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(54) **BEARING DEVICE**

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F16C 17/03 (2006.01)
F16C 33/10 (2006.01)

(52) **U.S. Cl.**

CPC ***F16C 17/03*** (2013.01); ***F16C 33/1045*** (2013.01); ***F16C 33/1065*** (2013.01); ***F16C 33/107*** (2013.01)

(58) **Field of Classification Search**

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See application file for complete search history.

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(57) **ABSTRACT**

A bearing device includes a plurality of bearing pads tiltably supporting a rotation shaft which rotates about an axial line, from the outer circumferential side of the rotation shaft, the bearing pads being spaced apart along the circumferential direction; and an oil supply part that supplies oil between the outer circumferential surface of the rotation shaft and pad surfaces of the bearing pads which face the rotation shaft. The plurality of bearing pads include a first bearing pad that supports the rotation shaft directly below the axial line, and a pair of second bearing pads which sandwich the first bearing pad from the rotation direction. Among the first bearing pad and the second bearing pads, a groove is formed only on the pad surfaces of the second bearing pads so as to extend in the rotation direction.

6 Claims, 4 Drawing Sheets

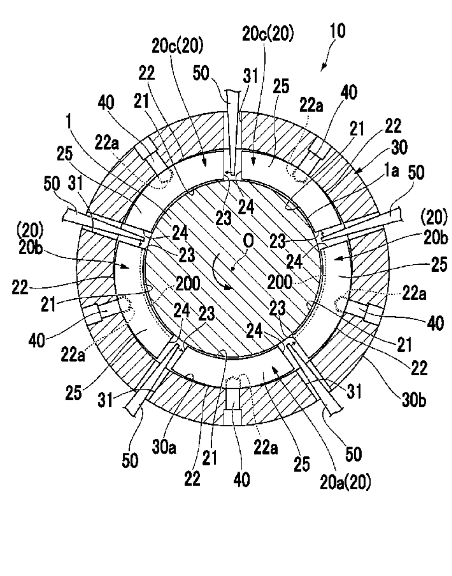

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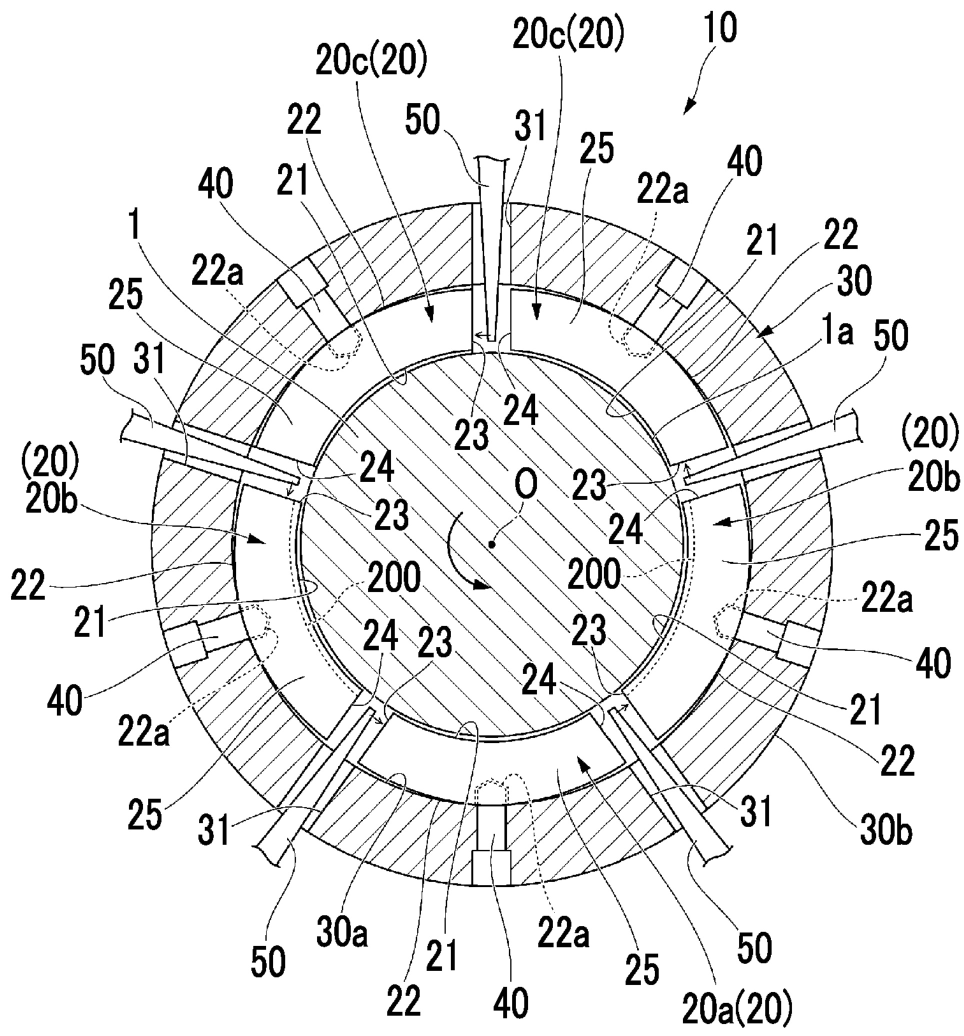
FIG. 1



10
20c(20)
20c(20)
50
31
25
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22a
40
40
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50
50
31
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23
(20)
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24
20b
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200
200
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22a
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FIG. 2

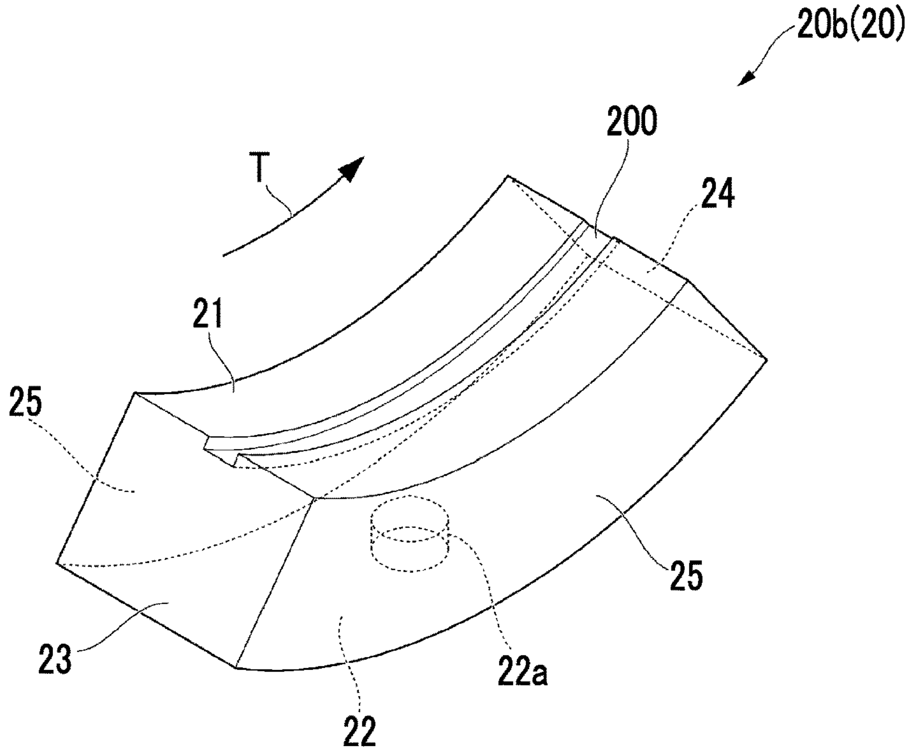


FIG. 3

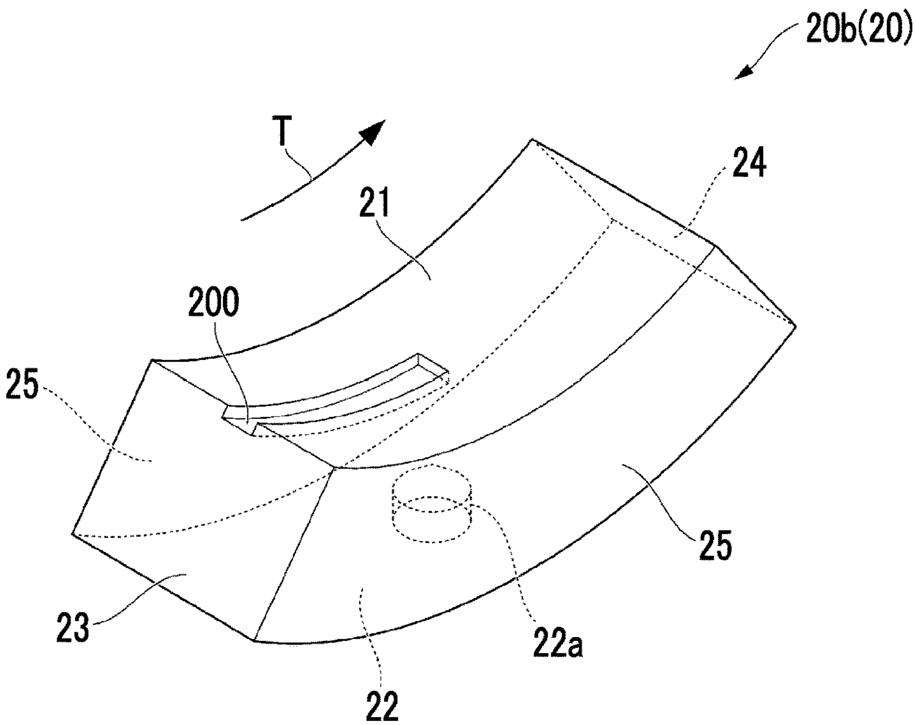
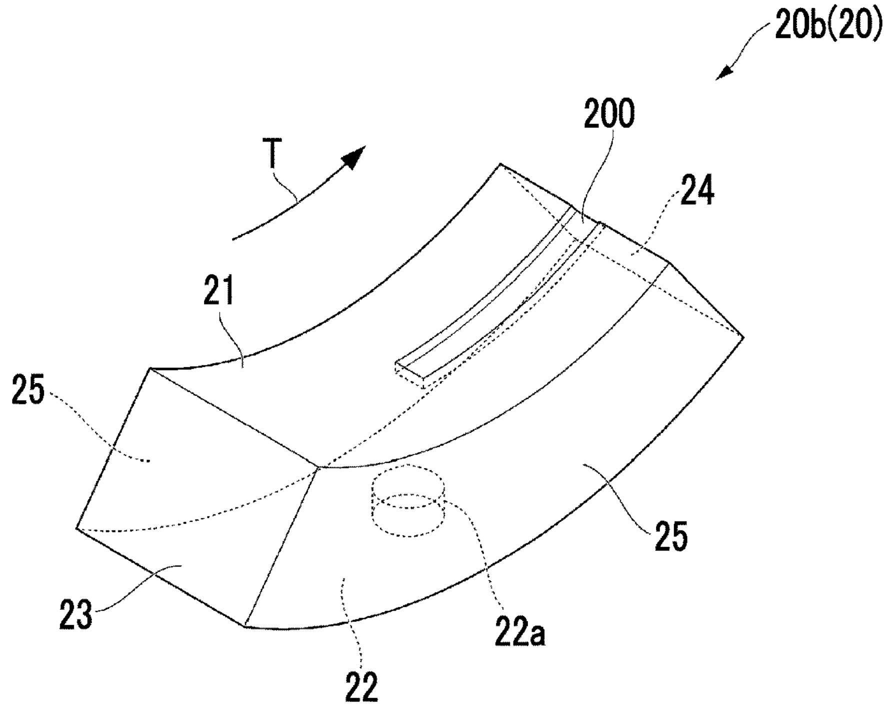


FIG. 4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22a
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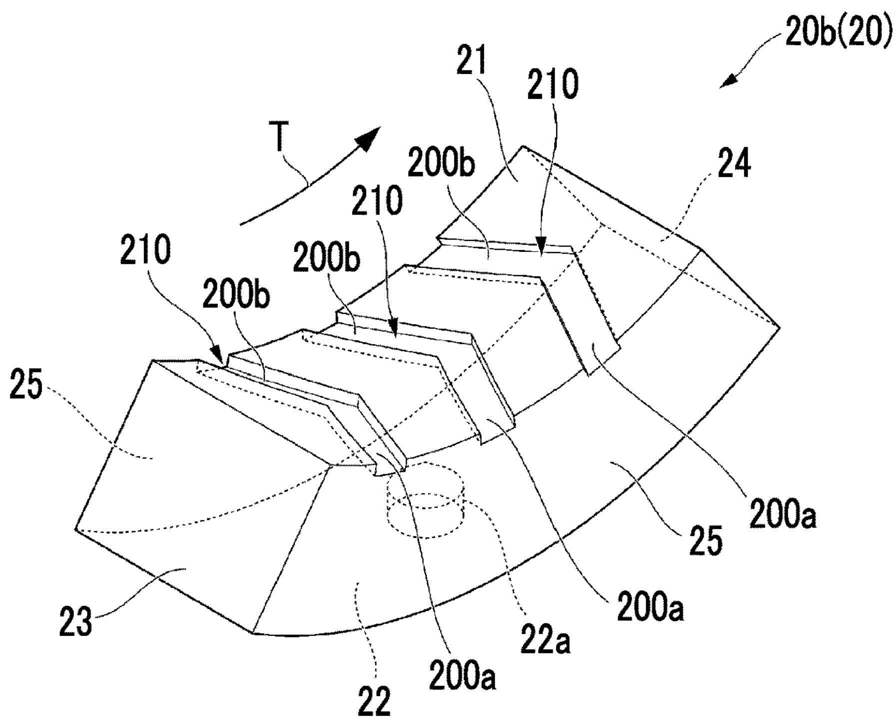
FIG. 5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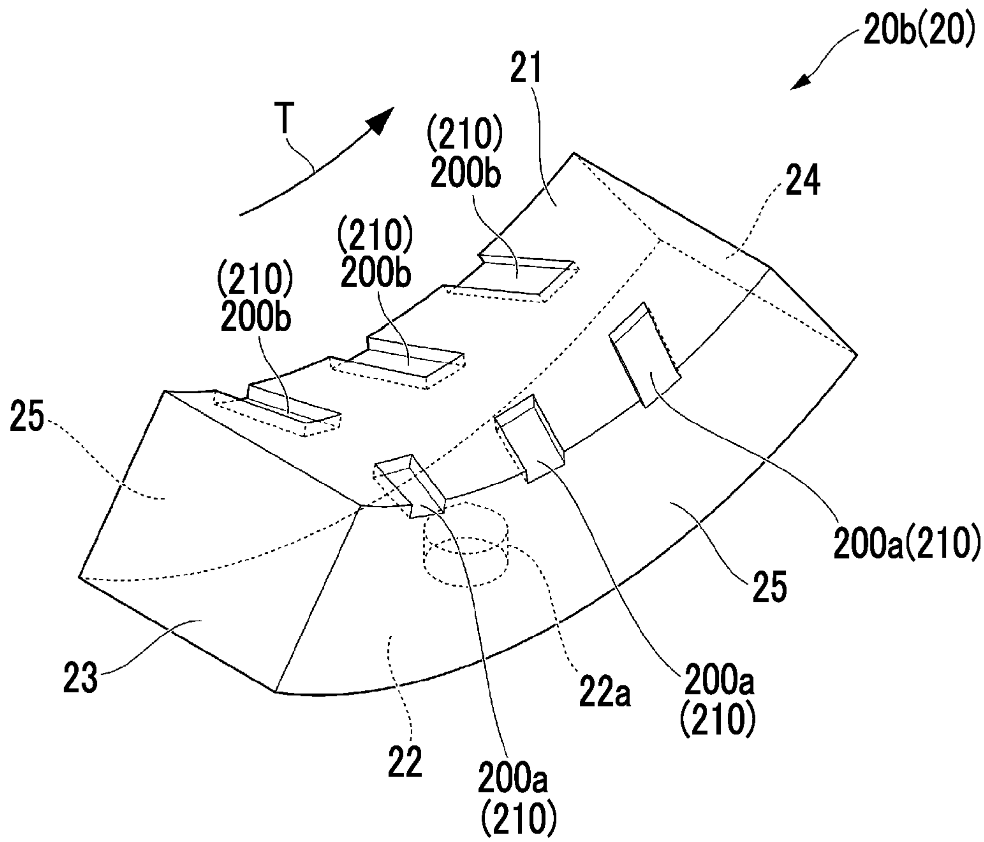
200a
22

FIG. 6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T
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200b
(210)
200b
(210)
200b
24
25
200a(210)
25
23
22a
200a
(210)
22
200a
(210)

BEARING DEVICE

TECHNICAL FIELD

The present disclosure relates to a bearing device.

Priority is claimed on Japanese Patent Application No. 2021-087514, filed May 25, 2021, the content of which is incorporated herein by reference.

BACKGROUND ART

PTL 1 discloses a bearing device including bearing pads disposed in a load-on-pad (LOP) manner, which is used in a rotary machine such as a compressor or a steam turbine. A rotating shaft supported by the bearing device may vibrate under the influence of an excitation force applied from the outside. When the rotating shaft vibrates and is displaced, a bearing housing or a bearing ring surrounding the rotating shaft from the outside is pushed outward via an oil film. At that time, the bearing housing and the bearing ring function as dampers that dampens vibration of the rotating shaft by returning an oil film reaction force to the rotating shaft.

In the bearing device of PTL 1, oil reservoir portions are formed in both side portions of the bearing ring in a horizontal direction, the bearing ring surrounding a periphery of the bearing housing. Accordingly, the magnitudes of horizontal and vertical components of the oil film reaction force that the bearing ring returns to the rotating shaft during vibration of the rotating shaft can be made different. Namely, the anisotropy of an oil film reaction force from the bearing pads toward the rotating shaft can be increased. As a result, vibration stability of the rotating shaft is improved.

CITATION LIST

Patent Literature

[PTL 1] Japanese Patent No. 5911125

SUMMARY OF INVENTION

Technical Problem

When the vibration stability of the rotating shaft is improved, the rotation speed of the rotary machine can be increased. However, when the rotation speed of the rotary machine is increased, the temperature of the oil film increases, the oil film being a portion sliding on the rotating shaft, and the temperature of the bearing pads increases more than before, which is a problem.

In addition, in the case of the bearing device in which the bearing pads are disposed in an LOP manner, an oil film reaction force that is returned to the rotating shaft by a bearing pad disposed directly below the rotating shaft is larger than oil film reaction forces of the other bearing pads. Namely, the anisotropy of the oil film reaction force can also be increased by the disposition of the bearing pads. Meanwhile, a load applied to the bearing pad disposed directly below the rotating shaft is larger than those applied to the other bearing pads. For this reason, when vibration stability of the rotating shaft is improved, the temperature of the bearing pad directly below the rotating shaft increases, which is a problem.

The present disclosure is conceived to solve the foregoing problems, and an object of the present disclosure is to provide a bearing device capable of suppressing an increase in the temperature of a bearing pad while improving vibration stability of a rotating shaft.

Solution to Problem

According to the present disclosure, in order to solve the foregoing problems, there is provided a bearing device including: a plurality of bearing pads that tiltably support a rotating shaft rotating around an axis, from an outer peripheral side, and that are provided at intervals in a circumferential direction; and an oil supply unit that supplies oil to a gap between a pad surface of each of the bearing pads and an outer peripheral surface of the rotating shaft, the pad surface facing the rotating shaft. Each of the plurality of bearing pads includes a first bearing pad that supports the rotating shaft from directly below the axis, and a pair of second bearing pads disposed to sandwich the first bearing pad between the second bearing pads in a rotation direction. A groove extending in the rotation direction is formed only in the pad surface of the second bearing pad out of the first bearing pad and the second bearing pad.

Advantageous Effects of Invention

According to the bearing device of the present disclosure, it is possible to suppress an increase in the temperature of the bearing pad while improving vibration stability of the rotating shaft.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a cross-sectional view of a bearing device according to embodiments of the present disclosure taken along a direction orthogonal to an axis.

FIG. **2** is a perspective view of a second bearing pad of the bearing device according to a first embodiment of the present disclosure.

FIG. **3** is a perspective view of a second bearing pad according to a first modification example of the first embodiment of the present disclosure.

FIG. **4** is a perspective view of a second bearing pad according to a second modification example of the first embodiment of the present disclosure.

FIG. **5** is a perspective view of a second bearing pad of a bearing device according to a second embodiment of the present disclosure.

FIG. **6** is a perspective view of a second bearing pad according to a modification example of the second embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

First Embodiment

(Bearing Device)

Hereinafter, a bearing device according to embodiments of the present disclosure will be described with reference to the drawings.

The bearing device of the present embodiment is a bearing device used in a rotary machine such as a compressor or a steam turbine. The bearing device is a radial bearing that rotatably supports a rotating shaft of the rotary machine.

As shown in FIG. **1**, a bearing device **10** includes a bearing pad **20**, a housing **30**, a pivot shaft **40**, and an oil supply unit **50**.

(Bearing Pad)

The bearing pad **20** is a member that extends in an axis O direction, and that tiltably supports a rotating shaft **1**, which rotates around an axis O, from an outer peripheral side. In the present embodiment, five bearing pads **20** are provided at equal intervals in a circumferential direction around the rotating shaft **1**.

The bearing pad **20** has a pad surface **21**, a back surface **22**, a leading side surface **23**, a trailing side surface **24**, and side surfaces **25**.

The pad surface **21** is an inner peripheral surface that is recessed outward in a radial direction when viewed in the axis O direction, that has a uniform arc shape having a radius of curvature of a predetermined dimension, and that extends in the axis O direction while maintaining the arc shape. Namely, the pad surface **21** has a cylindrical surface shape that is concave outward in the radial direction. The pad surface **21** faces an outer peripheral surface **1***a* of the rotating shaft **1**. Accordingly, for example, during rotation of the rotating shaft **1**, oil as a lubricant is supplied to a gap defined between the pad surface **21** and the outer peripheral surface **1***a* of the rotating shaft **1**, and an oil film is formed in the gap. The pad surface **21** slidably (rotatably) supports the rotating shaft **1** from the outer peripheral side via the oil film.

In the present embodiment, an outer periphery-side end portion forming the back surface **22** of the bearing pad **20** is a base portion (not shown) made of a steel material or the like. For example, a bearing steel such as white metal is laminated on the base portion. Namely, the pad surface **21** is formed by laminating the bearing steel on the base portion.

The back surface **22** is an outer peripheral surface having a cylindrical surface shape which is located opposite to the pad surface **21**, which has a uniform arc shape having a radius of curvature of a predetermined dimension, and which extends in the axis O direction while maintaining the arc shape. Namely, the back surface **22** has a cylindrical surface shape that is convex outward in the radial direction. A recessed portion **22***a* that is recessed inward in the radial direction is formed at substantially the center of the back surface **22**.

The leading side surface **23** and the trailing side surface **24** are surfaces that connect the pad surface **21** and the back surface **22**, and that face a rotation direction T of the rotating shaft **1**.

The side surfaces **25** are a pair of surfaces that connect the pad surface **21**, the back surface **22**, the leading side surface **23**, and the trailing side surface **24**, and that face the axis O direction.

By means of the pad surface **21**, the back surface **22**, the leading side surface **23**, the trailing side surface **24**, and the side surfaces **25**, the bearing pad **20** extends in an arc shape in the circumferential direction in a cross-sectional view orthogonal to the axis O, and has a curved plate shape having a uniform radial dimension from the pad surface **21** to the back surface **22**.

The bearing pad **20** includes a first bearing pad **20***a*, a second bearing pad **20***b*, and a third bearing pad **20***c*. The first bearing pad **20***a* supports the rotating shaft **1** from directly below the axis O. A pair of the second bearing pads **20***b* are disposed to sandwich the first bearing pad **20***a* in the rotation direction T of the rotating shaft **1**. The third bearing pad **20***c* supports the rotating shaft **1** from above the axis O. In the present embodiment, the bearing pad **20** includes one first bearing pad **20***a*, two second bearing pads **20***b*, and two third bearing pads **20***c*.

(Second Bearing Pad)

As shown in FIG. **2**, a groove **200** extending in the rotation direction T is formed in the pad surface **21** of the second bearing pad **20***b*. More specifically, the groove **200** extends from the leading side surface **23** to the trailing side surface **24** along the pad surface **21**, and is open on the leading side surface **23** and on the trailing side surface **24**. In the present embodiment, one groove **200** is formed in the pad surface **21** of the second bearing pad **20***b*.

(Housing)

As shown in FIG. **1**, the housing **30** has an annular shape surrounding the axis O, covers the rotating shaft **1** and the bearing pads **20** from the outer peripheral side, and swingably supports the bearing pads **20** from the outer peripheral side. The housing **30** has an inner surface **30***a* having a cylindrical surface shape which is formed with a uniform curvature smaller than that of the back surface **22** of the bearing pad **20**. In the present embodiment, the inner surface **30***a* of the housing **30** is in line contact with the back surface **22** of the bearing pad **20**, and the bearing pad **20** is swingably supported on the inner surface **30***a*. Accordingly, a so-called tilting mechanism is configured between the housing **30** and the bearing pad **20**.

A plurality of oil supply holes **31** are formed in the housing **30** at equal intervals in the circumferential direction. In the present embodiment, the oil supply holes **31** penetrate through the housing **30** in the radial direction from an outer surface **30***b* to the inner surface of the housing **30**. The oil supply holes **31** of which the number is the same as that of the bearing pads **20** are formed. An opening of the oil supply hole **31** formed in the inner surface **30***a* of the housing **30** is open to a space existing between the housing **30** and the rotating shaft **1** and between the bearing pads **20**.

(Pivot Shaft)

The pivot shaft **40** is a columnar member that swingably positions the bearing pad **20** on the inner surface **30***a* of the housing **30**. The pivot shaft **40** is provided inside the housing **30**, and extends in the radial direction toward the inside of the recessed portion **22***a* formed in the back surface **22** of the bearing pad **20**. Namely, an end portion of the pivot shaft **40** protrudes inward from the inner surface **30***a* of the housing **30** in the radial direction, and is inserted into the recessed portion **22***a*.

A clearance having a predetermined size exists between an outer surface of the end portion of the pivot shaft **40** inserted into the recessed portion **22***a* and an inner surface of the recessed portion **22***a*. Therefore, when a force to swing the bearing pad **20** acts during operation of the rotary machine, the bearing pad **20** can swing on the inner surface **30***a* of the housing **30** by the amount of the clearance.

(Oil Supply Unit)

The oil supply unit **50** is a nozzle that supplies the oil as a lubricant supplied from an oil supply device or the like (not shown) existing outside the bearing device to the inside of the housing **30**. The oil supply unit extends from the outside toward the inside of the housing **30** in the radial direction. More specifically, the oil supply unit **50** passes through the inside of the oil supply hole **31** in a process of extending from the outside toward the inside of the housing **30**. An end portion of the oil supply unit **50** is located between the bearing pads **20**. The oil supply unit **50** sprays the oil in the rotation direction T in the space inside the housing

(Actions and Effects)

Subsequently, an operation of the bearing device **10** according to the present embodiment will be described. When the rotating shaft **1** is rotated by the operation of the rotary machine, the oil is supplied to gaps between the rotating shaft **1** and the bearing pads **20** from the oil supply unit **50**. Then, the gaps defined by the outer peripheral surface **1***a* of the rotating shaft **1** and the pad surfaces **21** of the bearing pads **20** are filled with the lubricant, and oil films are formed. Accordingly, the rotating shaft **1** is slidably (rotatably) supported by the pad surfaces **21** via the oil films.

Here, in the bearing device **10** of the present embodiment, since the groove **200** is formed in the pad surface **21** of each of the pair of second bearing pads **20***b*, the area of the pad surface **21** is reduced and the surface pressure decreases compared to when the groove **200** is not formed in the pad surface **21**. Accordingly, for example, when an excitation force from the outside is applied to the rotating shaft **1**, an oil film reaction force that the rotating shaft **1** receives when pushing the bearing pad **20** via the oil film decreases. Meanwhile, the pad surface **21** of the first bearing pad **20***a* is configured to support the rotating shaft **1** from directly below the axis O in a direction of gravity, and at the same time, the groove **200** is not formed in the pad surface **21**. Namely, an oil film reaction force from the pad surface **21** of the first bearing pad **20***a* toward the rotating shaft **1** is larger than an oil film reaction force from the second bearing pad **20***b* toward the rotating shaft **1**. Namely, the magnitude of the oil film reaction force from the bearing pad **20** toward the rotating shaft **1** can be made different between the first bearing pad **20***a* and the second bearing pad **20***b*. Therefore, the anisotropy of the oil film reaction force generated on the rotating shaft **1** during operation of the rotary machine can be increased, and as a result, vibration stability of the rotating shaft **1** can be improved.

In addition, the oil supplied from the oil supply unit **50** enters the groove **200** formed in the pad surface **21** of the second bearing pad **20***b*. Accordingly, the inside of the second bearing pad **20***b* can be cooled, and a larger amount of the oil can be supplied to the gap between the housing **30** and the rotating shaft **1**. Therefore, an increase in the temperature of the bearing pad **20** can be suppressed.

(Modification Examples of First Embodiment)

As a first modification example of the first embodiment, for example, the second bearing pad **20***b* shown in FIG. **3** may be adopted. In the first modification example, a configuration of the groove **200** formed in the pad surface **21** of the second bearing pad **20***b* is different from that of the first embodiment.

In the first modification example, the groove **200** is open only on the leading side surface **23**, and extends along the pad surface **21** from the leading side surface **23** to an intermediate position on the pad surface **21** toward the trailing side surface **24**.

Even with this configuration, the same actions and effects as those of the first embodiment can be obtained.

As a second modification example of the first embodiment, for example, the second bearing pad **20***b* shown in FIG. **4** may be adopted. In the second modification example, a configuration of the groove **200** formed in the pad surface **21** of the second bearing pad **20***b* is different from that of the first embodiment.

In the second modification example, the groove **200** is open only on the trailing side surface **24**, and extends along the pad surface **21** from the trailing side surface **24** to an intermediate position on the pad surface **21** toward the leading side surface **23**.

Even with this configuration, the same actions and effects as those of the first embodiment can be obtained.

Second Embodiment

Hereinafter, a bearing device according to a second embodiment of the present disclosure will be described with reference to FIG. **5**. The bearing device to be described in the second embodiment is different from that of the first embodiment only in a configuration of a groove formed in the pad surface of the second bearing pad. For this reason, the same components as those of the first embodiment are denoted by the same reference signs, and the detailed descriptions thereof will not be repeated.

(Second Bearing Pad)

A groove **210** extending in the rotation direction T is formed in the pad surface **21** of the second bearing pad **20***b*. The groove **210** includes a first groove **200***a* and a second groove **200***b*.

The first groove **200***a* is open on one side surface **25** of the pair of side surfaces **25** facing the axis O direction, and separates away from the one side surface **25** as the first groove **200***a* extends in the rotation direction T. The second groove **200***b* is open on the other side surface **25**, and separates away from the other side surface as the second groove **200***b* extends in the rotation direction T. In the present embodiment, respective end portions of tips of the first groove **200***a* and the second groove **200***b* extending in the rotation direction T are connected to each other on the pad surface **21** to form one groove **210**. Namely, the groove **210** is formed in a herringbone shape, which extends in the rotation direction T, in the pad surface **21**. In the present embodiment, a plurality of the grooves **210** are formed in the pad surface **21**, and FIG. **5** shows a case where three grooves **210** are formed. As shown in FIG. **6**, the respective end portions of tips of the first groove **200***a* and the second groove **200***b* extending in the rotation direction T may not be connected to each other in a state where the end portions are close to each other on the pad surface **21**.

(Actions and Effects)

According to the above configuration, the same actions and effects as those of the first embodiment can be obtained.

Meanwhile, when an oil film reaction force from the second bearing pad **20***b* toward the rotating shaft **1** decreases, a probability that the rotating shaft **1** causes unbalanced vibration not caused by an external excitation force increases. Since the grooves **210** are formed in the pad surface **21** of the second bearing pad **20***b*, an oil film reaction force that cancels a force applied to the bearing pad **20** from the rotating shaft **1** when unbalanced vibration occurs can be returned from the pad surface **21**.

In addition, in the bearing device **10** according to the second embodiment, the plurality of grooves **210** are formed in the pad surface **21** of the second bearing pad **20***b*.

Accordingly, the above actions and effects can be further enhanced.

Other Embodiments

Hereinafter, the embodiments of the present disclosure have been described in detail with reference to the drawings, but the specific configurations are not limited to the configurations of each embodiment, and the addition, omission, and replacement of configurations and other changes can be made without departing from the concept of the present disclosure. In addition, the present disclosure is not limited by the embodiments, and is limited only by the claims.

A plurality of the grooves **200** described in the first embodiment and in the modification examples of the first embodiment may be formed in the pad surface **21** of the second bearing pad **20***b*. Accordingly, the actions and effects described in the first embodiment can be further enhanced.

In addition, in the embodiments, the groove **200** or **210** may be formed in the pad surface **21** of the third bearing pad **20***c*.

According to the above configuration, the oil supplied from the oil supply unit **50** enters the groove **200** or **210** formed in the pad surface **21** of the third bearing pad **20***c*. Accordingly, the inside of the third bearing pad **20***c* can be cooled, and a larger amount of the oil can be supplied to the gap between the housing **30** and the rotating shaft **1**. Therefore, an increase in the temperature of the bearing pad **20** can be suppressed.

In addition, in the embodiments, the configuration has been described in which the bearing pad **20** includes one first bearing pad **20***a*, two second bearing pads **20***b*, and two third bearing pads **20***c*, but the present disclosure is not limited to this configuration. The bearing pad **20** may include one first bearing pad **20***a*, two second bearing pads **20***b*, and one third bearing pad **20***c*. In this case, the first bearing pad **20***a*, the second bearing pads **20***b*, and the third bearing pad **20***c* may be disposed at equal intervals in the circumferential direction. Namely, the configuration may be such that the first bearing pad **20***a* is disposed directly below the rotating shaft **1**, a pair of the second bearing pads **20***b* are disposed right beside the rotating shaft **1**, and the third bearing pad **20***c* is disposed directly above the rotating shaft **1**.

Additional Notes

For example, the bearing device according to the embodiments is understood as follows.

(1) A bearing device **10** according to a first aspect includes: a plurality of bearing pads **20** that tiltably support a rotating shaft **1** rotating around an axis O, from an outer peripheral side, and that are provided at intervals in a circumferential direction; and an oil supply unit **50** that supplies oil to a gap between a pad surface **21** of each of the bearing pads **20** and an outer peripheral surface **1***a* of the rotating shaft **1**, the pad surface **21** facing the rotating shaft **1**. Each of the plurality of bearing pads **20** includes a first bearing pad **20***a* that supports the rotating shaft **1** from directly below the axis O, and a pair of second bearing pads **20***b* disposed to sandwich the first bearing pad **20***a* between the second bearing pads **20***b* in a rotation direction T. A groove **200** or **210** extending in the rotation direction T is formed only in the pad surface **21** of the second bearing pad **20***b* out of the first bearing pad **20***a* and the second bearing pad **20***b*.

According to the above configuration, since the groove **200** is formed in the pad surface **21** of each of the pair of second bearing pads **20***b*, the area of the pad surface **21** is reduced and the surface pressure decreases compared to when the groove **200** is not formed. Accordingly, for example, when an excitation force from the outside is applied to the rotating shaft **1**, an oil film reaction force that the rotating shaft **1** receives when pushing the bearing pad **20** via the oil film decreases. Meanwhile, the pad surface **21** of the first bearing pad **20***a* is configured to support the rotating shaft **1** from directly below the axis O in a direction of gravity, and at the same time, the groove **200** is not formed. Namely, an oil film reaction force from the pad surface **21** of the first bearing pad **20***a* toward the rotating shaft **1** is larger than an oil film reaction force from the second bearing pad **20***b* toward the rotating shaft **1**. Namely, the magnitude of the oil film reaction force from the bearing pad **20** toward the rotating shaft **1** can be made different between the first bearing pad **20***a* and the second bearing pad **20***b*. In addition, the oil supplied from the oil supply unit **50** enters the groove **200** formed in the pad surface **21** of the second bearing pad **20***b*. Accordingly, the inside of the second bearing pad **20***b* can be cooled, and a larger amount of the oil can be supplied to the gap between the housing **30** and the rotating shaft **1**.

(2) According to the bearing device **10** of a second aspect, in the bearing device **10** of (1), the bearing pad **20** may have a pair of side surfaces **25** that connect the pad surface **21** and a back surface **22** located opposite to the pad surface **21**, and that face an axis O direction. The groove **210** may include a first groove **200***a* that is open on one side surface **25**, and that separates away from the one side surface **25** as the first groove **200***a* extends in the rotation direction T, and a second groove **200***b* that is open on the other side surface **25**, and that separates away from the other side surface **25** as the second groove **200***b* extends in the rotation direction T.

According to the above configuration, the same actions and effects as those described above can be obtained. Meanwhile, when an oil film reaction force from the second bearing pad **20***b* toward the rotating shaft **1** decreases, a probability that the rotating shaft **1** causes unbalanced vibration not caused by an external excitation force increases. Since the groove **210** is formed in the pad surface **21** of the second bearing pad **20***b*, an oil film reaction force that cancels a force applied to the bearing pad **20** from the rotating shaft **1** when unbalanced vibration occurs can be returned from the pad surface **21**.

(3) According to the bearing device **10** of a third aspect, in the bearing device **10** of (1) or (2), the bearing pad **20** may further include a third bearing pad **20***c* which supports the rotating shaft **1** from above the axis O, and in which the groove **200** or **210** is formed in the pad surface **21**.

According to the above configuration, the oil supplied from the oil supply unit **50** enters the groove **200** or **210** formed in the pad surface **21** of the third bearing pad **20***c*. Accordingly, the inside of the third bearing pad can be cooled, and a larger amount of the oil can be supplied to the gap between the housing **30** and the rotating shaft **1**.

(4) According to the bearing device **10** of a fourth aspect, in the bearing device **10** of any one of (1) to (3), a plurality of the grooves **200** or **210** may be formed in the pad surface **21**.

Accordingly, the above actions and effects can be further enhanced.

INDUSTRIAL APPLICABILITY

According to the bearing device of the present disclosure, it is possible to suppress an increase in the temperature of the bearing pad while improving vibration stability of the rotating shaft.

REFERENCE SIGNS LIST

1: rotating shaft
1*a*: outer peripheral surface
10: bearing device
20: bearing pad
20*a*: first bearing pad
20*b*: second bearing pad
20*c*: third bearing pad
21: pad surface
22: back surface
22*a*: recessed portion
23: leading side surface
24: trailing side surface
25: side surface

30: housing
30*a*: inner surface
30*b*: outer surface
31: oil supply hole
40: pivot shaft
50: oil supply unit
200, **210**: groove
200*a*: first groove
200*b*: second groove
O axis
T: rotation direction

The invention claimed is:

1. A bearing device comprising:

a plurality of bearing pads that tiltably support a rotating shaft rotating around an axis, from an outer peripheral side, and that are provided at intervals in a circumferential direction; and

an oil supply unit that supplies oil to a gap between a pad surface of each of the bearing pads and an outer peripheral surface of the rotating shaft, the pad surface facing the rotating shaft,

wherein the plurality of bearing pads includes a single first bearing pad that supports the rotating shaft from directly below the axis, and a pair of second bearing pads disposed to sandwich the first bearing pad between the second bearing pads in a rotation direction,

a groove extending in the rotation direction is formed only in the pad surface of each of the second bearing pads out of the first bearing pad and the pair of second bearing pads, and

for each second bearing pad, the groove is open only on a leading side surface of the second bearing pad and extends along the pad surface from the leading side surface toward a trailing side surface of the second bearing pad, and ends at an intermediate position on the pad between the leading side surface and the trailing side surface.

2. The bearing device according to claim **1**,

wherein the plurality of bearing pads further includes a third bearing pad which supports the rotating shaft from above the axis, and in which a groove extending in the rotation direction is formed in the pad surface of the third bearing pad.

3. A bearing device comprising:

a plurality of bearing pads that tiltably support a rotating shaft rotating around an axis, from an outer peripheral side, and that are provided at intervals in a circumferential direction; and

an oil supply unit that supplies oil to a gap between a pad surface of each of the bearing pads and an outer peripheral surface of the rotating shaft, the pad surface facing the rotating shaft,

wherein the plurality of bearing pads includes a single first bearing pad that supports the rotating shaft from directly below the axis, and a pair of second bearing pads disposed to sandwich the first bearing pad between the second bearing pads in a rotation direction,

a groove extending in the rotation direction is formed only in the pad surface of each of the second bearing pads out of the first bearing pad and the pair of second bearing pads,

wherein each of the plurality of bearing pads has a pair of side surfaces that connect the pad surface and a back surface located opposite to the pad surface, and that face an axis direction,

the groove includes a first groove that is open on one side surface of the pair of side surfaces, and that separates away from the one side surface as the first groove extends in the rotation direction, and a second groove that is open on the other side surface of the pair of side surfaces, and that separates away from the other side surface as the second groove extends in the rotation direction, and

the first groove extends to a closed end at a tip of the first groove in the rotation direction, the second groove extends to a closed end at a tip of the second groove in the rotation direction, and the closed end of the first groove and the closed end of the second groove are spaced apart from each other in the axis direction.

4. The bearing device according to claim **3**,

wherein the plurality of bearing pads further includes a third bearing pad which supports the rotating shaft from above the axis, and in which a groove extending in the rotation direction is formed in the pad surface of the third bearing pad.

5. A bearing device comprising:

a plurality of bearing pads that tiltably support a rotating shaft rotating around an axis, from an outer peripheral side, and that are provided at intervals in a circumferential direction; and

an oil supply unit that supplies oil to a gap between a pad surface of each of the bearing pads and an outer peripheral surface of the rotating shaft, the pad surface facing the rotating shaft,

wherein the plurality of bearing pads includes a single first bearing pad that supports the rotating shaft from directly below the axis, and a pair of second bearing pads disposed to sandwich the first bearing pad between the second bearing pads in a rotation direction,

a groove extending in the rotation direction is formed only in the pad surface of each of the second bearing pads out of the first bearing pad and the pair of second bearing pads, and

for each second bearing pad, the groove is open only on a trailing side surface of the second bearing pad and extends along the pad surface from the trailing side surface toward a leading side surface of the second bearing pad, and ends at an intermediate position on the pad between the trailing side surface and the leading side surface.

6. The bearing device according to claim **4**,

wherein the plurality of bearing pads further includes a third bearing pad which supports the rotating shaft from above the axis, and in which a groove extending in the rotation direction is formed in the pad surface of the third bearing pad.

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