CLAIMS

1. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

a position of the upstream end in the axial direction of the rotation axis remains constant.

2. The centrifugal air blower according to claim 1, wherein a position of the downstream end in the axial direction of the rotation axis remains constant.

3. The centrifugal air blower according to claim 1, wherein, between an end portion of the discharge opening on a side of the tongue portion and an end portion of the discharge opening on a side farther from the tongue portion, a position of the downstream end in the axial direction of the rotation axis is farther from the main plate at a location where an angle relative to the end portion of the discharge opening on the side of the tongue portion in the direction of rotation of the fan is larger.

4. The centrifugal air blower according to claim 1, wherein, between an end portion of the discharge opening on a side of the tongue portion and an end portion of the discharge opening on a side farther from the tongue portion, a position of the downstream end in the axial direction of the rotation axis is closer to the main plate at a location where an angle relative to the end portion of the discharge opening on the side of the tongue portion in the direction of rotation of the fan is larger.

5. The centrifugal air blower according to any one of claims 1 to 4, wherein the upstream end is located at an end portion of the peripheral wall.

6. The centrifugal air blower according to any one of claims 1 to 5, wherein the distance in the radial direction of the rotation axis between the upstream end and the downstream end becomes continuously longer over a region from an end portion of the discharge opening on a side of the tongue portion to an end portion of the discharge opening on a side farther from the tongue portion.

7. The centrifugal air blower according to any one of claims 1 to 6, wherein a cross-sectional shape of the bell mouth in a

plane including the rotation axis is a curved shape.

8. The centrifugal air blower according to any one of claims 1 to 7, wherein the scroll casing includes a curling start portion, a curling end portion, and an opposite portion to the tongue portion, and wherein the bell mouth has a flat surface portion and a curved surface portion at least one of the curling start portion, the curling end portion, and the opposite portion to the tongue portion, the flat surface portion having a liner outer contour when viewed from the axial direction of the rotation axis, the curved surface portion having an outer contour, the outer contour of the curved surface portion being a curved line protruding in a direction away from the rotation axis and partially having a small curvature when viewed from the axial direction of the rotation axis.

9. The centrifugal air blower according to any one of claims 1 to 8, wherein a distance in the axial direction of the rotation axis between the upstream end and the downstream end is shorter than a distance in a direction perpendicular to the rotation axis between the upstream end and the downstream end.

10. The centrifugal air blower according to any one of claims 1 to 8, wherein a distance in the axial direction of the rotation axis between the upstream end and the downstream end is longer than a distance in a direction perpendicular to the rotation axis between the upstream end and the downstream end.

11. The centrifugal air blower according to any one of claims 1 to 10, wherein

the scroll casing is defined by a plurality of components joined together at a plurality of locations, and,

at least one of engaging portions by which the components

are engaged with one another is disposed closer to the main plate than the upstream end in the axial direction of the rotation axis and between the upstream end and the peripheral wall.

12. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

between an end portion of the discharge opening on a side of the tongue portion and an end portion of the discharge

opening on a side farther from the tongue portion, a position of the downstream end in the axial direction of the rotation axis is farther from the main plate at a location where an angle relative to the end portion of the discharge opening on the side of the tongue portion in the direction of rotation of the fan is larger.

13. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

between an end portion of the discharge opening on a side of the tongue portion and an end portion of the discharge opening on a side farther from the tongue portion, a position of the downstream end in the axial direction of the rotation axis is closer to the main plate at a location where an angle relative to the end portion of the discharge opening on the side of the tongue portion in the direction of rotation of the fan is larger.

14. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial

direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

between an end portion of the discharge opening on a side of the tongue portion and an end portion of the discharge opening on a side farther from the tongue portion, a position of the upstream end in the axial direction of the rotation axis is closer to the main plate at a location where an angle relative to the end portion of the discharge opening on the side of the tongue portion in the direction of rotation of the fan is larger.

15. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location

larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

the scroll casing includes a curling start portion, a curling end portion, and an opposite portion to the tongue portion, and wherein the bell mouth has a flat surface portion and a curved surface portion at least one of the curling start portion, the curling end portion, and the opposite portion to the tongue portion, the flat surface portion having a liner outer contour when viewed from the axial direction of the rotation axis, the curved surface portion having an outer contour, the outer contour of the curved surface portion being a curved line protruding in a direction away from the rotation axis and partially having a small curvature when viewed from the axial direction of the rotation axis.

16. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream

end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion, and

a distance in the axial direction of the rotation axis between the upstream end and the downstream end is longer than a distance in a direction perpendicular to the rotation axis between the upstream end and the downstream end.

17. A centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction

opening, the downstream end being an end portion on a downstream side in the direction of flow of the air,

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion

the scroll casing is defined by a plurality of components joined together at a plurality of locations, and,

at least one of engaging portions by which the components are engaged with one another is disposed closer to the main plate than the upstream end in the axial direction of the rotation axis and between the upstream end and the peripheral wall.

18. An air-blowing apparatus comprising:

a case housing the centrifugal air blower according to any one of claims 1 to 17, wherein

the case includes:

a case suction opening communicating with the suction opening;

a case discharge opening communicating with the discharge opening; and

a partition plate separating a part having the case suction opening formed therein, from a part having the case discharge opening formed therein.

19. An air-blowing apparatus comprising:

a case housing the centrifugal air blower according to any one of claims 1 to 17, wherein

the case includes:

a case suction opening communicating with the suction opening; and

a case discharge opening communicating with the discharge opening, and wherein

a portion at which a distance in the radial direction of the rotation axis between the upstream end and the downstream end is longest in an entire circumference of the bell mouth is located on a side of the case suction opening.

20. An air-blowing apparatus comprising:

a centrifugal air blower comprising:

a fan including a disk-shaped main plate and a plurality of blades disposed on a peripheral portion of the main plate; and

a scroll casing including:

a sidewall covering the fan from an axial direction of a rotation axis on which the fan rotates, the side wall having a suction opening for sucking air;

a discharge opening for discharging an airflow generated by the fan;

a tongue portion for guiding the airflow to the discharge opening;

a peripheral wall surrounding the fan from a radial direction of the rotation axis; and

a bell mouth formed along the suction opening of the sidewall, wherein

the bell mouth includes an upstream end and a downstream end, the upstream end being an end portion on an upstream side in a direction of flow of the air passing through the suction opening, the downstream end being an end portion on a downstream side in the direction of flow of the air, and

a distance in the radial direction of the rotation shaft between the upstream end and the downstream end at a location larger than the tongue portion in angle of a direction of rotation of the fan is longer than a distance in

the radial direction between the upstream end and the downstream end at a location adjacent to the tongue portion; and

a case housing the centrifugal air blower, wherein

the case includes:

a case suction opening communicating with the suction opening; and

a case discharge opening communicating with the discharge opening, and wherein

a portion at which a distance in the radial direction of the rotation axis between the upstream end and the downstream end is longest in an entire circumference of the bell mouth is located on a side of the case suction opening.

21. An air-conditioning apparatus comprising the air-blowing apparatus according to any one of claims 18 to 20, wherein the case includes a heat exchanger in the portion having the case discharge opening formed therein.

22. A refrigeration cycle apparatus comprising the centrifugal air blower according to any one of claims 1 to 17.