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## Cooling device for electronic equipment

### Abstract

A fan duct includes: an intake port to introduce air by a fan; a heat sink to dissipate heat by allowing air introduced from the intake port to pass between a plurality of fins; a branch wall disposed downstream in a flow of air, to branch the flow of air passing between the fins into two directions; and a plurality of ribs each being a plate-like member directed toward the fins in a manner of being parallel to the fins at a side where a branch angle exceeds 45°, and comprising an apex portion at a tip end thereof, the rib being configured to, at the tip end, branch the flow of air passing between the fins into two directions, a base of the ribs being connected to the branch wall; and an exhaust port to exhaust the air branched by the ribs and the branch wall.

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## Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION
(1) This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2022-178570, filed on Nov. 8, 2022, the entire contents of which are incorporated herein by reference.
FIELD
(2) Embodiments described herein relate generally to a cooling device for electronic equipment.
BACKGROUND
(3) In the related art, electronic equipment such as a personal computer (PC) includes a component whose temperature increases to a high temperature, such as a central processing unit (CPU). A heat sink is generally attached to such a component for heat dissipation. The air suctioned by a fan disposed upstream flows to the heat sink and is exhausted downstream of the heat sink, whereby heat is dissipated.
(4) Recently, to meet requirements for miniaturization of electronic equipment, components such as input and output equipment of a CPU and a connector may be disposed downstream of a heat sink in a housing of electronic equipment. Such a component is not preferable because a smooth flow of air passing through the heat sink is hindered and the heat dissipation performance is deteriorated.

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## Description

DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a perspective view illustrating an example of a fan duct;
(2) FIG. **2** is a perspective view illustrating an example of a schematic structure of electronic equipment to which the fan duct is attached;
(3) FIG. **3** is a perspective view illustrating an example of a vent hole provided in an electronic equipment;
(4) FIG. **4** is a plan view illustrating an example of a shape of the fan duct;
(5) FIG. **5** is a longitudinal side view illustrating the example of the shape of the fan duct;
(6) FIG. **6** is a longitudinal side view for illustrating a positional relationship between the fan duct and components near an exhaust port;
(7) FIG. **7** is a first diagram illustrating an example of a shape of a rib; and
(8) FIG. **8** is a second diagram illustrating an example of a shape of a rib.
DETAILED DESCRIPTION
(9) In general, according to one embodiment, a cooling device for electronic equipment that can obtain good heat dissipation performance even when an obstacle is present leeward of a heat sink is provided.
Solution to Problem
(10) A cooling device for electronic equipment according to one embodiment includes an intake port, a heat sink, a branch wall, a plurality of ribs, and an exhaust port. The intake port is provided with a fan and introduces air. The heat sink dissipates heat generated from electronic equipment by allowing air introduced from the intake port to pass between a plurality of fins. The branch wall is disposed downstream in a flow of the air across the plurality of fins of the heat sink in a manner of being orthogonal to a longitudinal direction of the fin, and is configured to branch a flow of air passing between the fins into two directions, one of which has a branch angle of 45° or less with respect to an exhaust direction of air passing between the fins. The plurality of ribs are each a plate-like member directed toward the fins in a manner of being parallel to the fins at a side of the branch wall where a branch angle exceeds 45°, and including an apex portion at a tip end thereof. The rib branches, at the tip end, a flow of air passing between the fins into two directions. A base of the rib is connected to the branch wall. The exhaust port discharges air branched by the rib and the branch

wall.

(11) An embodiment in which a cooling device of the present disclosure is applied as a fan duct **1** will be described with reference to the drawings.

(12) Schematic Structure of Fan Duct

(13) A schematic structure of the fan duct **1** as an example of a cooling device of the present disclosure will be described with reference to FIG. **1**. FIG. **1** is a perspective view illustrating the example of the fan duct according to the embodiment. For convenience of description, a three-dimensional coordinate system XYZ shown in FIG. **1** is set. In the three-dimensional coordinate system XYZ, a width direction (left-right direction) of the fan duct **1** is defined as an X-axis direction, a depth direction (front-rear direction) is defined as a Y-axis direction, and a height direction (up-down direction) is defined as a Z-axis direction.

(14) As illustrated in FIG. **1**, the fan duct **1** is a cover member that has a substantially box shape and that covers a heat sink **2** and a suction fan **3** for blowing air to the heat sink **2**. The fan duct **1** is a member having so-called intake duct and exhaust duct, in which air suctioned by the suction fan **3** from an intake port **11** passes between fins **22** of the heat sink **2** installed inside a ventilation pipe (duct) and is exhausted from an exhaust port **12**.

(15) The suction fan **3** suctions air outside the fan duct **1**, introduces the suctioned air into the fan duct **1**, and blows the air in a −Y-axis negative direction. The suction fan **3** is an example of a fan disclosed herein. In the fan duct **1**, the intake port **11** is provided at a position upstream in an air blowing direction of the suction fan **3**, and the exhaust port **12** is provided at a position downstream.

(16) Hereinafter, the simple term “upstream” means upstream (or windward) in the air blowing direction of the suction fan **3**. Similarly, the simple term “downstream” means downstream (or leeward) in the air blowing direction of the suction fan **3**.

(17) The heat sink **2** is attached to an electronic component that generates heat, for example, a central processing unit (CPU). The heat generated by the CPU is conducted through the heat sink **2**. The heat transferred through the heat sink **2** is dissipated to the surrounding air. Accordingly, malfunction or the like due to overheating of the CPU is prevented.

(18) The heat sink **2** includes a base portion **21** and a plurality of fins **22**. The fin **22** is erected on the base portion **21**. The plurality of fins **22** are adjacent to each other at a predetermined interval. The base portion **21** is in contact with the CPU, and the heat of the CPU is conducted thereto. The fins **22** dissipate the heat conducted from the base portion **21** into the air.

(19) The heat sink **2** is fixed on frames **41**, **42**, and **43**, which are layered at predetermined intervals, with coiled springs **44** and screws **45**. A motherboard **101** (see FIG. **2**) is sandwiched between the frame **41** and the frame **42**.

(20) For example, blades rotated by an electric motor continuously blows air in one direction, whereby the suction fan **3** blows air. In the embodiment, the intake port **11**, the suction fan **3**, the heat sink **2**, and the exhaust port **12** are arranged in this order from the upstream side to the downstream side in the air blowing direction of the suction fan **3**.

(21) In order to sufficiently exhibit the effect of the fan duct **1** described above, it is desirable that no component (obstacle) that hinders exhaust is provided leeward of the exhaust port **12**. However, due to a size of electronic equipment **100** (see FIG. **2**) including the fan duct **1**, arrangement of built-in components, and the like, an obstacle may be arranged downstream of the exhaust port **12**.

(22) In order to exhaust air while avoiding such obstacles on the leeward side, the fan duct **1** includes a branch wall **13** and a plurality of ribs **14** illustrated in FIG. **1**. The branch wall **13** branches a flow of air passing between the fins **22** of the heat sink **2** into two directions. The ribs **14** are disposed on a wall surface of the branch wall **13**, in parallel to the fins **22** of the heat sink **2**, and branch the flow of air passing between the fins **22** of the heat sink **2** into two directions. The branch wall **13** and the ribs **14** will be described in detail later (see FIGS. **4** and **5**).

(23) Schematic Structure of Electronic Equipment

(24) Electronic equipment attached with a fan duct will be described with reference to FIGS. **2** and **3**. FIG. **2** is a perspective view illustrating an example of a schematic structure of the electronic equipment attached with the fan duct. FIG. **3** is a perspective view illustrating an example of a vent hole provided in the electronic equipment.
(25) As illustrated in FIG. **2**, the electronic equipment **100** includes the motherboard **101**, a CPU **102**, a memory **103**, a solid state drive (SSD) **104**, a riser card **105**, and an input and output board **106** inside a housing **110**.
(26) The motherboard **101** is an example of a circuit board mounted with an electronic component (the CPU **102** in the embodiment) that dissipates heat through the heat sink **2**. The memory **103** and the SSD **104** also generate heat due to operations thereof. The heat is also dissipated by a flow of air in the housing **110** that is generated by the air blown by the suction fan **3**.
(27) The input and output board **106** is connected to the motherboard **101** via an insertion port (slot) of the riser card **105**. Since the input and output board **106** is arranged in parallel to the motherboard **101** by being connected to the insertion port of the riser card **105**, it is possible to reduce a height dimension of the housing **110**.
(28) However, when the input and output board **106** is located downstream of the exhaust port **12** due to the above-described arrangement, the input and output board **106** becomes an obstacle that hinders the exhaust. In the embodiment, the exhaust from the fan duct **1** avoids the input and output board **106**.
(29) As illustrated in FIG. **3**, the fan duct **1** is accommodated inside the housing **110** of the electronic equipment **100**. Vent holes **161**, **162**, and **163** for taking in air to be introduced into the fan duct **1** and vent holes **164**, **165**, **166**, and **167** for exhausting air passing through the fan duct **1** are provided in the housing **110**.
(30) The vent holes **161**, **162**, and **163** are provided in a front cover **111** that constitutes a front face of the housing **110**. The vent holes **164** and **165** are provided in a rear cover **112** that constitutes a rear face of the housing **110**. The vent holes **166** and **167** are provided in an input and output panel **113** that constitutes a part of the rear face of the housing **110**. The input and output panel **113** includes connection terminals of various types of peripheral equipment for connecting to the electronic equipment **100**.
(31) In the electronic equipment **100** of the embodiment, the input and output board **106** is arranged behind the CPU **102**. Therefore, the exhaust port **12** of the fan duct **1** is divided into an upper exhaust port **121** that opens toward upward and a lower exhaust port **122** that opens toward downward, so that the exhaust avoids the input and output board **106** (see FIG. **1**). Specifically, the exhaust port **12** is divided into the upper exhaust port **121** and the lower exhaust port **122** by the branch wall **13** and the ribs **14** illustrated in FIG. **1**. The ribs **14** are erected from the branch wall **13** toward the heat sink **2**. Further, a plurality of the ribs **14** are provided along the X axis (side by side in the left-right direction) at fixed intervals. Details will be described later (see FIGS. **4** and **5**).
(32) Structures of Branch Wall and Rib
(33) Structures of the branch wall **13** and the ribs **14** will be described with reference to FIGS. **4** and **5**. FIG. **4** is a plan view illustrating an example of a shape of the fan duct. FIG. **5** is a longitudinal sectional view illustrating the example of the shape of the fan duct.
(34) The branch wall **13** is disposed at an inner side of an edge of the exhaust port **12**, and has a substantially V-shaped cross section in a side view as illustrated in FIG. **5**, and a bent portion thereof protrudes toward the heat sink **2**. The flow of air passing between the fins **22** of the heat sink **2** is divided into two by the branch wall **13**.
(35) The branch wall **13** is disposed downstream in the flow of air across the plurality of fins **22** of the heat sink **2** in a manner of being orthogonal to a longitudinal direction of the fins **22**. The branch wall **13** includes an upper wall portion **131** and a lower wall portion **132**. The upper wall portion **131** and the lower wall portion **132** are connected at sides along the X axis upstream in the air blowing direction of the suction fan **3**. The upper wall portion **131** and the lower wall portion

**132** are inclined with respect to the air blowing direction of the suction fan **3** such that a distance therebetween increases downstream in the air blowing direction of the suction fan **3**. The upper wall portion **131** guides the flow of air, which passes between the fins **22** of the heat sink **2**, in an obliquely upward direction. The lower wall portion **132** guides the flow of air, which passes between the fins **22** of the heat sink **2**, in an obliquely downward direction. In this way, the branch wall **13** guides the exhaust so as to avoid a partial range downstream of the branch wall **13** (a range where the input and output board **106** is disposed (see FIG. **6**)), and branches the exhaust.

(36) The branch wall **13** divides the exhaust port **12** into the upper exhaust port **121** and the lower exhaust port **122**. The upper exhaust port **121** discharges the exhaust, which flows along the upper wall portion **131**, from the vent hole **164** (see FIG. **3**) to the outside of the housing **110**. The lower exhaust port **122** discharges the exhaust, which flows along the lower wall portion **132**, from the vent holes **165**, **166**, and **167** (see FIG. **3**) to the outside of the housing **110**. As illustrated in FIG. **5**, the branch wall **13** has a substantially V-shaped cross section in a side view, and the bent portion thereof protrudes toward the heat sink **2**. The flow of air passing between the fins **22** of the heat sink **2** is divided into two by the branch wall **13**.

(37) A deflection angle θa between the upper wall portion **131** of the branch wall **13** and an exhaust direction of the air passing through the fins **22** of the heat sink **2** (−Y-axis negative direction) is formed to be 45° or less. Further, a deflection angle θb between the lower wall portion **132** of the branch wall **13** and the exhaust direction of the air passing through the fins **22** of the heat sink **2** (−Y-axis negative direction) is formed to exceed 45°.

(38) The lower wall portion **132** of the branch wall **13** is provided with the plurality of ribs **14** that are directed toward the fin **22** of the heat sink **2** and that are parallel to the fin **22**. The rib **14** is formed of, for example, a resin material, and is a plate-like member including a pointed apex portion **141** at a tip end thereof. A base of the rib **14** is connected to the lower wall portion **132** at a rib upper rear end Pa and a rib lower rear end Pb. In FIG. **4**, the ribs **14** are inserted between the fins **22**. Alternatively, the ribs **14** may not be inserted between the fins **22**. When the ribs **14** are inserted between the fins **22**, regions thereof inserted between the fins **22** may or may not contact the fins **22**.

(39) The branch wall **13** in FIG. **5** may be inverted in the up-down direction. In this case, the deflection angle θa of the upper wall portion **131** exceeds 45°, and the deflection angle θb of the lower wall portion **132** is 45° or less. The ribs **14** are disposed on the upper wall portion **131**.

(40) As illustrated in FIG. **5**, a base of the rib **14** is smoothly connected to the branch wall **13**. The rib **14** branches, at the apex portion **141** on the tip end, the flow of air passing between the fins **22** into a flow along an upper edge portion **142** and a flow along a lower edge portion **143** illustrated in FIG. **5**. In FIG. **5**, the upper edge portion **142** and the lower edge portion **143** of the rib **14**, which extend from the apex portion **141** to the base, are both formed in a straight line. That is, a region of the rib **14** in a plate thickness direction (a region along the X-axis) is formed as a flat surface. The upper edge portion **142** and the lower edge portion **143** of the rib **14** may be formed in a curved line (see FIG. **8**). That is, the region of the rib **14** in the plate thickness direction (the region along the X-axis) may be formed as a curved surface. One of the upper edge portion **142** and the lower edge portion **143** may be formed in a straight line, and the other may be formed in a curved line. Further, the upper edge portion **142** and the lower edge portion **143** may be partially formed in a straight line, and the remaining portions thereof may be formed in a curved line. That is, the region of the rib **14** in the plate thickness direction (the region along the X-axis) may be formed by a combination of a flat surface and a curved surface.

(41) A deflection angle θc between the upper edge portion **142** of the rib **14** and the exhaust direction of the air passing between the fins **22** of the heat sink **2** (−Y-axis negative direction) is formed to be 30° or less. Further, a deflection angle θd between the lower edge portion **143** of the rib **14** and the exhaust direction of the air passing between the fins **22** of the heat sink **2** (−Y-axis negative direction) is formed to be 30° or less.

(42) If the deflection angles θc and θd are too small, the apex portion **141** of the rib **14** becomes too sharp, and accordingly a filling failure of a raw material is likely to occur when forming a mold of the rib **14**, which is not preferable. Further, if the deviations θc and θd are too small, a length of the rib **14** is increased to be longer than necessary in order to secure a sufficient distance between the upper edge portion **142** and the lower edge portion **143** at the base, and the rib **14** cannot fit in the exhaust port **12**. Accordingly, it is desirable that the deflection angles θc and θd are as close to 30° as possible within a range not exceeding 30°.
(43) The rib **14** is formed by, for example, pouring a resin material into a mold, but if a thickness of the rib **14** is 3 mm or less, sink marks are less likely to occur at the time of molding, and there is no need to perform thinning with the mold. Further, since there is no wall on the upper and lower sides of the rib **14**, the rib **14** can be molded by a normal cavity core.
(44) Positional Relationship Between Exhaust Port of Fan Duct and Mounted Components
(45) A positional relationship between the fan duct **1** of the embodiment and components mounted near the exhaust port will be described with reference to FIG. **6**. FIG. **6** is a longitudinal sectional side view illustrating a positional relationship between the fan duct and components near the exhaust port.
(46) As illustrated in FIG. **6**, the input and output board **106** mounted near the exhaust port is disposed at a position not exposed to the exhaust from the upper exhaust port **121** and the exhaust from the lower exhaust port **122**. Accordingly, the fan duct **1** enables components to be arranged downstream of the fan duct **1** without hindering the cooling performance for the CPU **102** in the electronic equipment **100** (see FIG. **2**).
(47) In such a configuration, when the electronic equipment **100** is energized, the CPU **102**, the memory **103**, the SSD **104**, and the like generate heat, and temperatures thereof rise. When the suction fan **3** operates to blow air, the air flows inside the fan duct **1**, and thus the CPU **102** for which the heat sink **2** is disposed is cooled. Further, at this time, among the exhaust from the upper exhaust port **121** and the lower exhaust port **122**, air that is not discharged to the outside of the housing **110** (see FIG. **2**) moves, for example, toward the intake port **11** inside the housing **110**. Accordingly, since a flow of air is also generated outside the fan duct **1**, the memory **103**, the SSD **104**, and the like for which the heat sink **2** is not disposed are also cooled by the flow of air.
(48) Shape of Edge of Rib
(49) Specific shapes of the upper edge portion **142** and the lower edge portion **143** of the rib **14** will be described with reference to FIGS. **7** and **8**. FIG. **7** is a first diagram illustrating an example of a shape of the rib. FIG. **8** is a second diagram illustrating an example of the shape of the rib.
(50) In a rib **14***a* illustrated in FIG. **7**, the upper edge portion **142** and the lower edge portion **143** both have a linear shape. The upper edge portion **142** is connected to the upper wall portion **131** at the rib upper rear end Pa. The lower edge portion **143** is connected to the lower wall portion **132** at the rib lower rear end Pb.
(51) At this time, a tangent of the upper edge portion **142** at the rib upper rear end Pa coincides with a tangent of the upper wall portion **131** at the rib upper rear end Pa. That is, the upper edge portion **142** and the upper wall portion **131** are smoothly connected at the rib upper rear end Pa. Further, a tangent of the lower edge portion **143** at the rib lower rear end Pb coincides with a tangent of the lower wall portion **132** at the rib lower rear end Pb. That is, the lower edge portion **143** and the lower wall portion **132** are smoothly connected at the rib lower rear end Pb.
(52) In a rib **14***b* illustrated in FIG. **8**, the upper edge portion **142** and the lower edge portion **143** both have a curved shape. The curve may be, for example, a quadratic curve such as an arc or a high-order curve. The upper edge portion **142** is connected to the upper wall portion **131** at the rib upper rear end Pa. The lower edge portion **143** is connected to the lower wall portion **132** at the rib lower rear end Pb.
(53) At this time, a tangent of the upper edge portion **142** at the rib upper rear end Pa coincides with a tangent of the upper wall portion **131** at the rib upper rear end Pa. That is, the upper edge

portion **142** and the upper wall portion **131** are smoothly connected at the rib upper rear end Pa. Further, a tangent of the lower edge portion **143** at the rib lower rear end Pb coincides with a tangent of the lower wall portion **132** at the rib lower rear end Pb. That is, the lower edge portion **143** and the lower wall portion **132** are smoothly connected at the rib lower rear end Pb.

(54) Although a specific shape of a curve forming the upper edge portion **142** and the lower edge portion **143** of the rib **14***b* is not limited, the deflection angle θc of the upper edge portion **142** of the rib **14***b* gradually increases from the apex portion **141** to the rib upper rear end Pa, and is formed to be 30° or less from the apex portion **141** to the rib upper rear end Pa. The deflection angle θd of the lower edge portion **143** of the rib **14***b* gradually increases from the apex portion **141** to the rib lower rear end Pb, and is formed to be 30° or less from the apex portion **141** to the rib lower rear end Pb. The upper edge portion **142** and the lower edge portion **143** of the rib **14***b* may be formed in a combination of a curved line and a straight line.

Operations and Effects of Embodiment

(55) As described above, the fan duct **1** (cooling device) according to the embodiment includes: the intake port **11** provided with the suction fan **3** (fan) and configured to introduce air; the heat sink **2** configured to dissipate heat generated from the electronic equipment **100** by allowing air introduced from the intake port **11** to pass between the plurality of fins **22**; the branch wall **13** disposed downstream in the flow of air across the plurality of fins **22** of the heat sink **2** in a manner of being orthogonal to the longitudinal direction of the fin **22**, and configured to branch the flow of air passing between the fins **22** into two directions, one of which has a branch angle of 45° or less with respect to the exhaust direction of the air passing through the fins **22**; and the plurality of ribs **14** each being a plate-like member directed toward the fin **22** in a manner of being parallel to the fin **22** at a side of the branch wall **13** where a branch angle exceeds 45°, and including the apex portion **141** at the tip end thereof, the rib **14** being configured to branch, at the tip end, the flow of air passing between the fins **22** into two directions, the base of the ribs being connected to the branch wall **13**; and the exhaust port **12** configured to exhaust the air branched by the ribs **14** and the branch wall **13**. Accordingly, even when there is an obstacle leeward of the heat sink **2**, good cooling performance can be obtained. In addition, a size of the heat sink **2** can be increased as much as possible in a limited space by inserting the rib **14** between the fins **22** of the heat sink **2**, and thus both the miniaturization of the electronic equipment **100** and the improvement of the cooling performance can be achieved.

(56) In the fan duct **1** (cooling device) according to the embodiment, both the upper edge portion **142** and the lower edge portion **143**, which connect the apex portion **141** of the rib **14** and the base of the rib **14**, are formed to have an angle of 30° or less from the apex portion **141** to the base with respect to a direction of flow of air passing between the fins **22** of the heat sink **2**. Accordingly, the flow of air flowing between the fins **22** of the heat sink **2** can be branched at the apex portion **141** of the rib **14** to flow downstream without being disturbed.

(57) In the fan duct **1** (cooling device) according to the embodiment, the tangents of each rib **14** and the tangents of the branch wall **13**, at the connection points (the rib upper rear end Pa and the rib lower rear end Pb) between the base of the rib **14** and the branch wall **13**, coincide with each other correspondingly in the side view of the rib **14**. Accordingly, the air branched at the apex portion **141** of the rib **14** can smoothly flow from the upper edge portion **142** to the upper wall portion **131**. The air branched at the apex portion **141** of the rib **14** can smoothly flow from the lower edge portion **143** to the lower wall portion **132**. Accordingly, smooth exhaust can be performed.

(58) In the fan duct **1** (cooling device) according to the embodiment, an interval between the upper edge portion **142** and the lower edge portion **143** of the rib **14** increases toward the base of the rib **14**, and the upper edge portion **142** and the lower edge portion **143** are both formed in a straight line, a curved line, or a combination thereof in a side view of the rib **14**. Accordingly, the air branched at the apex portion **141** of the rib **14** can smoothly flow downstream.

(59) Other than in the operating examples, if any, or where otherwise indicated, all numbers, values and/or expressions referring to parameters, measurements, conditions, etc., used in the specification and claims are to be understood as modified in all instances by the term "about."
(60) While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the embodiments. The novel embodiments can be implemented in various other forms, and various omissions, replacements, and modifications can be made without departing from the gist of the embodiments. The embodiments and modifications thereof are included in the scope and the gist of the embodiments, and are included in the disclosure described in the claims and the scope of equivalents of the disclosure.

## Claims

1. A cooling device for electronic equipment, comprising: an intake port comprising a fan and configured to introduce air; a heat sink configured to dissipate heat generated from the electronic equipment by allowing air introduced from the intake port to pass between a plurality of fins; a branch wall disposed downstream in a flow of the air across the plurality of fins of the heat sink in a manner of being orthogonal to a longitudinal direction of the fins, and configured to branch a flow of air passing between the fins into two directions, one of which has a branch angle of 45° or less with respect to an exhaust direction of air passing between the fins; a plurality of ribs each being a plate-like member directed toward the fins in a manner of being parallel to the fins at a side of the branch wall where a branch angle exceeds 45°, and comprising an apex portion at a tip end thereof, the rib being configured to branch, at the tip end, a flow of air passing between the fins into two directions, a base of the ribs being connected to the branch wall; and an exhaust port configured to exhaust air branched by the rib and the branch wall.
2. The cooling device according to claim 1, wherein both an upper edge portion and a lower edge portion of the rib are formed to have an angle of 30° or less from the apex portion to the base with respect to a direction of flow of air passing between the fins of the heat sink.
3. The cooling device according to claim 2, wherein a tangent of each rib and a tangent of the branch wall, at a connection point between the base of the rib and the branch wall, coincide with each other in a side view of the rib.
4. The cooling device according to claim 3, wherein an interval between the upper edge portion and the lower edge portion of the rib increases toward the base of the rib, and both the upper edge portion and the lower edge portion are formed in a straight line, a curved line, or a combination thereof in a side view of the rib.
5. The cooling device according to claim 1, wherein the plurality of fins are adjacent to each other at a predetermined interval.
6. The cooling device according to claim 1, wherein the electronic equipment comprises at least one of a central processing unit, a motherboard, a memory, a solid state drive, a riser card, and an input and output board.
7. The cooling device according to claim 1, wherein the ribs are inserted between the fins.
8. A fan duct assembly to reduce a temperature of electronic equipment, comprising: an intake port comprising a fan and configured to introduce air; a heat sink configured to dissipate heat generated from the electronic equipment by allowing air introduced from the intake port to pass between a plurality of fins; a branch wall disposed downstream in a flow of the air across the plurality of fins of the heat sink in a manner of being orthogonal to a longitudinal direction of the fins, and configured to branch a flow of air passing between the fins into two directions, one of which has a branch angle of 45° or less with respect to an exhaust direction of air passing between the fins; a plurality of ribs each being a plate-like member directed toward the fins in a manner of being parallel to the fins at a side of the branch wall where a branch angle exceeds 45°, and comprising an apex portion at a tip end thereof, the rib being configured to branch, at the tip end, a flow of air

passing between the fins into two directions, a base of the ribs being connected to the branch wall; and an exhaust port configured to exhaust air branched by the rib and the branch wall.
9. The fan duct assembly according to claim 8, wherein both an upper edge portion and a lower edge portion of the rib are formed to have an angle of 30° or less from the apex portion to the base with respect to a direction of flow of air passing between the fins of the heat sink.
10. The fan duct assembly according to claim 9, wherein a tangent of each rib and a tangent of the branch wall, at a connection point between the base of the rib and the branch wall, coincide with each other in a side view of the rib.
11. The fan duct assembly according to claim 10, wherein an interval between the upper edge portion and the lower edge portion of the rib increases toward the base of the rib, and both the upper edge portion and the lower edge portion are formed in a straight line, a curved line, or a combination thereof in a side view of the rib.
12. The fan duct assembly according to claim 8, wherein the plurality of fins are adjacent to each other at a predetermined interval.
13. The fan duct assembly according to claim 8, wherein the electronic equipment comprises at least one of a central processing unit, a motherboard, a memory, a solid state drive, a riser card, and an input and output board.
14. The fan duct assembly according to claim 8, wherein the ribs are inserted between the fins.
15. A personal computer, comprising: central processing unit; and a cooling device, comprising: an intake port comprising a fan and configured to introduce air; a heat sink configured to dissipate heat generated from the central processing unit by allowing air introduced from the intake port to pass between a plurality of fins; a branch wall disposed downstream in a flow of the air across the plurality of fins of the heat sink in a manner of being orthogonal to a longitudinal direction of the fins, and configured to branch a flow of air passing between the fins into two directions, one of which has a branch angle of 45° or less with respect to an exhaust direction of air passing between the fins; a plurality of ribs each being a plate-like member directed toward the fins in a manner of being parallel to the fins at a side of the branch wall where a branch angle exceeds 45°, and comprising an apex portion at a tip end thereof, the rib being configured to branch, at the tip end, a flow of air passing between the fins into two directions, a base of the ribs being connected to the branch wall; and an exhaust port configured to exhaust air branched by the rib and the branch wall.
16. The personal computer according to claim 15, wherein both an upper edge portion and a lower edge portion of the rib are formed to have an angle of 30° or less from the apex portion to the base with respect to a direction of flow of air passing between the fins of the heat sink.
17. The personal computer according to claim 16, wherein a tangent of each rib and a tangent of the branch wall, at a connection point between the base of the rib and the branch wall, coincide with each other in a side view of the rib.
18. The personal computer according to claim 17, wherein an interval between the upper edge portion and the lower edge portion of the rib increases toward the base of the rib, and both the upper edge portion and the lower edge portion are formed in a straight line, a curved line, or a combination thereof in a side view of the rib.
19. The personal computer according to claim 15, wherein the plurality of fins are adjacent to each other at a predetermined interval.
20. The personal computer according to claim 15, further comprising at least one of a motherboard, a memory, a solid state drive, a riser card, and an input and output board.