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Rotary electric machine and electric actuator

Abstract

A rotary electric machine includes a conductive member attached to a substrate surface on an other axial side. The conductive member has a connection part electrically connected with the substrate and a holding part having multiple elastic support pieces. A first penetration part axially penetrates through the connection part. A second penetration part axially penetrates through the substrate. A coil lead wire passes through the first and second penetration parts and is supported by elastic support pieces on the other axial side relative to the first penetration part. Each elastic support piece contacts an outer peripheral surface of the coil lead wire, is positioned on the axial side toward the coil lead wire, and, when elastically deformed, presses the coil lead wire against other portions in the conductive member. The holding part holds two or more coil lead wires by using the elastic support pieces.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) The present invention claims priority under 35 U.S.C. § 119 to Japanese Application No. 2022-151359 filed on Sep. 22, 2022 the entire content of which is incorporated herein by reference.

FIELD OF THE INVENTION

(2) The invention relates to a rotary electric machine and an electric actuator.

BACKGROUND

(3) A motor including a substrate to which a coil wire is connected is known. For example, a motor may include a support member supporting a coil wire.

(4) In the above-mentioned motor, a process of electrically connecting the coil wire to a substrate by soldering after guiding the coil wire to a through hole provided on the substrate by passing the coil wire through a hole provided on the support member is required. Comparatively, it is required that the man-hours and time required in the process of electrically connecting the coil wire to the substrate be further reduced.

SUMMARY

(5) An aspect of a rotary electric machine according to the invention includes: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the substrate on an other side in the axial direction. The stator has a plurality of coil lead wires extending from the coils toward the side in the axial direction. The conductive member has: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part. The connection part has a first penetration part penetrating through the connection part in the axial direction. The substrate has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part. The coil lead wire passes through the first penetration part and the second penetration part. The coil lead wires passing through the first penetration part and the second penetration part are supported by at least two elastic support pieces on the other side in the axial direction with respect to the first penetration part. Each of the at least two elastic support pieces contacts outer peripheral surfaces of the coil lead wires, is positioned on the side in the axial direction toward the coil lead wires, and, in a state of being elastically deformed, presses the coil lead wires against other portions in the conductive member. The holding part holds two or more coil lead wires by using the elastic support pieces.
(6) Another aspect of a rotary electric machine according to the invention includes: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the substrate on an other side in the axial direction. The stator has a coil lead wire extending from the coils toward the side in the axial direction. The conductive member has: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part. The connection part has a first penetration part penetrating through the connection part in the axial direction. The substrate has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part. The coil lead wire passes through the first penetration part and the second penetration part. The elastic support pieces include an elastic support piece group, the elastic support piece group including three or more elastic support pieces surrounding the coil lead wire. The coil lead wire is supported by the elastic support piece group on the other side in the axial direction with respect to the first penetration part. Each of the elastic support pieces included in the elastic support piece group contacts an outer peripheral surface of the coil lead wire, is positioned on the side in the axial direction toward the coil lead wire, and, in a state of being elastically deformed, presses the coil lead wire against other elastic support pieces.
(7) An aspect of an electric actuator according to the invention includes: the rotary electric machine; and a transmission mechanism, linked with the rotor of the rotary electric machine.
(8) The above and other elements, features, steps, characteristics and advantages of the present disclosure will become more apparent from the following detailed description of the preferred embodiments with reference to the attached drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) FIG. **1** is a cross-sectional view illustrating a rotary electric machine according to a first embodiment.
(2) FIG. **2** is a cross-sectional view illustrating a portion of the rotary electric machine according to the first embodiment.

(3) FIG. **3** is a cross-sectional view illustrating a portion of the rotary electric machine according to the first embodiment, and is a cross-sectional view taken along III-III in FIG. **2**.
(4) FIG. **4** is a view illustrating a portion of the rotary electric machine in the first embodiment when viewed from an upper side.
(5) FIG. **5** is a perspective view illustrating a conductive member according to the first embodiment.
(6) FIG. **6** is a cross-sectional view illustrating a portion of a procedure of a process of connecting a coil lead wire to a substrate according to the first embodiment.
(7) FIG. **7** is a cross-sectional view illustrating a portion of a rotary electric machine according to a second embodiment.
(8) FIG. **8** is a cross-sectional view illustrating a portion of the rotary electric machine according to the second embodiment, and is a cross-sectional view taken along VIII-VIII in FIG. **7**.
(9) FIG. **9** is a perspective view illustrating an elastic support piece group and a coil lead wire according to the second embodiment.
(10) FIG. **10** is a view illustrating a conductive member according to the second embodiment when viewed from a lower side, and is a view illustrating the conductive member in a state before the coil lead wire is held.
(11) FIG. **11** is a view illustrating the conductive member according to a modified example of the second embodiment when viewed from a lower side.
(12) FIG. **12** is a cross-sectional view illustrating an embodiment of an electric actuator.
DESCRIPTION OF THE EMBODIMENTS
(13) Each figure virtually shows a central axis J in a rotary electric machine of the embodiments described below. In the following description, the axial direction of the central axis J is simply referred to as “axial direction”. The radial direction with the central axis J as the center is simply referred to as “radial direction”. The circumferential direction with the central axis J as the center is simply referred to as “circumferential direction”. Z-axis in each figure illustrates a direction in which the central axis J extends. In the following description, in the axial direction, the side toward which the arrow of Z-axis points (+Z side) is referred to as “upper side”, and the side (−Z side) opposite to the side toward which the arrow of Z-axis points is referred to as “lower side”. In the following embodiments, the upper side corresponds to “a/the side in the axial direction”, and the lower side corresponds to “an/the other side in the axial direction”. The upper side and the lower sides are simply expressions for describing the relative relationship of the respective parts. The actual arrangement relationship and the like may be arrangement relationships and the like other than the arrangement relationships and the like indicated by these expressions.
(14) An electric rotary machine **100** according to the embodiment shown in FIG. **1** is a motor mounted in a vehicle. As shown in FIG. **1**, the rotary electric machine **100** is an electromechanical motor. The rotary electric machine **100** includes a housing **10**, a rotor **20**, a stator **30**, and a substrate **40**. The rotor **20**, the stator **30**, and the substrate **40** are accommodated inside the housing **10**. The housing **10** includes a housing body **11** open to the upper side and a cover member **12** blocking the opening on the upper side of the housing body **11**. The housing body **11**, for example, exhibits a cylindrical shape with the central axis J as the center. The housing body **11** has a stator accommodation part **11***a* accommodating the stator **30** inside, and a substrate accommodation part **11***b* accommodating the substrate **40** inside. The substrate accommodation part **11***b* is connected with the upper side of the stator accommodation part **11***a*. The inner diameter of the substrate accommodation part **11***b* is greater than the inner diameter of the stator accommodation part **11***a*.
(15) The rotor **20** is rotatable about the central axis J as the center, the central axis J extending in the axial direction. The rotor **20** is provided with a shaft **21** extending in the axial direction, a rotor core **22** fixed to the shaft **21**, and a magnet **23** fixed to the rotor core **22**. Multiple magnets **23** are provided at intervals in the circumferential direction, for example. The shaft **21** is supported to be rotatable about the central axis J by using a bearing **13** held at the bottom part of the housing body

11 and a bearing **14** held at the cover member **12**.
(16) The stator **30** is disposed to face the rotor **20** via a gap. The stator **30** is positioned on the radially outer side of the rotor **20**. The stator **30** is provided with a stator core **31** fixed to the inner peripheral surface of the stator accommodation part **11***a*, an insulator **32** attached to the stator core **31**, and multiple coils **33** attached to the stator core **31** via the insulator **32**. The stator core **31** surrounds the rotor core **22** and the magnets **23** from the radially outer side. The coils **33** are disposed side-by-side along the circumferential direction. The coils **33** are respectively formed by winding conductive wires.
(17) The stator **30** is provided with multiple coil lead wires **34**. The coil lead wires **34** extend to the upper side from the coils **33**. In the embodiment, the coil lead wires **34** extend toward the upper side one after another from some of the coils **33**. While not shown in the drawings, six coil lead wires **34** are provided, for example. The coil lead wires **34** are end parts of conductive wires forming the coils **33**. The coil lead wires **34** are electrically connected with the substrate **40** via a conductive member **50** to be described afterwards.
(18) The substrate **40** is positioned on the upper side of the stator **30**. The substrate **40** expands in the radial direction. The plate surface of the substrate **40** is directed in the axial direction. More specifically, the plate surface of the substrate **40** is orthogonal to the axial direction. The substrate **40** is accommodated in the substrate accommodation part **11***b*. The radially outer edge of the substrate **40** is supported from the lower side by a stepped part provided between the inner peripheral surface of the stator accommodation part **11***a* and the inner peripheral surface of the substrate accommodation part **11***b*. The substrate **40** is provided with a central hole **41** penetrating through the substrate **40** in the axial direction. The shaft **21** passes through the central hole **41** in the axial direction.
(19) As shown in FIGS. **2** to **4**, the substrate **40** has a second penetration part **42**. The second penetration part **42** penetrates through the substrate **40** in the axial direction. In the embodiment, the second penetration part **42** is an elongated hole extending in a direction orthogonal to the axial direction. More specifically, the second penetration part **42** is a rectangular hole elongated in a direction orthogonal to the axial direction. Multiple second penetration parts **42** are provided at intervals in the circumferential direction. While not shown in the drawings, three second penetration parts **42** are provided, for example.
(20) The rotary electric machine **100** includes the conductive member **50** attached to the lower side surface of the substrate **40**. The conductive member **50** is a member electrically connecting the coil lead wires **34** and the substrate **40**. In the embodiment, multiple conductive members **50** are provided at intervals in the circumferential direction. While not shown in the drawings, three conductive members **50** are provided, for example. The conductive member **50** is made of metal. In the embodiment, the conductive member **50** is a sheet metal member. As shown in FIG. **5**, the conductive member **50** in the embodiment is in a shape elongated in a direction orthogonal to the axial direction.
(21) In the following description, the longitudinal direction of the conductive member **50** is appropriately indicated by Y-axis in the drawings and is referred to as “longitudinal direction Y”. In addition, a direction orthogonal to both the axial direction and the longitudinal direction Y of the conductive member **50** is appropriately indicated by X-axis, and is referred to as “transverse direction X”. The transverse direction X and the longitudinal direction Y are directions orthogonal to the axial direction, and are directions orthogonal to each other. The transverse direction X and the longitudinal direction Y are, for example, different directions for each conductive member **50**.
(22) In the transverse direction X, the side toward which the arrow of X-axis points (+X side) is referred to as “a/the side of the transverse direction”, and the side (−X side) opposite to the side toward which the arrow of X-axis points is referred to as “an/the other side of the transverse direction”. In the longitudinal direction Y, the side toward which the arrow of Y-axis points (+Y side) is referred to as “a/the side of the longitudinal direction”, and the side (−Y side) opposite to

the side toward which the arrow of X-axis points is referred to as "an/the other side of the longitudinal direction". In the embodiment, the transverse direction X corresponds to "first direction" intersecting with the axial direction, and the longitudinal direction Y corresponds to "second direction" intersecting with the axial direction and orthogonal to the first direction.

(23) As shown in FIG. **5**, the conductive member **50** includes a connection part **51** and a holding part **50***a*. The connection part **51** extends in the longitudinal direction Y. The connection part **51** is in a plate shape in which the plate surface is directed in the axial direction. The plate surface of the connection part **51** is orthogonal to the axial direction. The connection part **51** in the embodiment is in a rectangular plate shape elongated in the longitudinal direction Y. As shown in FIG. **3**, the connection part **51** is fixed in a state of contacting the lower side surface of the substrate **40**. An end part **51***b* of the connection part **51** on the side (+Y side) in the longitudinal direction and an end part **51***c* of the connection part **51** on the other side (−Y side) in the longitudinal direction are respectively electrically connected with land parts **43** provided on the lower side surface of the substrate **40** through solders **44**. Accordingly, the connection part **51** is electrically connected with the substrate **40**.

(24) The connection part **51** has a first penetration part **51***a* penetrating through the connection part **51** in the axial direction. In the embodiment, the first penetration part **51***a* is an elongated hole extending in the longitudinal direction Y. More specifically, the first penetration part **51***a* is a rectangular hole elongated in the longitudinal direction Y. The first penetration part **51***a* is positioned on the lower side of the second penetration part **42**. That is, when viewed in the axial direction, the second penetration part **42** is overlapped with the first penetration part **51***a*. When viewed in the axial direction, the direction in which the second penetration part **42** overlapped with the first penetration part **51***a* extends is the same as the direction in which the first penetration part **51***a* extends. That is, the second penetration part **42** in the embodiment is an elongated hole extending in the longitudinal direction Y.

(25) As shown in FIGS. **3** and **4**, in the embodiment, the first penetration part **51***a* and the second penetration part **42**, when viewed in the axial direction, have shapes same as each other and sizes substantially same as each other. When viewed in the axial direction, the first penetration part **51***a* and the second penetration part **42** are substantially entirely overlapped with each other. The coil lead wire **34** passes through the first penetration part **51***a* and the second penetration part **42** in the axial direction. In the embodiment, two coil lead wires **34** pass through one first penetration part **51***a* and one second penetration part **42** in the axial direction. As shown in FIG. **3**, the coil lead wire **34** passing through the first penetration part **51***a* and the second penetration part **42** protrude upward with respect to the upper surface of the substrate **40**.

(26) The holding part **50***a* is connected with the connection part **51**. The holding part **50***a* is a portion that holds the coil lead wire **34** passing through the first penetration part **51***a*. The holding part **50***a* protrudes downward from the connection part **51**. As shown in FIG. **5**, the holding part **51***a* has a pair of holding arm parts **52**, **53**. The holding arm part **52** is connected with an edge of the connection part **51** on the side (+X side) in the transverse direction. The holding arm part **53** is connected with an edge of the connection part **51** on the other side (−X side) in the transverse direction. The holding arm part **52** and the holding arm part **53** are disposed to be symmetric to each other in the transverse direction X.

(27) The holding arm part **52** has a protrusion part **52***a* protruding downward from the connection part **51** and an elastic support piece **52***b* connected with the end part on the lower side of the protrusion part **52***a*. The holding arm part **53** has a protrusion part **53***a* protruding downward from the connection part **51** and an elastic support piece **53***b* connected with the end part on the lower side of the protrusion part **53***a*. That is, the holding part **50***a* has the pair of protrusion parts **52***a*, **53***a* protruding downward from the connection part **51** and the pair of elastic support pieces **52***b*, **53***b* respectively connected with the end parts on the lower side of the pair of protrusion parts **52***a*, **53***a*.

(28) The protrusion part **52***a* protrudes downward from the edge of the connection part **51** on the side (+X side) in the transverse direction. The protrusion part **53***a* protrudes downward from the edge of the connection part **51** on the other side (−X side) in the transverse direction. In the embodiment, the protrusion parts **52***a*, **53***a* are in plate-shapes in which the plate surfaces are directed in the transverse direction X. The protrusion parts **52***a*, **53***a* are substantially rectangular plate-shaped and elongated in the longitudinal direction Y. The protrusion part **52***a* and the protrusion part **53***a* are disposed to face each other at an interval in the transverse direction X. The dimensions of the protrusion parts **52***a*, **53***a* in the longitudinal direction Y are smaller than the dimension of the connection part **51** in the longitudinal direction Y. The protrusion parts **52***a*, **53***a* are disposed to be spaced apart in the longitudinal direction Y from the end parts **51***b*, **51***c* of the connection part **51** in the longitudinal direction Y. In other words, the connection part **51** protrudes toward the two sides in the longitudinal direction Y with respect to the protrusion parts **52***a*, **53***a*. The dimensions of the protrusion parts **52***a*, **53***a* in the longitudinal direction Y is smaller than the dimension of the first penetration part **51***a* in the longitudinal direction Y in the connection part **57**. The first penetration part **51***a* in the embodiment protrudes toward the two sides in the longitudinal direction Y with respect to the protrusion parts **52***a*, **53***a*.
(29) The pair of elastic support pieces **52***b*, **53***b* are elastically deformable in the axial direction by using the respective end parts on the lower side of the pair of protrusion parts **52***a*, **53***a* as fulcrums. The elastic support piece **52***b* protrudes toward the other side (−X side) in the transverse direction from the end part on the lower side of the protrusion part **52***a*. The elastic support piece **52***b* is positioned upward toward the other side in the transverse direction. The elastic support piece **53***b* protrudes toward the side (+X side) in the transverse direction from the end part on the lower side of the protrusion part **53***a*. The elastic support piece **53***b* is positioned upward toward the side in the transverse direction. The end part on the other side of the elastic support piece **52***b* in the transverse direction and the end part on the side of the elastic support piece **53***b* in the transverse direction are disposed to face each other by being spaced apart by a gap G in the transverse direction X. That is, the pair of elastic support pieces **52***b*, **53***b* are disposed to face each other in the transverse direction X as the first direction intersecting with the axial direction.
(30) In the embodiment, the pair of elastic support pieces **52***b*, **53***b* extend in the longitudinal direction Y. The pair of elastic support pieces **52***b*, **53***b* are substantially rectangular plate-shaped and elongated in the longitudinal direction Y. The plate surfaces of the pair of elastic support pieces **52***b*, **53***b* are directed in a direction obliquely inclined in the transverse direction X with respect to the axial direction. The dimension of the elastic support piece **52***b* in the longitudinal direction Y and the position of the elastic support piece **52***b* in the longitudinal direction Y are respectively the same as the dimension of the protrusion part **52***a* in the longitudinal direction Y and the position of the protrusion part **52***a* in the longitudinal direction Y. The dimension of the elastic support piece **53***b* in the longitudinal direction Y and the position of the elastic support piece **53***b* in the longitudinal direction Y are respectively the same as the dimension of the protrusion part **53***a* in the longitudinal direction Y and the position of the protrusion part **53***a* in the longitudinal direction Y.
(31) As shown in FIG. **4**, the end part on the other side (−X side) of the elastic support piece **52***b* in the transverse direction and the end part on the side (+X side) of the elastic support piece **53***b* in the transverse direction sandwich the two coil lead wires **34** in the transverse direction X. The end part on the other side of the elastic support piece **52***b* in the transverse direction and the end part on the side of the elastic support piece **53***b* in the transverse direction contact the outer peripheral surfaces of the two coil lead wires **34**. In the embodiment, the pair of elastic support pieces **52***b*, **53***b* contact the outer peripheral surfaces of the two coil lead wires **34** in the state of being elastically deformed toward the upper side by using, as fulcrums, the lower end parts of the protrusion parts **52***a*, **53***a* connected with the respective elastic support pieces **52***b*, **53***b*. Each of the elastic support pieces **52***b*, **53***b* presses the coil lead wires **34** against the other elastic support piece by using the restoring force generated in each of the elastic support pieces **52***b*, **53***b*.

(32) Accordingly, each of the pair of elastic support pieces **52***b*, **53***b* contacts the outer peripheral surfaces of the coil lead wires **34**, is positioned upward toward the coil lead wires **34**, and, in the state of being elastically deformed, presses the coil lead wires **34** against other portions in the conductive member **50**. Accordingly, the coil lead wires **34** passing through the first penetration part **51***a* and the second penetration part **42** are supported by the two elastic support pieces **52***b*, **53***b* on the lower side with respect to the first penetration part **51***a*. Therefore, the coil lead wires **34** are held at the conductive member **50** by using the holding part **50***a*.
(33) In the embodiment, the holding part **50***a* holds the two coil lead wires **34** by using the two elastic support pieces **52***b*, **53***b*. The two coil lead wires **34** held by the support part **50***a* are disposed to be space apart at an interval in the longitudinal direction Y. That is, between the pair of elastic support pieces **52***b*, **53***b* in the transverse direction X, the two coil lead wires **34** are held at an interval in the longitudinal direction Y. The two coil lead wires **34** held by the pair of elastic support pieces **52***b*, **53***b* both pass through the first penetration part **51***a* in the axial direction. In the embodiment, the respective coils **33** drawn out by the two coil lead wires **34** held by one conductive member **50** are coils **33** through which currents of the same phase flow.
(34) As shown in FIG. **4**, when viewed in the axial direction, the entire gap G between the pair of elastic support pieces **52***b*, **53***b* is overlapped with the first penetration part **51***a* and the second penetration part **42**. When viewed in the axial direction, the entire gap G is disposed to be away from the inner edge of the first penetration part **51***a* and the inner edge of the second penetration part **42**. When viewed in the axial direction, the gap G extends in the longitudinal direction Y.
(35) In the following, a procedure of a process of connecting the coil lead wire **34** to the substrate **40** via the conductive member **50** is described. As shown in FIG. **6**, an operator, etc., brings from the lower side the coil lead wire **34** drawn upward from the coil **33** toward the gap G between the pair of elastic support pieces **52***b*, **53***b* provided at the conductive member **50**. Specifically, the operator, etc., brings from the lower side the coil lead wire **34** toward the gap G by, for example, bringing the substrate **40** in which the conductive member **50** is fixed to the lower surface toward the stator **30** fixed to the housing **10**.
(36) Here, as indicated by the solid line shown in FIG. **6**, in the state before the coil lead wire **34** is held at the conductive member **50**, the dimension of the gap G between the pair of elastic support pieces **52***b*, **53***b* in the transverse direction X is smaller than the outer diameter of the coil lead wire **34**. When the substrate **40** is brought toward the stator **40** from the upper side to insert the coil lead wire **34** into the gap G from the lower side in such state, as indicated by a two-dot chain line in FIG. **6**, the pair of elastic support pieces **52***b*, **53***b* are pressed upward by the coil lead wire **34** to be elastically deformed, and the gap G becomes widened in the transverse direction X. Accordingly, the coil lead wire **45** can pass between the pair of elastic support pieces **52***b*, **53***b* in the axial direction, and the coil lead wire **34** can be electrically connected with the conductive member **50** by being sandwiched using the pair of elastically support pieces **52***b*, **53***b*. In the embodiment, the coil lead wire **34** is electrically connected with the land part **43** of the substrate **40** via the pair of elastic support pieces **52***b*, **53***b* and the connection part **51**.
(37) By bringing the substrate **40** further toward the stator **30**, the operator, etc., further presses the coil lead wire **34** with respect to the holding part **51***a* of the conductive member **50**, and, as shown in FIG. **2**, passes the coil lead wire **34** through the first penetration part **51***a* and the second penetration part **42**. After passing the coil lead wire **34** through the first penetration part **51***a* and the second penetration part **42** and making the coil lead wire **34** protrude upward with respect to the substrate **40**, the operator, etc., cuts off a redundant portion **34***a*, as indicated by two-dot chain lines in FIG. **3**, from the coil lead wire **34**.
(38) “Operator, etc.” in the specification covers the operator as well as an assembling device, etc., performing the respective processes. The respective processes may be performed by the operator only, by the assembling device only, or by the operator and the assembling device.
(39) According to the embodiment, the rotary electric machine **100** includes the conductive

member **50** attached to the lower side surface of the substrate **40**. The conductive member **50** is provided with the connection part **51** electrically connected with the substrate **40** and the holding part **50***a* having the elastic support pieces **52***b*, **53***b* and connected with the connection part **51**. The coil lead wire **34** passes through the first penetration part **51***a* of the connection part **51** and the second penetration part **42** of the substrate **40**. The coil lead wire **34** passing through the first penetration part **51***a* and the second penetration part **42** is supported by the two elastic support pieces **52***b*, **53***b* on the lower side with respect to the first penetration part **51***a*. Each of the two elastic support pieces **52***b*, **53***b* contacts the outer peripheral surface of the coil lead wire **34**, is positioned upward toward the coil lead wire **34**, and presses the coil lead wire **34** against other portions in the conductive member **50** in the state of being elastically deformed. Therefore, as described above, by bringing from the lower side the coil lead wire **34** toward the two elastic support pieces **52***b*, **53***b*, the coil lead wire **34** can be easily and firmly electrically connected with the conductive wire **50** by using the two elastic support pieces **52***b*, **53***b*. Accordingly, the coil lead wire **34** can be easily electrically connected with the substrate **40** via the conductive member **50** without soldering the coil lead wire **34** with respect to the substrate **40**. Therefore, according to the embodiment, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be reduced.

(40) In addition, since the elastic support pieces **52***b*, **53***b* are positioned upward toward the coil lead wire **34**, when the coil lead wire **34** is brought toward the elastic support pieces **52***b*, **53***b* from the lower side and the coil lead wire **34** is held by the holding part **50***a*, the elastic support pieces **52***b*, **53***b* are pushed upward by the coil lead wire **34** and can be easily elastically deformed. Accordingly, the coil lead wire **34** can be easily held by the holding part **50***a*. Therefore, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be further reduced.

(41) In addition, since the second penetration part **42** through which the coil lead wire **34** passes is provided at the substrate **40**, at the time of performing the process of holding the coil lead wire **34** at the conductive member **50**, it is not necessary to adjust the length of the coil lead wire **34** in advance. That is, even if the coil lead wire **34** is longer than the necessary length for the rotary electric machine **100**, the redundant portion **34***a* of the coil lead wire **34** may be cut off and removed after the coil lead wire **34** passes through the second penetration part **42** as described above. Therefore, it is not necessary to perform the process of adjusting the length of the coil lead wire in advance in accordance with the position in the axial direction at which the substrate **40** is disposed with respect to the stator **30**, and the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be further reduced.

(42) In addition, according to the embodiment, the holding part **50***a* holds the two coil lead wires **34** by using multiple elastic support pieces **52***b*, **53***b*. Therefore, the quantity of the conductive members **50** can be fewer than the quantity of the coil lead wires **34**, and the increase in the number of parts of the rotary electric machine **100** can be suppressed. For example, in the case where multiple coil lead wires **34** are held by the pair of elastic support pieces **52***b*, **53***b* as in the embodiment, when the coil lead wires **34** are inserted between the pair of elastic support pieces **52***b*, **53***b*, the coil lead wires **34** apply a force to the pair of elastic support pieces **52***b*, **53***b*, and the pair of elastic support pieces **52***b*, **53***b* can thus be elastically deformed. Therefore, the pair of elastic support pieces **52***b*, **53***b* are easily elastically deformed. Accordingly, the process of passing the coil lead wires **34** through the first penetration part **51***a* and the second penetration part **42** while holding the coil lead wires **34** at the holding part **50***a* can be easily performed. Therefore, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be more appropriately reduced.

(43) In addition, according to the embodiment, the holding part **50***a* is provided with the pair of protrusion parts **52***a*, **53***a* protruding downward from the connection part **51**. The elastic support pieces include the pair of elastic support pieces **52***b*, **53***b* respectively connected with the end parts

on the lower side of the pair of protrusion parts **52***a*, **53***a*. The pair of elastic support pieces **52***b*, **53***b* are disposed to face each other in the transverse direction X intersecting with the axial direction and extend in the longitudinal direction Y intersecting with the axial direction and orthogonal to the transverse direction X. Between the pair of elastic support pieces **52***b*, **53***b* in the transverse direction X, the two coil lead wires **34** are held at an interval in the longitudinal direction Y. Therefore, the two coil lead wires **34** can be properly sandwiched and held between the pair of elastic support pieces **52***b*, **53***b*. Compared with the case where the pair of elastic support pieces **52***b*, **53***b* are provided for each coil lead wire **34**, the shape of the conductive member **50** can be suppressed from being complicated.
(44) In addition, according to the embodiment, the first penetration part **51***a* is an elongated hole extending in the longitudinal direction Y. The two coil lead wires **34** held by the pair of elastic support pieces **52***b*, **53***b* pass through the first penetration part **51***a*. Therefore, even if the positions, in the longitudinal direction Y, of the two coil lead wires **34** passing between the pair of elastic support pieces **52***b*, **53***b* from the lower side are slightly deviated, the two coil lead wires **34** easily pass through the first penetration part **51***a* that is an elongated hole. Accordingly, compared with the case where the holes through which the two coil lead wires **34** pass are provided separately in the connection part **51**, the two coil lead wires **34** can easily pass through the first penetration part **51***a*. Therefore, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be further reduced.
(45) In addition, according to the embodiment, the entire gap G between the pair of elastic support pieces **52***b*, **53***b* is overlapped with the first penetration part **51***a* when viewed in the axial direction. Therefore, regardless of the position in the gap G between the pair of elastic support pieces **52***b*, **53***b* at which the coil lead wire **34** passes through in the axial direction, the coil lead wires **34** can pass through the first penetration part **51***a* after passing through the gap G between the pair of elastic support pieces **52***b*, **53***b*. Accordingly, the coil lead wires **34** do not need to be positioned with respect to the first penetration part **51***a* in the longitudinal direction Y, as long as the positions of the coil lead wires **34** in the longitudinal direction Y are aligned with the gap G between the pair of elastic support pieces **52***b*, **53***b*. Therefore, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be further reduced.
(46) In addition, according to the embodiment, the second penetration part **42** is an elongated hole extending in the longitudinal direction Y. The entire gap G between the pair of elastic support pieces **52***b*, **53***b* is overlapped with the second penetration part **42** when viewed in the axial direction. Therefore, regardless of the position in the gap G between the pair of elastic support pieces **52***b*, **53***b* at which the coil lead wire **34** passes through in the axial direction, the coil lead wires **34** can pass through the first penetration part **51***a* as well as the second penetration part **42** after passing through the gap G between the pair of elastic support pieces **52***b*, **53***b*. Accordingly, The coil lead wires **34** do not need to be positioned with respect to the first penetration part **51***a* and the second penetration part **42** in the longitudinal direction Y, as long as the positions of the coil lead wires **34** in the longitudinal direction Y are aligned with the gap G between the pair of elastic support pieces **52***b*, **53***b*. Therefore, the man-hours and the time required for the process of electrically connecting the coil lead wire **34** to the substrate **40** can be further reduced.
(47) In addition, according to the embodiment, multiple conductive members **50** are provided. Therefore, four or more coil lead wires **34** can be easily connected with the substrate via the conductive members **50**.
(48) It is noted that, in the embodiment, the first penetration part **51***a* and the second penetration part **42** have the same quantities as the quantity of the coil lead wire **34**. In such case, for example, in the connection part **51**, two first penetration parts **51***a* are provided at an interval in the longitudinal direction Y, and in the substrate **40**, the second penetration parts **42** are respectively provided at positions overlapped with the two first penetration parts **51***a* in the axial direction.
(49) In the following, embodiments different from the first embodiment are described. In the

description of each embodiment below, the same reference numerals may be given to the same configurations as in the first embodiment described above, and the description thereof may be omitted. Moreover, as the configuration omitted from the description in each embodiment below, the configuration similar to that of the above-described first embodiment can be adopted, as long as no inconsistency is caused.

(50) As shown in FIGS. **7** and **8**, a substrate **240** in a rotary electric machine **200** of the embodiment has multiple second penetration parts **242** for one conductive member **250**. In the embodiment, two second penetration parts **242** are provided for one conductive member **250**. The two second penetration parts **242** are disposed at an interval in the longitudinal direction Y. The second penetration part **242** is a circular hole.

(51) In the embodiment, a connection part **251** of the conductive member **250** has multiple first penetration parts **251***a*. In the embodiment, two first penetration parts **251***a* are provided in the connection part **251**. The two first penetration parts **251***a* are disposed at an interval in the longitudinal direction Y. As shown in FIG. **8**, the two first penetration parts **251***a*, when viewed in the axial direction, are respectively overlapped with the two second penetration parts **242**. When viewed in the axial direction, the first penetration part **251***a* that is circular and the second penetration part **242** that is circular are coaxially disposed. The inner diameter of the first penetration part **251***a* is greater than the inner diameter of the second penetration part **242**. When viewed in the axial direction, the inner edge of the first penetration part **251***a* surrounds the second penetration part **242**.

(52) A holding part **250***a* of the conductive member **250** is provided with a pair of holding arm parts **252**, **253**. The holding arm part **252** has a first protrusion part **252***a* protruding downward from the connection part **251** and a second protrusion part **252***b* connected with the end part on the lower side of the first protrusion part **252***a*. The holding arm part **253** has a first protrusion part **253***a* protruding downward from the connection part **251** and a second protrusion part **253***b* connected with the end part on the lower side of the first protrusion part **253***a*. That is, the holding part **250***a* has the pair of first protrusion parts **252***a*, **253***a* protruding downward from the connection part **251** and the pair of second protrusion parts **252***b*, **253***b* respectively connected with the end parts on the lower side of the pair of first protrusion parts **252***a*, **253***a*. The pair of first protrusion parts **252***a*, **253***a* respectively have the same configurations as the pair of protrusion parts **52***a*, **53***a* in the first embodiment.

(53) In the transverse direction X intersecting with the axial direction, each of the pair of second protrusion parts **252***b*, **253***b* protrudes toward the other second protrusion part with respect to each other. The second protrusion part **252***b* protrudes toward the other side (−X side) in the transverse direction from the end part on the lower side of the first protrusion part **252***a*. The second protrusion part **253***b* protrudes toward the side (+X side) in the transverse direction from the end part on the lower side of the first protrusion part **253***a*. In the embodiment, the pair of second protrusion parts **252***b*, **253***b* are in a substantially rectangular shape elongated in the longitudinal direction Y. The plate surfaces of the pair of second protrusion parts **252***b*, **253***b* are directed in the axial direction.

(54) Slits **252***c*, **253***c* extending in the transverse direction X are respectively provided at the pair of second protrusion parts **252***b*, **253***b*. Two slits **252***c* are provided at the second protrusion part **252***b* at an interval in the longitudinal direction Y. Two slits **253***c* are provided at the second protrusion part **253***b* at an interval in the longitudinal direction Y. The two slits **252***c* and the two slits **253***c* are respectively disposed to face each other in the transverse direction X. Each of the slits **252***c*, **253***c* is in a state of expanding in the longitudinal direction Y.

(55) The slit **252***c* extends from the end part on the side (+X side) of the second protrusion part **252***b* in the transverse direction until the end part on the other side (−X side) in the transverse direction to open on the other side in the transverse direction. In the longitudinal direction Y, the slit **252***c* splits the tip end part of the second protrusion part **252***b* in the protrusion direction. The

tip end part of the second protrusion part **252***b* in the protrusion direction is the end part on the other side of the second protrusion part **252***b* in the transverse direction.

(56) The slit **253***c* extends from the end part on the other side (−X side) of the second protrusion part **253***b* in the transverse direction until the end part on the side (+X side) in the transverse direction to open on the side in the transverse direction. In the longitudinal direction Y, the slit **253***c* splits the tip end part of the second protrusion part **253***b* in the protrusion direction. The tip end part of the second protrusion part **253***b* in the protrusion direction is the end part on the side of the second protrusion part **253***b* in the transverse direction.

(57) The tip end parts of the second protrusion parts **252***b*, **253***b* in the protrusion direction are disposed to face each other in the transverse direction, and are partially in contact with each other. More specifically, except for the portions where the slits **252***c*, **253***c* are provided and the peripheral parts of the portions where the slits **252***c* and **253***c* are provided, the tip end parts of the second protrusion parts **252***b*, **253***b* in the protrusion direction are in contact with each other in the transverse direction X. The tip end parts of the second protrusion parts **252***b*, **253***b* in the protrusion direction may also be disposed to face each other via a gap.

(58) As shown in FIG. **9**, the elastic support pieces for the holding part **250***a* of the conductive member **250** include an elastic support piece group **255** including three or more elastic support pieces surrounding the coil lead wire **34**. The elastic support piece group **255** in the embodiment includes four elastic support pieces **255***a*, **255***b*, **255***c*, **255***d*. The pair of elastic support pieces **255***a*, **255***b* are respectively formed by two portions split in the longitudinal direction Y by the slit **252***c* in the tip end part of the second protrusion part **252***b* in the protrusion direction. The pair of elastic support pieces **255***c*, **255***d* are respectively formed by two portions split in the longitudinal direction Y by the slit **253***c* in the tip end part of the second protrusion part **253***b* in the protrusion direction. That is, the four elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* in the embodiment are respectively formed by two portions split in the longitudinal direction Y by the slit **252***c* in the second protrusion part **252***b* and two portions split in the longitudinal direction Y by the split **253***c* in the other second protrusion part **253***b*. The elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* surround one coil lead wire **34**.

(59) The elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* included in the elastic support piece group **255** are respectively in contact with the outer peripheral surface of the coil lead wire **34**. The elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* included in the elastic support piece group **255** are respectively positioned upward toward the coil lead wire **34**. In the state of being elastically deformed, the elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* included in the elastic support piece group **255** press the coil lead wire **34** against other elastic support pieces. Accordingly, the coil lead wire **34** is supported by the elastic support piece group **255** on the lower side with respect to the first penetration part **251***a*.

(60) As shown in FIGS. **8** and **10**, in the embodiment, two elastic support piece groups **255** are provided at an interval in the longitudinal direction Y. When viewed in the axial direction, each elastic support piece group **255** is provided at a position overlapped with each first penetration part **251***a* and each second penetration part **242**. Each elastic support piece group **255** respectively holds one coil lead wire **34**.

(61) The elastic support piece group **255** in the embodiment is manufactured by providing the respective slits **252***c*, **253***c* at the second protrusion parts **252***b*, **253***b*, then pushing a rod-shaped member from the lower side to a portion where the slits **252***c*, **253***c* face each other in the transverse direction X, and plastically deforming, toward the upper side, the respective portions arranged to sandwich the slits **252***c*, **253***c* in the second protrusion parts **252***b*, **253***b*.

(62) As shown in FIG. **10**, in the state before the lead wire **34** passes through, a gap G**2** surrounded by the four elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* in the elastic support piece group **255** is smaller than the coil lead wire **34**. By inserting the coil lead wire **34** into the gap G**2** from the lower side, the elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* are elastically deformed upward, and the

gap G**2** is pushed to expand. In the embodiment, by inserting the coil lead wire **34** among the four elastic support pieces **255***a*, **255***b*, **255***c*, **255***d* from the lower side, the coil lead wire **34** can be electrically connected with the conductive member **250** easily.

(63) According to the embodiment, the elastic support pieces for the conductive member **250** have the elastic support piece group **255** including three or more elastic support pieces **255***a* to **255***d* surrounding the coil lead wire **34**. Therefore, by using the three or more elastic support pieces **255***a* to **255***d*, the coil lead wire **34** can be positioned in a plane orthogonal to the axial direction. Specifically, in the embodiment, with the elastic support piece group **255**, the coil lead wire **34** can be positioned in the transverse direction X and the longitudinal direction Y. Accordingly, the coil lead wire **34** can be stably held with respect to the holding part **250***a*. Since the coil lead wire **34** can be positioned in the plane orthogonal to the axial direction, by arranging the first penetration part **251***a* and the second penetration part **242** at a position overlapped with the elastic support piece group **255** in the axial direction, the coil lead wire **34** passing through the three or more elastic support pieces **255***a* to **255***d* can appropriately pass through the first penetration part **251***a* and the second penetration part **242**. Accordingly, the size of the first penetration part **251***a* and the size of the second penetration part **242** can be reduced within a range in which the coil lead wire **34** can pass through. Therefore, the rigidity of the connection part **251** and the rigidity of the substrate **240** can be suppressed from decreasing. In addition, since the second penetration part **242** provided at the substrate **240** can be reduced, the region where a conductive patter is provided and a region in which an electronic component is mounted on the substrate **240** can be suppressed from decreasing.

(64) In the embodiment, since the elastic support pieces includes two or more elastic support piece groups **255** in one conductive member **250**, by using one conductive member **250**, multiple coil lead wires **34** can be stably held. Accordingly, the quantity of the conductive members **250** can be suppressed from increasing, and the number of parts of the rotary electric machine **200** can be suppressed from increasing.

(65) In addition, according to the embodiment, the elastic support piece group **255** includes four elastic support pieces **255***a* to **255***d*. The four elastic support pieces **255***a* to **255***d* in the embodiment are respectively formed by two portions split in the longitudinal direction Y by the slit **252***c* in the second protrusion part **252***b* and two portions split in the longitudinal direction Y by the split **253***c* in the other second protrusion part **253***b*. Therefore, by using the four elastic support pieces **255***a* to **255***d*, the coil lead wire **34** can be held stably. In addition, with a simple configuration in which the slits **252***c*, **253***c* are provided at the pair of second protrusion parts **252***b*, **253***b*, the elastic support piece group **255** can be formed.

(66) In the embodiment, two elastic support piece groups **255** are provided in the holding part **250***a* of one conductive member **250**. However, the invention is not limited thereto. According to a holding part **350***a* of a conductive member **350** shown in FIG. **11**, it may also be that only one elastic support piece group **255** is provided at the holding part **350***a* of one conductive member **350**. In addition, while not shown in the drawings, it may also be that three or more elastic support piece groups are provided in the holding part of one conductive member.

(67) As shown in FIG. **12**, the rotary electric motor according to the embodiments of the invention may also be applied to an electric actuator including a transmission mechanism. An electric actuator **1000** shown in FIG. **12** includes a rotary electric machine **400**, a transmission mechanism **460** linked with a rotor **420** of the rotary electric machine **400**, and an output part **470**.

(68) A shaft **421** in the rotor **420** of the rotary electric machine **400** is a hollow shaft open on two sides in the axial direction. The transmission mechanism **460** is linked to the end part on the lower side of the shaft **421**. The rotary electric machine **400**, like the rotary electric machine **100** of the first embodiment, includes the conductive member **50**.

(69) The transmission mechanism **460** of the embodiment is a decelerator. The transmission mechanism **460** is fixed in the housing **10**. The transmission mechanism **460** has an external gear

461 linked with the shaft **421** via a bearing and an internal gear **462** having a ring shape and surrounding the external gear **461**. The external gear **461** is linked with a portion with an eccentric axis J**2** as the center in the shaft **421** via a bearing. The eccentric axis J**2** is a virtual axis eccentric with respect to the central axis J in the radial direction. The central axis J and the eccentric axis J**2** are parallel to each other. The internal gear **462** meshes with the external gear **461**. The internal gear **462** is fixed in the housing **10**.
(70) The output part **470** is provided with an output shaft **471** extending in the axial direction and an output flange part **472** fixed to a lower portion of the output shaft **471**. At least a portion of the output shaft **471** is located inside the shaft **421**. In the embodiment, the output shaft **471** passes through the inside of the shaft **421** in the axial direction and protrudes toward the two sides in the axial direction with respect to the shaft **421**. The end part on the lower side of the output shaft is exposed to the outside of the housing **10**. A driven shaft DS is linkable with the end part on the lower side of the output shaft **471**.
(71) The output flange part **471** expands from the output shaft **471** toward the radially outer side. The output flange part **472** has a protrusion part **472***a* protruding upward. Multiple protrusion parts **472***a* are provided at intervals in the circumferential direction. The protrusion parts **472***a* are respectively inserted from the lower side into multiple hole parts **461***a* provided at the external gear **461**. The outer peripheral surface of the protrusion part **472***a* is inscribed with the inner peripheral surface of the hole part **461***a*. Accordingly, the protrusion parts **472***a* support the external gear **461** via the inner side surfaces of the hole parts **461***a* to be swingable about the central axis J.
(72) When the rotary electric machine **400** is supplied with power and the shaft **421** rotates about the central axis J, the external gear **461** linked with the shaft **421** via the bearing swings, while the positions where the inner peripheral surfaces of the hole parts **461** are inscribed with the outer peripheral surfaces of the protrusion parts **472***a* change. Accordingly, the position where the gear part of the external gear **461** and the gear part of the internal gear **462** are meshed with each other changes in the circumferential direction. Therefore, the rotation force of the shaft **421** is transmitted to the internal gear **462** via the external gear **461**. Here, in the embodiment, the internal gear **462** is fixed to the housing **10** and therefore does not rotate. Therefore, due to a reaction force of the rotation force transmitted to the internal gear **462**, the external gear **461** rotates about the eccentric axis J**2**. The orientation in which the external gear **461** rotates at this time is opposite to the orientation in which the shaft **421** rotates. The rotation of the external gear **461** about the eccentric axis J**2** is transmitted to the output flange part **472** via the hole parts **461***a* and the protrusion parts **472***a*. Accordingly, the output flange part **472** and the output shaft **471** rotate about the central axis J. In this way, the rotation of the shaft **421** is decelerated and transmitted to the output shaft **471** via the transmission mechanism **460**.
(73) It may also be that the protrusion parts **472***a* are provided at the external gear **461**, and the hole parts **461***a* are provided at the flange part **472**. In such case, the protrusion parts **472***a* provided at the external gear **461** protrude downward and are inserted into the hole parts **461***a* provided at the output flange part **472**.
(74) The invention is not limited to the above-described embodiments, and other configurations and methods can be adopted within the scope of the technical concept of the invention. The conductive member may be configured as appropriate as long as the conductive member is provided with the connection part and the holding part. The quantity of the conductive member is not particularly limited as long as one or more conductive members are provided. The quantity of the coil lead wire held by the holding part in one conductive member is not particularly limited as long as one or more coil lead wires are provided. For example, in the holding part **50***a* of the conductive member **50** of the first embodiment, it may be that only one coil lead wire **34** is held, and it may also be that three or more coil lead wires **34** are held. It suffices as long as the elastic support piece group is formed by three or more elastic support pieces. For example, the elastic support piece group may be formed by three elastic support pieces, and may also be formed by five or more elastic support

pieces.

(75) The elastic support piece may press the coil lead wire against any part of the conductive member as long as the elastic support piece presses the coil lead wire against other portions of the conductive member in the state of being elastically deformed. For example, the elastic support piece may press the coil lead wire against the protrusion part protruding from the connection part toward the other side in the axial direction.

(76) The rotary electric machine to which the invention is applied is not limited to a motor, and may be a generator. The purpose of the rotary electric machine is not particularly limited. The rotary electric machine may also be mounted to an apparatus other than an electric actuator, such as an electric pump. The rotary electric machine may also be mounted to an apparatus other than a vehicle.

(77) The technology may be configured as follows. (1) A rotary electric machine includes: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the substrate on an other side in the axial direction. The stator has a plurality of coil lead wires extending from the coils toward the side in the axial direction. The conductive member has: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part. The connection part has a first penetration part penetrating through the connection part in the axial direction. The substrate has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part. The coil lead wires pass through the first penetration part and the second penetration part. The coil lead wires passing through the first penetration part and the second penetration part are supported by at least two elastic support pieces on the other side in the axial direction with respect to the first penetration part. Each of the at least two elastic support pieces contacts outer peripheral surfaces of the coil lead wires, is positioned on the side in the axial direction toward the coil lead wires, and, in a state of being elastically deformed, presses the coil lead wires against other portions in the conductive member. The holding part holds two or more coil lead wires by using the elastic support pieces. (2) The rotary electric machine according to (1). In the rotary electric machine, the holding part has a pair of protrusion parts protruding from the connection part to the other side in the axial direction. The elastic support pieces include a pair of elastic support pieces respectively connected with end parts on the other side of the pair of protrusion parts in the axial direction. The pair of elastic support pieces are disposed to face in a first direction intersecting with the axial direction and extend in a second direction intersecting with the axial direction and orthogonal to the first direction. Between the pair of elastic support pieces in the first direction, two or more of the coil lead wires are held at an interval in the second direction. (3) The rotary electric machine according to (2). In the rotary electric machine, the first penetration part is an elongated hole extending in the second direction. The two or more coil lead wires held at the pair of elastic support pieces pass through the first penetration part. (4) The rotary electric machine according to (3). In the rotary electric machine, when viewed in the axial direction, an entirety of a gap between the pair of elastic support pieces is overlapped with the first penetration part. (5) The rotary electric machine according to (4). In the rotary electric machine, the first penetration part is an elongated hole extending in the second direction. When viewed in the axial direction, an entirety of a gap between the pair of elastic support pieces is overlapped with the first penetration part. (6) The rotary electric machine according to (1). In the rotary electric machine, the elastic support pieces include two or more elastic support piece groups. The elastic support piece group include three or more elastic support pieces surrounding one coil lead wire. (7) A rotary electric machine includes: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the

substrate on an other side in the axial direction. The stator has a coil lead wire extending from the coils toward the side in the axial direction. The conductive member includes: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part. The connection part has a first penetration part penetrating through the connection part in the axial direction. The substrate has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part. The coil lead wire passes through the first penetration part and the second penetration part. The elastic support pieces include an elastic support piece group, the elastic support piece group including three or more elastic support pieces surrounding the coil lead wire. The coil lead wire is supported by the elastic support piece group on the other side in the axial direction with respect to the first penetration part. Each of the elastic support pieces included in the elastic support piece group contacts an outer peripheral surface of the coil lead wire, is positioned on the side in the axial direction toward the coil lead wire, and, in a state of being elastically deformed, presses the coil lead wire against other elastic support pieces. (8) The rotary electric machine according to (6) or (7). The holding part has: a pair of first protrusion parts, protruding from the connection part to the other side in the axial direction; and a pair of second protrusion parts, respectively connected with end parts on the other side of the pair of first protrusion parts in the axial direction. Each of the pair of second protrusion parts protrudes toward the other second protrusion part with respect to each other in a first direction intersecting with the axial direction. A slit extending in the first direction is provided at each of the pair of second protrusion parts. The slit splits, in a second direction, a tip end part of the second protrusion part in a protrusion direction, the second direction intersecting with the axial direction and orthogonal to the first direction. The elastic support piece group includes four elastic support pieces. The four elastic support pieces are respectively formed by two portions split in the second direction by the slit in one of the second protrusion parts and two portions split in the second direction by the slit in an other of the second protrusion parts. (9) The rotary electric machine according to any one of (1) to (8). In the rotary electric machine, a plurality of conductive members are provided. (10) An electric actuator includes: the rotary electric machine according to any one of (1) to (9); and a transmission mechanism, linked with the rotor of the rotary electric machine.
(78) Features of the above-described preferred embodiments and the modifications thereof may be combined appropriately as long as no conflict arises. While preferred embodiments of the present disclosure have been described above, it is to be understood that variations and modifications will be apparent to those skilled in the art without departing from the scope and spirit of the present disclosure. The scope of the present disclosure, therefore, is to be determined solely by the following claims.

Claims

1. A rotary electric machine, comprising: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the substrate on an other side in the axial direction, wherein the stator has a plurality of coil lead wires extending from the coils toward the side in the axial direction, the conductive member has: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part, the connection part has a first penetration part penetrating through the connection part in the axial direction, the substrate has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part, the coil lead wires pass through the first penetration part and the second penetration part, the coil lead wires passing through the first penetration part and the second penetration part are supported by at least two

elastic support pieces on the other side in the axial direction with respect to the first penetration part, each of the at least two elastic support pieces contacts outer peripheral surfaces of the coil lead wires, is positioned on the side in the axial direction toward the coil lead wires, and, in a state of being elastically deformed, presses the coil lead wires against other portions in the conductive member, and the holding part holds two or more coil lead wires by using the elastic support pieces.
2. The rotary electric machine as claimed in claim 1, wherein the holding part has a pair of protrusion parts protruding from the connection part to the other side in the axial direction, the elastic support pieces comprise a pair of elastic support pieces respectively connected with end parts on the other side of the pair of protrusion parts in the axial direction, the pair of elastic support pieces are disposed to face in a first direction intersecting with the axial direction and extend in a second direction intersecting with the axial direction and orthogonal to the first direction, and between the pair of elastic support pieces in the first direction, two or more of the coil lead wires are held at an interval in the second direction.
3. The rotary electric machine as claimed in claim 2, wherein the first penetration part is an elongated hole extending in the second direction, and the two or more coil lead wires held at the pair of elastic support pieces pass through the first penetration part.
4. The rotary electric machine as claimed in claim 3, wherein, when viewed in the axial direction, an entirety of a gap between the pair of elastic support pieces is overlapped with the first penetration part.
5. The rotary electric machine as claimed in claim 4, wherein the second penetration part is an elongated hole extending in the second direction, and when viewed in the axial direction, the entirety of the gap between the pair of elastic support pieces is overlapped with the second penetration part.
6. The rotary electric machine as claimed in claim 1, wherein the elastic support pieces comprise two or more elastic support piece groups, the elastic support piece group comprising three or more elastic support pieces surrounding one coil lead wire.
7. The rotary electric machine as claimed in claim 6, wherein the holding part has: a pair of first protrusion parts, protruding from the connection part to the other side in the axial direction; and a pair of second protrusion parts, respectively connected with end parts on the other side of the pair of first protrusion parts in the axial direction, wherein each of the pair of second protrusion parts protrudes toward the other second protrusion part with respect to each other in a first direction intersecting with the axial direction, a slit extending in the first direction is provided at each of the pair of second protrusion parts, the slit splits, in a second direction, a tip end part of the second protrusion part in a protrusion direction, the second direction intersecting with the axial direction and orthogonal to the first direction, the elastic support piece group comprises four elastic support pieces, and the four elastic support pieces are respectively formed by two portions split in the second direction by the slit in one of the second protrusion parts and two portions split in the second direction by the slit in an other of the second protrusion parts.
8. The rotary electric machine as claimed in claim 1, wherein a plurality of conductive members are provided.
9. An electric actuator, comprising: the rotary electric machine as claimed in claim 1; and a transmission mechanism, linked with the rotor of the rotary electric machine.
10. A rotary electric machine, comprising: a rotor, rotatable about a central axis extending in an axial direction as a center; a stator, having a plurality of coils and facing the rotor via a gap; a substrate, positioned on a side of the stator in the axial direction; and a conductive member, attached to a surface of the substrate on an other side in the axial direction, wherein the stator has a coil lead wire extending from the coils toward the side in the axial direction, the conductive member has: a connection part, electrically connected with the substrate; and a holding part, having a plurality of elastic support pieces and connected with the connection part, the connection part has a first penetration part penetrating through the connection part in the axial direction, the substrate

has a second penetration part penetrating through the substrate in the axial direction and, when viewed in the axial direction, overlapped with the first penetration part, the coil lead wire passes through the first penetration part and the second penetration part, the elastic support pieces comprise an elastic support piece group, the elastic support piece group comprising three or more elastic support pieces surrounding the coil lead wire, the coil lead wire is supported by the elastic support piece group on the other side in the axial direction with respect to the first penetration part, and each of the elastic support pieces comprised in the elastic support piece group contacts an outer peripheral surface of the coil lead wire, is positioned on the side in the axial direction toward the coil lead wire, and, in a state of being elastically deformed, presses the coil lead wire against other elastic support pieces.