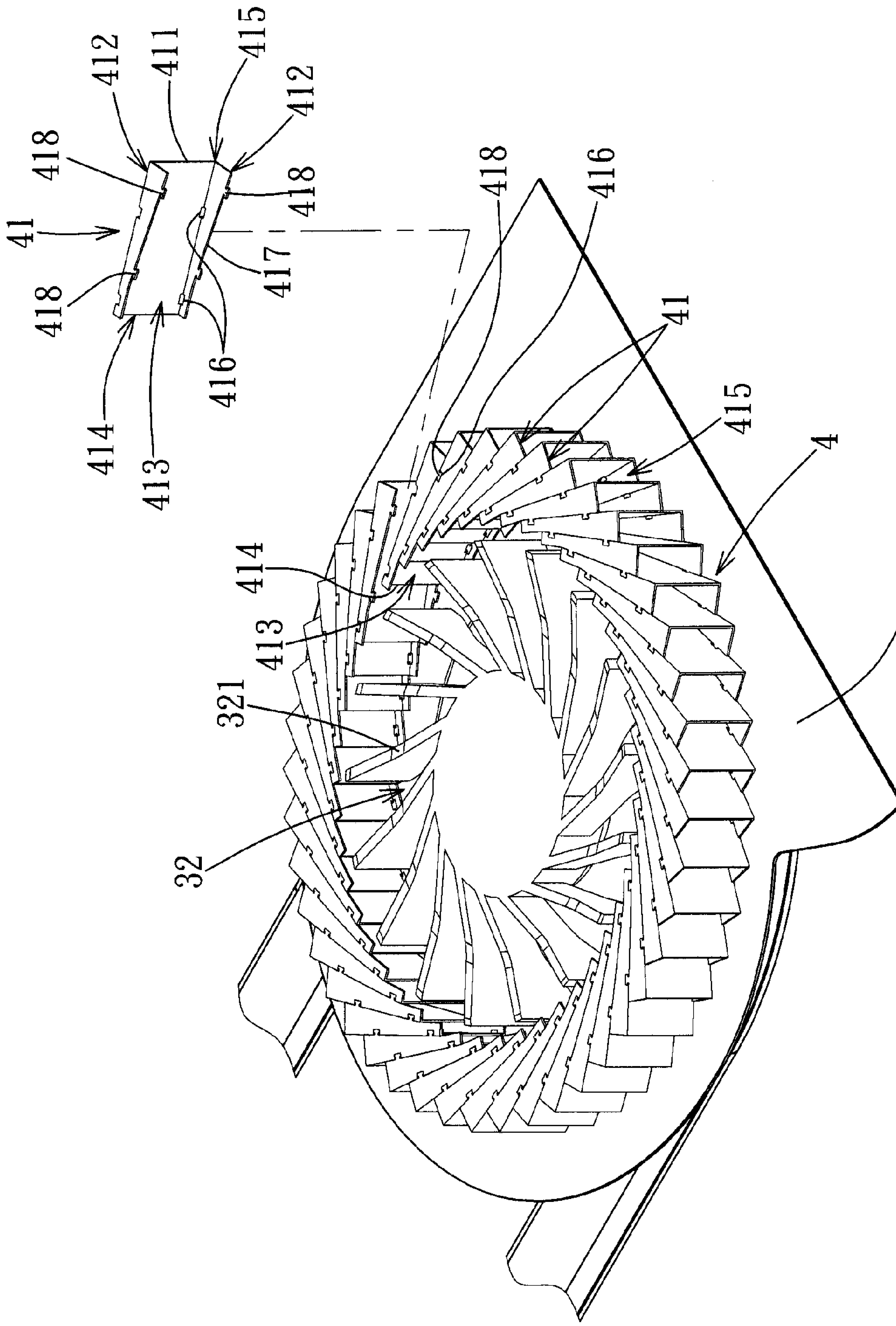


FIG. 5


412
411
415
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4
414
413
311
321
32

FIG. 6

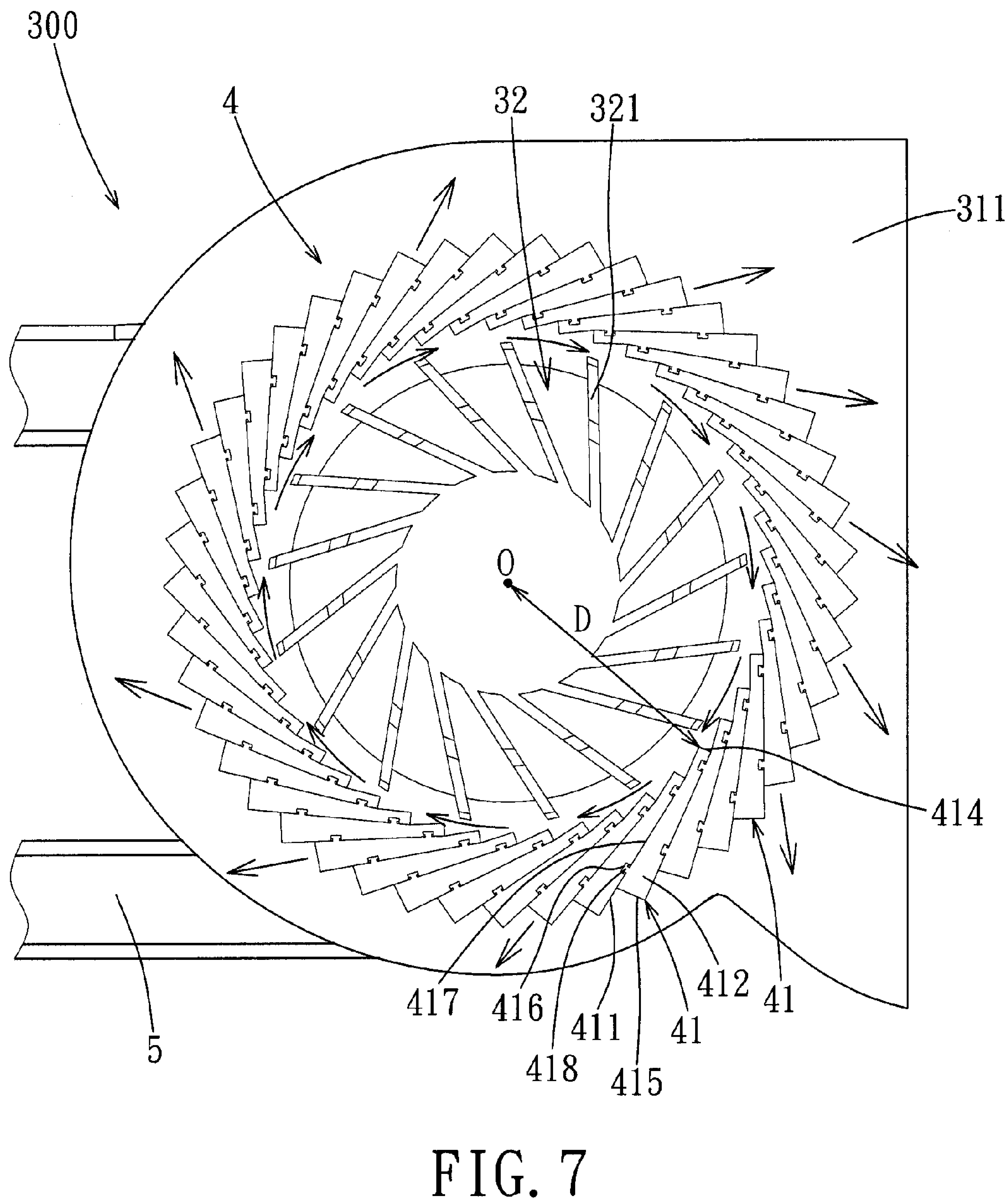
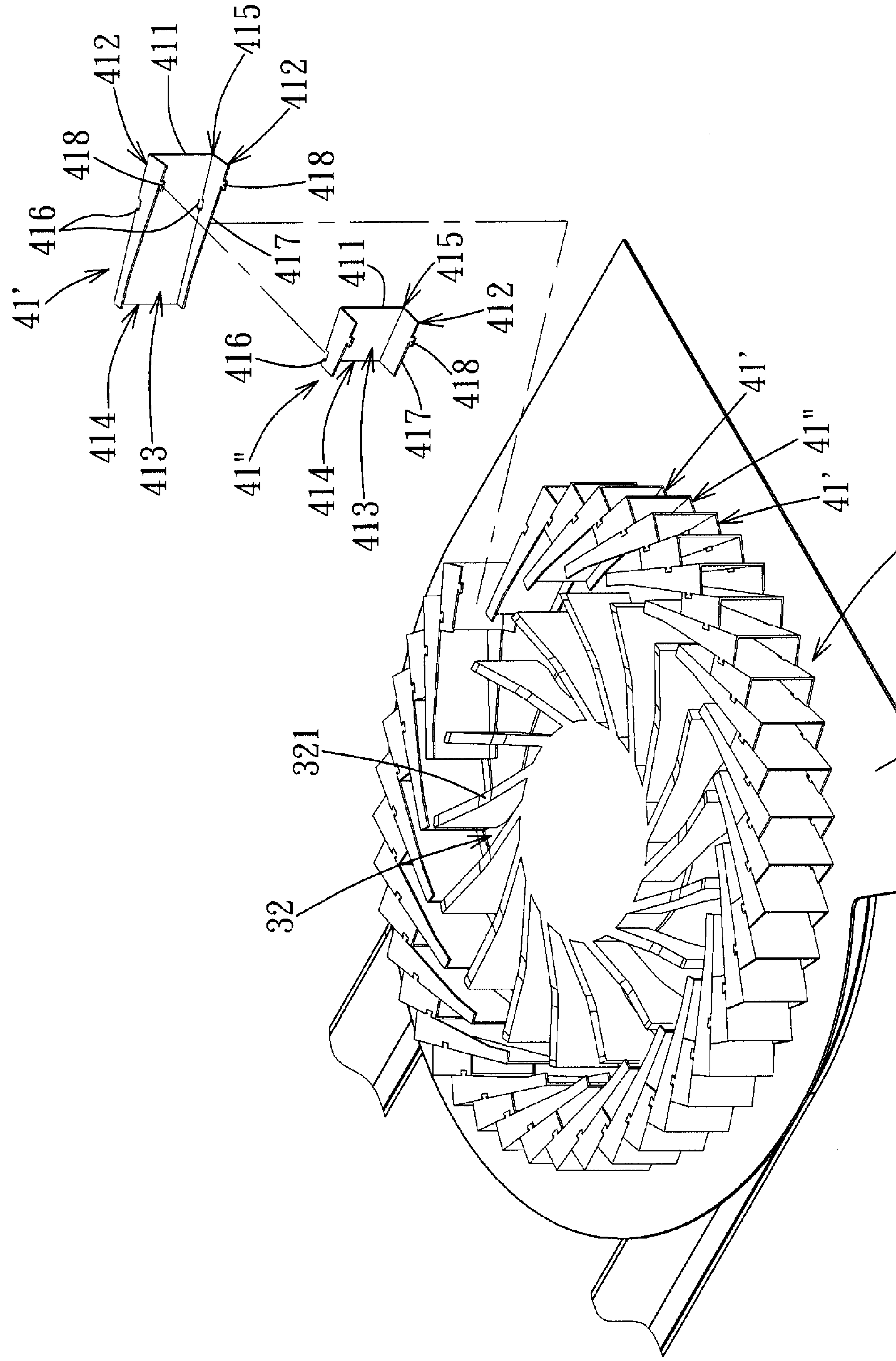


FIG. 7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41'
41"
41'
4'
311
321
32

FIG. 8

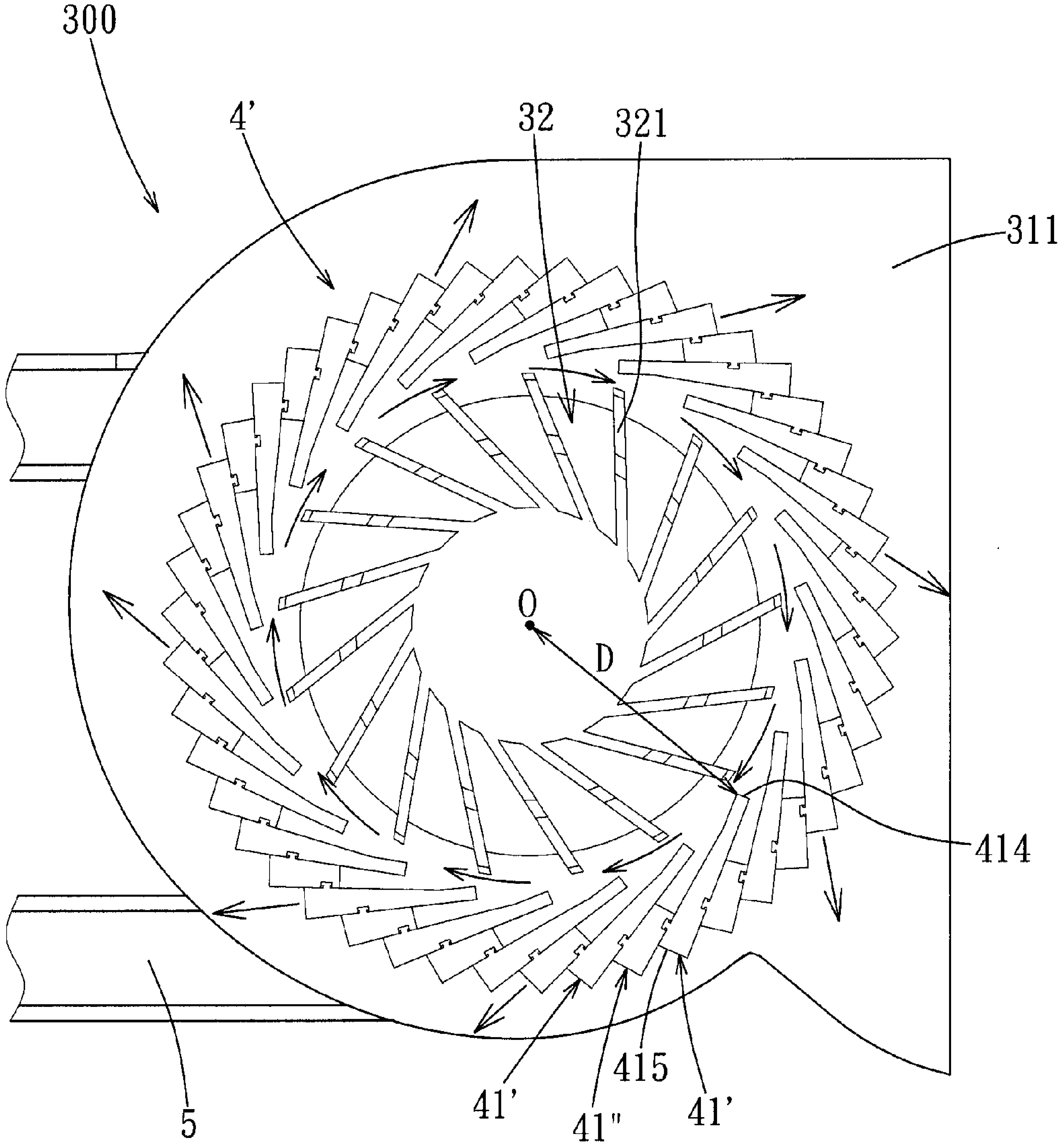

FIG. 9

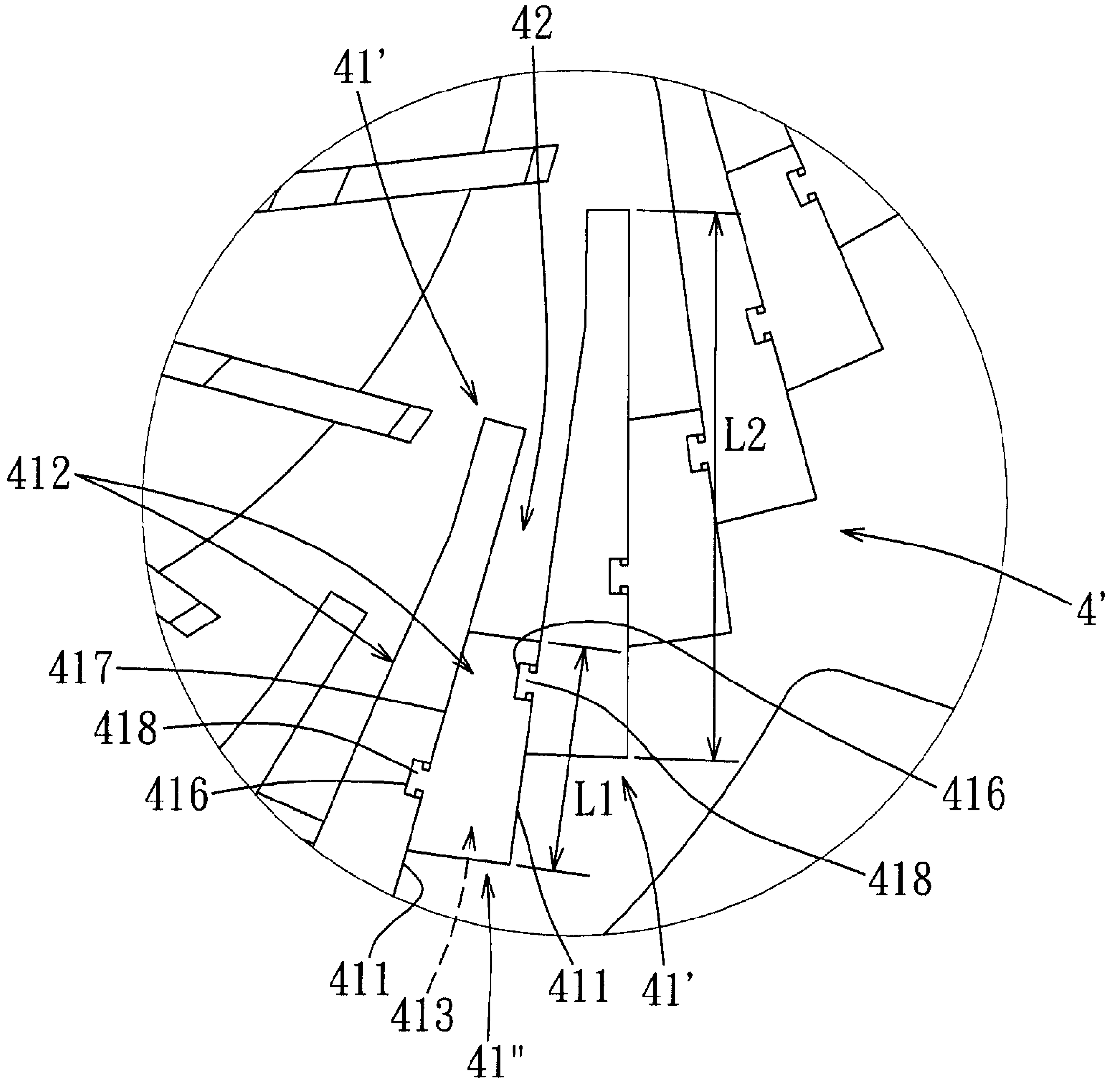

FIG. 10

HEAT DISSIPATING UNIT AND HEAT DISSIPATING DEVICE HAVING THE HEAT DISSIPATING UNIT

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority of Chinese Application No. 201020516254.6, filed on Sep. 3, 2010.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] This invention relates to a heat dissipating unit, and more particularly to a heat dissipating unit for dissipating heat generated by a heat generating element and a heat dissipating device having the heat dissipating unit.

[0004] 2. Description of the Related Art

[0005] Referring to FIG. **1**, a conventional heat dissipating device **1** for a notebook computer includes a heat dissipating fan **11** and a heat dissipating unit **12**. The heat dissipating fan **11** is a centrifugal fan, and includes a casing **111**, and an impeller **112** disposed in the casing **111**. When the impeller **112** rotates, air is discharged through an air outlet **113** of the casing **111** to dissipate heat in heat dissipating fins **121** of the heat dissipating unit **12** which is disposed external to the casing **111**.

[0006] Air is discharged along the tangent directions of fan blades **114** during rotation of the impeller **112** so that flow, speed, and direction of air flowing through the air outlet **113** are different. Because the heat dissipating fins **121** are arranged parallel to each other outside of the air outlet **113**, an included angle is formed between each heat dissipating fin **121** and an air stream direction.

[0007] Following the different directions of air stream and the different included angles between the heat dissipating fins **121**, the degree of air blockage of each heat dissipating fin is also different. When the included angle is small, the heat dissipating effect is good. When the included angle is large, the heat dissipating effect is poor. As a result, different positions of the heat dissipating fins result in different heat dissipating effects. Further, when the air stream impacts against the heat dissipating fins **121**, noise is produced. Moreover, because the heat dissipating unit **12** is disposed external to the air outlet **113**, the heat dissipating device **1** when installed on the notebook computer will occupy a substantial space.

SUMMARY OF THE INVENTION

[0008] A main object of the present invention is to provide a heat dissipating unit that can effectively utilize heat dissipating fins to enhance a heat dissipating effect and that can minimize production of noise.

[0009] Another object of the present invention is to provide a heat dissipating device having a heat dissipating unit that can effectively utilize heat dissipating fins to enhance a heat dissipating effect, that can minimize production of noise, and that can effectively minimize space during installation.

[0010] The purpose of the present invention and the solution to the conventional technical problems are achieved through employment of the below technical means. According to the disclosure of one aspect of the present invention, a heat dissipating unit comprises a plurality of heat dissipating fins arranged in an annular array for surrounding an impeller. Each heat dissipating fin includes a flow guide plate extending from an inner side to an outer side of the annular array, two connecting plates respectively connected to and forming an angle with two opposite sides of the flow guide plate, an air inlet formed by the flow guide plate and the connecting plates in proximity to the inner side of the annular array, and an air channel formed by the flow guide plate and the connecting plates and communicating fluidly with the air inlet. The flow guide plate is parallel with a flow direction of air stream generated by the impeller. Each connecting plate tapers from the outer side to the inner side, and includes a connecting hole adjacent to the flow guide plate, a slanting edge extending in an inner-to-outer direction and opposite to the flow guide plate, and connecting portion projecting from the slanting edge. The connecting portions of the connecting plates of each heat dissipating fin engage respectively the connecting holes in the connecting plates of an adjacent heat dissipating fin. The heat dissipating fins overlap each other so that the air inlets of the heat dissipating fins are arranged in a staggered manner.

[0011] According to the disclosure of another aspect of the present invention, a heat dissipating device includes a heat dissipating fan and a heat dissipating unit. The heat dissipating fan includes a casing and an impeller. The casing is formed with a receiving space, an air inlet communicating fluidly with the receiving space, and an air outlet communicating fluidly with the air inlet of the casing. The impeller is disposed in the receiving space. The heat dissipating unit is disposed in the receiving space, and surrounds the impeller. The heat dissipating unit includes a plurality of heat dissipating fins arranged in an annular array. Each heat dissipating fin includes a flow guide plate extending from an inner side to an outer side of the annular array, two connecting plates respectively connected to and forming an angle with two opposite sides of the flow guide plate, an air inlet formed by the flow guide plate and the connecting plates in proximity to the inner side of the annular array, and an air channel formed by the flow guide plate and the connecting plates and communicating fluidly with the air inlet. The flow guide plate is parallel with a flow direction of air stream generated by the impeller. Each connecting plate tapers from the outer side to the inner side, and includes a connecting hole adjacent to the flow guide plate, a slanting edge extending in an inner-to-outer direction and opposite to the flow guide plate, and a connecting portion projecting from the slanting edge. The connecting portions of the connecting plates of each heat dissipating fin engage respectively the connecting holes in the connecting plates of an adjacent heat dissipating fin. The heat dissipating fins overlap each other so that the air inlets of the heat dissipating fins are arranged in a staggered manner.

[0012] Through the aforesaid technical means, the heat dissipating device having the heat dissipating unit according to the present invention can effectively enhance heat dissipating effect and minimize production of noise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments of the invention, with reference to the accompanying drawings, in which:

[0014] FIG. **1** is a schematic view of a conventional heat dissipating device;

[0015] FIG. **2** is an exploded perspective view of an electronic device incorporating a heat dissipating device having a heat dissipating unit according to the first preferred embodiment of the present invention;

[0016] FIG. **3** is a perspective view of the first preferred embodiment;

[0017] FIG. **4** is an exploded perspective view of the first preferred embodiment;

[0018] FIG. **5** is a schematic top view of the first preferred embodiment in an assembled state;

[0019] FIG. **6** is a fragmentary enlarged perspective view of the first preferred embodiment, illustrating a structure of a single heat dissipating fin;

[0020] FIG. **7** is a fragmentary enlarged schematic top view of the first preferred embodiment;

[0021] FIG. **8** is a fragmentary enlarged perspective view of a heat dissipating device having a heat dissipating unit according to the second preferred embodiment of the present invention, illustrating structures of first and second heat dissipating fins;

[0022] FIG. **9** is a fragmentary enlarged schematic top view of the second preferred embodiment; and

[0023] FIG. **10** is a fragmentary enlarged schematic view of the second preferred embodiment, illustrating the length of the second heat dissipating fin being shorter than the length of the first heat dissipating fin.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] The above-mentioned and other technical contents, features, and effects of this invention will be clearly presented from the following detailed description of the two preferred embodiments in coordination with the reference drawings. Through description of the concrete implementation method, the technical means employed and the effectiveness to achieve the predetermined purposes of the present invention will be thoroughly and concretely understood. However, the enclosed drawings are used for reference and description only, and are not used for limiting the present invention.

[0025] Before this invention is described in detail, it should be noted that, in the following description, similar elements are designated by the same reference numerals.

[0026] Referring to FIGS. **2** to **7**, a heat dissipating device **300** according to the first preferred embodiment of the present invention is adapted to be installed in an electronic device **2**. In this embodiment, the electronic device **2** is exemplified as a notebook computer, and includes a main housing **21**, and a display screen **22** connected pivotally to a rear end of the main housing **21**. The main housing **21** includes a mounting space **211** for mounting of the heat dissipating device **300**. The heat dissipating device **300** is used for dissipating heat generated by a heat-generating element (not shown), for example, a central processing unit or a chip. Alternatively, the electronic device **2** may also be a tablet computer.

[0027] With reference to FIGS. **3** to **5**, the heat dissipating device **300** comprises a heat dissipating fan **3** and a heat dissipating unit **4**. The heat dissipating fan **3** is a centrifugal fan, and includes a casing **31** and an impeller **32**. In this embodiment, the casing **31** is made of a metallic material having a good conductivity, such as copper or aluminum. The casing **31** includes a bottom plate **311**, and a top cover **312** connected to and covering the bottom plate **311**. The bottom plate **311** and the top cover **312** cooperatively define a receiving space **313**, and an air outlet **314** communicating fluidly with the receiving space **313**. The top cover **312** has a plurality of air inlets **315** communicating fluidly with the receiving space **313** and the air outlet **314**. The impeller **32** is disposed rotatably in the receiving space **313**. The heat dissipating unit **4** is disposed in the receiving space **313**, and surrounds the impeller **32**. The heat dissipating unit **4** may be fixed to a top face of the bottom plate **311** by a welding method.

[0028] The heat dissipating device **300** further comprises a heat pipe **5** and a plurality of heat conductive elements **6**. The heat pipe **5** may be welded to a bottom face of the bottom plate **311**. Each heat conductive element **6** is disposed on the heat pipe **5**, and abuts against a heat-generating element (not shown). Heat generated by the heat-generating element can be transmitted to the heat dissipating unit **4** through the heat conductive elements **6**, the heat pipe **5**, and the bottom plate **311**. Through this configuration, when the impeller **32** is rotated, air outside the casing **31** enters the receiving space **313** via the air inlets **315**, and forms air stream to dissipate heat of the heat dissipating device **4**. The air stream after heat dissipation is discharged via the air outlet **314**.

[0029] With reference to FIGS. **6** and **7**, the heat dissipating unit **4** includes a plurality of heat dissipating fins **41** arranged in an annular array. Each heat dissipating fin **41** is made of a metallic material having a good conductivity, such as copper or aluminum. Each heat dissipating fin **41** includes a rectangular flow guide plate **411** extending from an inner side to an outer side of the annular array, and two connecting plates **412** respectively connected to and forming an angle with top and bottom ends of the flow guide plate **411**. The flow guide plate **411** and the connecting plates **412** cooperatively define an air channel **413**, an air inlet **414** proximate to the inner side of the annular array and communicating fluidly with the air channel **413**, and an air outlet **415** proximate to the outer side of the annular array and communicating fluidly with the air channel **413**. Air stream generated during rotation of the impeller **32** enters the air channel **413** via the air inlet **414**, and discharges via the air outlet **415**. Through this configuration, the air stream can exchange heat with each heat dissipating fins **41** to cool each heat dissipating fin **41**.

[0030] Each connecting plate **412** tapers from the outer side to the inner side of the annular array, and includes two spaced-apart connecting holes **416** adjacent to the flow guide plate **411**, a slanting edge **417** extending in an inner-to-outer direction and opposite to the flow guide plate **411**, and two spaced-apart connecting portions **418** projecting from the slanting edge **417**. Each connecting portion **418** has a T-shaped cross section. Through engagement of the connecting portions **418** of the connecting plates **412** of each heat dissipating fin **41** with the respective connecting holes **416** in the connecting plates **412** of an adjacent heat dissipating fin **41**, every two adjacent ones of the heat dissipating fins **41** can be interconnected. Preferably, after every two adjacent ones of the heat dissipating fins **41** are interconnected, the slanting edge **417** of each heat dissipating fin **41** abuts against the flow guide plate **411** of the adjacent heat dissipating fin **41**. Through this configuration, every two adjacent ones of the heat dissipating fins **41** can be stably connected to each other, and no rocking is likely to happen.

[0031] Since the air stream is discharged along the tangent direction of each fan blade **321** of the impeller **32** during rotation of the impeller **32**, in order for each heat dissipating fin **41** of the heat dissipating unit **4** to have a similar heat dissipating effect, the method of disposing each heat dissipating fin **41** on the bottom plate **311** and the relation between each heat dissipating fin **41** and the impeller **32** are as follows: the flow guide plate **411** of each heat dissipating fin **41** is parallel with a flow direction of the air stream generated by the impeller **42**, and the air inlets **414** of the heat dissipating fins **41** have the same distance (D) from the center of rotation (O) of the impeller **32**. Through the aforesaid configuration, air streams generated by the impeller **32** enter the air inlets **414** of the heat dissipating fins **41** at equal quantity, speed, and direction. Further, air streams can flow smoothly through the air channels **413** of the heat dissipating fins **41** to effectively exchange heat with the heat dissipating fins **41**, so that the heat dissipating fins **41** of the heat dissipating unit **4** have similar heat dissipating effects. Hence, the heat dissipating effect of the heat dissipating device **300** can be greatly enhanced.

[0032] Preferably, in this embodiment, the heat dissipating fins **41** overlap each other so that the air inlets **414** of the heat dissipating fins **41** are arranged in a staggered manner, and the air channel **413** of each heat dissipating fin **41** is partially covered by the flow guide plate **411** of an adjacent one of the heat dissipating fins **41** and is partially exposed at the inner side of the annular array. As such, air stream can enter via the air inlets **414** and the exposed portion of the air channel **413**, so that blocking of the air stream can be reduced, and the air stream flowing through the air channel **413** can be smoother, thereby effectively minimizing production of noise. Further, as shown in FIGS. **2** and **3**, since the heat dissipating unit **4** is disposed in the receiving space **313** of the casing **31**, when the heat dissipating device **300** is mounted to the mounting space **211** of the main housing **21**, a separate space is not necessary for the heat dissipating unit **4**. Hence, the heat dissipating device **300** can be mounted to the mounting space **211** at a minimum space.

[0033] With reference to FIGS. **4** and **7**, it should be noted that, in this embodiment, the aforesaid heat dissipating fins **41** are arranged in a circular array. Thus, air stream discharged through each fan blade **321** of the impeller **32** will quickly flow into the air channel **413** of each heat dissipating fin **41** to exchange heat with each heat dissipating fin **41**. As such, a portion of air stream discharged through the fan blade **321** can be prevented from impacting first a surrounding wall **316** of the top cover **312** and rebound which can interfere with the quantity, speed, and direction of the air stream flowing into the air inlet **414** of each heat dissipating fin **41**. Hence, equal quantity, speed, and direction of the air streams flowing into the air inlets **414** of the heat dissipating fins **41** can be ensured. Further, the heat dissipating fins **41** are arranged in the circular array to effectively utilize the receiving space **313** of the casing **31**, thereby further enhancing the effect of heat dissipation.

[0034] Referring to FIGS. **8** to **10**, a heat dissipating device **300** according to the second preferred embodiment of the present invention has a structure and a use method substantially similar to the first preferred embodiment. The main difference between the first and second preferred embodiments resides in the structure of the heat dissipating unit **4'**. In this embodiment, the heat dissipating unit **4'** further includes a plurality of first heat dissipating fins **41'**, and a plurality of second heat dissipating fins **41"** each of which is connected between two adjacent ones of the first heat dissipating fins **41'**. Each first heat dissipating fin **41'** has a structure similar to the heat dissipating fin **41** described in the first preferred embodiment. However, in this embodiment, each connecting plate **412** of each first heat dissipating fin **41'** is provided with one connecting hole **416** and one connecting portion **418**. The second heat dissipating fins **41"** have a same configuration as the first heat dissipating fins **41'**, but the length (L**1**) of each second heat dissipating fin **41"** measured in the inner-to-outer direction is shorter than the length (L**2**) of each first heat dissipating fin **41'** measured in the inner-to-outer direction. Each connecting plate **412"** of each second heat dissipating fin **41"** is connected between each two adjacent ones of the first heat dissipating fins **41'**. Every two adjacent ones of the first heat dissipating fins **41'** define a gap **42** proximate to the inner side of the annular array. The gap **42** communicates fluidly with the air channel **413** of each second heat dissipating fin **41"** and the air channel **413** of one of the two adjacent ones of the first heat dissipating fins **41'**. Further, the air inlets **414** of the first heat dissipating fins **41'** have the same distance (D) from the center of rotation of the impeller **32**.

[0035] When the heat dissipating unit **4'** is applied to the impeller **32** whose dimensions are small, although the dimensions of the heat dissipating unit **4'** may decrease following that of the impeller **32**, through the presence of the gap **42** between each two adjacent ones of the first heat dissipating fins **41'**, air generated by the impeller **32** can smoothly flow into the air channel **413** of each first heat dissipating fin **41'** and the air channel **413** of each second heat dissipating fin **41"** via the gap **42**. As such, blocking of the air stream can be reduced, thereby effectively minimizing production of noise. Further, the rotational speed of the impeller **32** may be increased to enhance the heat dissipating effect.

[0036] From the aforesaid description, the heat dissipating units **4**, **4'** of the two preferred embodiments, through the configuration of the flow guide plate **411** thereof being parallel with the flow direction of the air stream generated by the impeller **32**, the heat dissipation rate of the heat dissipating device **300** can be greatly enhanced. Further, through the stagger arrangement of the air inlets **414** of the heat dissipating fins **41**, **41'**, through the air channel **413** of each heat dissipating fin **41**, **41'** being partially covered by the flow guide plate **411** of an adjacent heat dissipating fin **41**, **41** and being partially exposed at the inner side of the annular array, or through the formation of the gap **42** between each two adjacent ones of the first heat dissipating fins **41'**, blockage of air stream can be reduced, and the air stream can flow smoothly into the air channel **413**, thereby effectively minimizing production of noise. Hence, the objects of the present invention can be realized.

[0037] While the present invention has been described in connection with what are considered the most practical and preferred embodiments, it is understood that this invention is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretations and equivalent arrangements.

We claim:

1. A heat dissipating unit, comprising:

a plurality of first heat dissipating fins arranged in an annular array for surrounding an impeller, each of said first heat dissipating fins including a flow guide plate extending from an inner side of said annular array to an outer side of said annular array, two connecting plates respectively connected to and forming an angle with two opposite sides of said flow guide plate, an air inlet formed by said flow guide plate and said connecting plates in proximity to said inner side of said annular array, and an air channel formed by said flow guide plate and said connecting plates and communicating fluidly with said air inlet, said flow guide plate being parallel with a flow direction of air stream generated by said impeller, each of said connecting plates tapering from said outer side to said inner side, and including a connecting hole adjacent to said flow guide plate, a slanting edge extending in an inner-to-outer direction and opposite to said flow guide plate, and a connecting portion projecting from said slanting edge, said connecting portions of said connecting plates of each of said first heat dissipating fins engaging respectively said connecting holes in said connecting plates of an adjacent one of said first heat dissipating fins, said first heat dissipating fins overlapping each other so that said air inlets of said first heat dissipating fins are arranged in a staggered manner.

2. The heat dissipating unit of claim **1**, wherein said first heat dissipating fins are arranged in a circular array.

3. The heat dissipating unit of claim **2**, wherein said air channel of each of said first heat dissipating fins is partially covered by said flow guide plate of an adjacent one of said first heat dissipating fins and is partially exposed at said inner side of said annular array.

4. The heat dissipating unit of claim **3**, wherein said slanting edge of each of said first heat dissipating fins abuts against said flow guide plate of the adjacent one of said first heat dissipating fins.

5. The heat dissipating unit of claim **1**, further comprising a plurality of second heat dissipating fins each of which is connected between two adjacent ones of said first heat dissipating fins, said air inlets of said first heat dissipating fins having the same distance from a center of rotation of the impeller.

6. The heat dissipating unit of claim **5**, wherein said second heat dissipating fins have a same configuration as said first heat dissipating fins, the length of each of said second heat dissipating fins measured in the inner-to-outer direction being shorter than the length of each of said first heat dissipating fins measured in the inner-to-outer direction, every two adjacent ones of said first heat dissipating fins defining a gap proximate to said inner side of said annular array, said gap communicating fluidly with an air channel of each of said second heat dissipating fins and said air channel of one of said two adjacent ones of said first heat dissipating fins.

7. The heat dissipating unit of claim **6**, wherein said first heat dissipating fins are arranged in a circular array.

8. The heat dissipating unit of claim **7**, wherein said slanting edge of each of said first heat dissipating fins abuts against said flow guide plate of the adjacent one of said first heat dissipating fins.

9. A heat dissipating device, comprising:

a heat dissipating fan including a casing and an impeller, said casing being formed with a receiving space, an air inlet communicating fluidly with said receiving space, and an air outlet communicating fluidly with said air inlet of said casing, said impeller being disposed in said receiving space; and

a heat dissipating unit disposed in said receiving space and surrounding said impeller, said heat dissipating unit including a plurality of first heat dissipating fins arranged in an annular array, each of said first heat dissipating fins including a flow guide plate extending from an inner side of said annular array to an outer side of said annular array, two connecting plates respectively connected to and forming an angle with two opposite sides of said flow guide plate, an air inlet formed by said flow guide plate and said connecting plates in proximity to said inner side of said annular array, and an air channel formed by said flow guide plate and said connecting plates and communicating fluidly with said air inlet, said flow guide plate being parallel with a flow direction of air stream generated by said impeller, each of said connecting plates tapering from said outer side to said inner side, and including a connecting hole adjacent to said flow guide plate, a slanting edge extending in an inner-to-outer direction and opposite to said flow guide plate, and a connecting portion projecting from said slanting edge, said connecting portions of said connecting plates of each of said first heat dissipating fins engaging respectively said connecting holes in said connecting plates of an adjacent one of said first heat dissipating fins, said first heat dissipating fins overlapping each other so that said air inlets of said first heat dissipating fins are arranged in a staggered manner.

10. The heat dissipating device of claim **9**, wherein said first heat dissipating fins are arranged in a circular array.

11. The heat dissipating unit of claim **10**, wherein said air channel of each of said first heat dissipating fins is partially covered by said flow guide plate of an adjacent one of said first heat dissipating fins and is partially exposed at said inner side of said annular array.

12. The heat dissipating unit of claim **11**, wherein said slanting edge of each of said first heat dissipating fins abuts against said flow guide plate of the adjacent one of said first heat dissipating fins.

13. The heat dissipating unit of claim **9**, further comprising a plurality of second heat dissipating fins each of which is connected between two adjacent ones of said first heat dissipating fins, said air inlets of said first heat dissipating fins having the same distance from a center of rotation of the impeller.

14. The heat dissipating unit of claim **13**, wherein said second heat dissipating fins have a same configuration as said first heat dissipating fins, the length of each of said second heat dissipating fins measured in an inner-to-outer direction being shorter than the length of each of said first heat dissipating fins measured in the inner-to-outer direction, every two adjacent ones of said first heat dissipating fins defining a gap proximate to said inner side of said annular array, said gap communicating fluidly with said air channel of each of said second heat dissipating fins and said air channel of one of said two adjacent ones of said first heat dissipating fins.

15. The heat dissipating unit of claim **14**, wherein said first heat dissipating fins are arranged in a circular array.

16. The heat dissipating unit of claim **15**, wherein said slanting edge of each of said first heat dissipating fins abuts against said flow guide plate of the adjacent one of said first heat dissipating fins.

* * * * *