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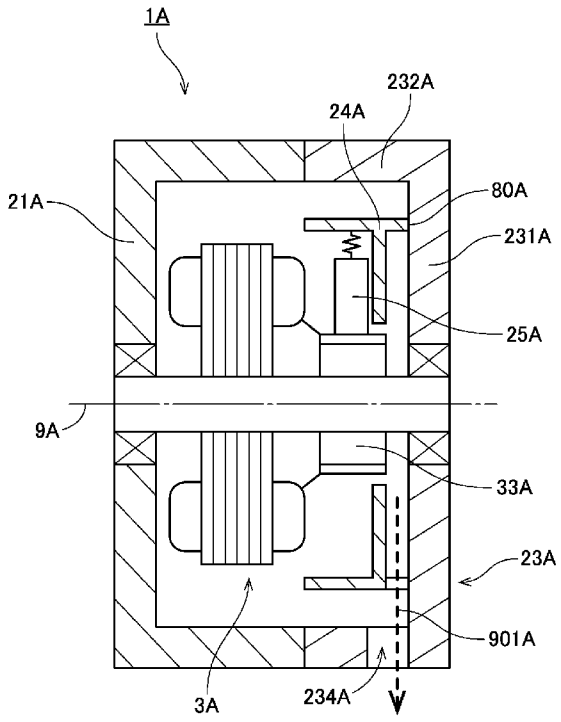
(54) **Title**: MOTOR



(57) **Abstract**: A motor includes a housing and a back cover. Further, the motor includes a brush card disposed in a casing constituted by the housing and the back cover, and a brush disposed forward of the brush card. The back cover includes a through-hole in the vicinity of a lower end portion of a first circumferential wall portion. Further, the back cover and the brush card are in contact with each other in a substantially annular shape, in a radially inner side of an inner circumferential surface of the first circumferential wall portion via a gap. Further, the contact portion is disconnected, or the brush card is radially penetrated at a position that radially overlaps with the through-hole. Accordingly, both of a droplet which infiltrates between the first circumferential wall portion and the contact portion and a droplet which infiltrates radially inside the contact portion flow along an inner surface of the back cover and are discharged outside the back cover through the through-hole. Accordingly, it is possible to efficiently discharge the droplets from the inside of the back cover. As a result, it is possible to suppress the droplets from adhering to the brush.

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Description

Title of Invention: MOTOR

Technical Field

[0001] The present invention relates to a motor.

Background Art

[0002] Hitherto, a motor having a brush has been known. The structure of a motor having a brush is described in,

for example, Japanese Patent Publication No. 3971349. The motor in the publication includes a rotatable armature and a brush which is in sliding

contact with a commutator of the armature (Paragraphs 0018 to 0019). In addition, the brush in the publication is connected to an external power source,

and supplies electric power to the armature via the commutator (paragraph 0019).

Citation List

Patent Literature

[0003] [PTL 1] Japanese Patent Publication No. 3971349

Summary of Invention

Technical Problem

[0004] There may be a case where the motor having the brush is used in an environment in which liquid droplets

are likely to be present, for example, the inside of a vehicle. In this case, it is preferable that liquid droplets be prevented from, at least, adhering to the

brush which is a conductor. To achieve this, it is necessary to efficiently discharge the droplet from the inside of a cover which accommodates the brush.

In particular, in a case where a brush card that supports the brush is disposed

inside the cover, it is necessary to secure drainage so that the droplet does

not remain in the brush card.

[0005] An object of the present invention is to provide, in a motor having a brush, a structure capable of

efficiently discharging liquid droplets from the inside of a cover and suppressing the droplets from adhering to the brush.

Solution to Problem

[0006] The first exemplary aspect of the present invention includes a rotating portion, a housing, a back cover, a

brush card, and a brush. The rotating portion is supported to be rotatable centered on a central axis which substantially horizontally extends in a

front-rear direction. Further, the rotating portion includes a commutator. The housing

is of a substantially cup shape which accommodates at least a portion of the rotating portion. The back cover is disposed rear of the housing, and is of a substantially cup shape which, together with the housing, constitutes a casing. The brush card is disposed in the casing and extends in a direction orthogonal to the central axis. The brush is disposed forward of the brush card and is in contact with the commutator. Further, the back cover includes a first rear wall portion, a first circumferential wall portion, and a through-hole. The first rear wall portion extends in the direction orthogonal to the central axis in a rear side of the brush card. The first circumferential wall portion is of a substantially cylindrical shape which extends forward from an outer circumferential portion of the first rear wall portion. The through-hole vertically penetrates through the first circumferential wall portion in the vicinity of a lower end portion of the first circumferential wall portion. The back cover or the brush card includes a contact portion of a substantially annular shape at which the back cover and the brush card are in contact. The back cover and the brush card are in contact with each other in a radially inner side of an inner circumferential surface of the first circumferential wall portion via a gap. The contact portion is disconnected at a position which radially overlaps with the through-hole. Or, the brush card is penetrated radially outward from the radially inner side than the contact portion at the position which radially overlaps with the through-hole.

[0007] According to the exemplary embodiment of the invention, both a droplet that infiltrates between the first circumferential wall portion and the contact portion and a droplet that infiltrates radially inside the contact portion flow along an inner surface of the back cover and are discharged outside the back cover through the through-hole. Thus, the motor 1 is capable of efficiently discharging the droplet from the inside the back cover. As a result, the motor 1 is capable of suppressing the droplets from adhering to the brush.

Brief Description of Drawings

[0008] Fig. 1 is a longitudinal cross-sectional view of a motor according to a first embodiment.

Fig. 2 is a view of the inside of the motor according to the first embodiment, viewed from the front.

Fig. 3 is a longitudinal cross-sectional view of a motor according to a second embodiment.

Fig. 4 is a view of a back cover, a brush card, and a connector member according to the second embodiment, viewed from the front.

Fig. 5 is a partial longitudinal cross-sectional view of the back cover, the brush card, and the connector member according to the second embodiment.

Fig. 6 is a top view of the connector member according to the second embodiment.

Fig. 7 is a view of the connector member according to the second embodiment, viewed from the front.

Fig. 8 is a bottom view of the connector member according to the second embodiment.

Fig. 9 is a view of the back cover according to the second embodiment, viewed from the front.

Fig. 10 is a partial transverse cross-sectional view of a housing, the back cover, the brush card, and the connector member according to the second embodiment.

Fig. 11 is a partial cross-sectional view of the housing, the back cover, and the brush card according to the second embodiment.

Fig. 12 is a partial longitudinal cross-sectional view of the housing, the back cover, and the brush card according to the second embodiment.

Fig. 13 is a partial longitudinal cross-sectional view of a housing, a back cover, and a brush card according to a modified embodiment.

Fig. 14 is a partial longitudinal cross-sectional view of a housing, a back cover, and a brush card according to another modified embodiment.

Examples

[0009] Hereinafter, an exemplary embodiment of the present invention will be described. In addition, in the present invention, a direction parallel to the center axis of a motor is referred to as an "axial direction", a direction orthogonal to the center axis

of the motor is referred to as a "radial direction", and a direction along the arc about the center axis of the motor as the center is referred to as a "circumferential direction". In addition, in the present invention, shapes and positional relationships of portions are described assuming that the axial direction is a forward and rearward direction and a housing side with respect to a back cover is a forward direction. In addition, a "parallel direction" in the present invention includes a substantially parallel direction. In addition, an "orthogonal direction" in the present invention includes a substantially orthogonal direction.

[0010] <

1. First embodiment>

Fig. 1 is a longitudinal cross-sectional view of a motor 1A according to a first embodiment.

Fig. 2 is a view of the inside of the motor 1A viewed from the front. As illustrated in Figs. 1 and 2, the motor 1A has a rotating portion 3A, a housing

21A, a back cover 23A, a brush card 24A, and a brush 25A. The rotating portion 3A is supported to be rotatable centered on a center axis 9A which substantially

horizontally extends from the front to the rear. In addition, the rotating portion 3A has a commutator 33A.

[0011] The housing 21A is a substantially cup-shaped member. At least a portion of the rotating portion 3A

is accommodated in the housing 21A. The back cover 23A is a substantially cup-shaped member which is disposed rearward of the housing 21A. The commutator

33A, the brush card 24A and the brush 25A are disposed in a casing constituted by the housing 21A and the back cover 23A. The brush card 24A extends in a

direction orthogonal to the central axis 9A. Further, the brush 25A is disposed forward of the brush card 24A, and is in contact with the commutator

33A.

[0012] The back cover 23A includes a first rear wall portion 231A, a first circumferential wall portion 232A, and a

through-hole 234A. The first rear wall portion 231A extends in the direction orthogonal to the central axis 9A in a rear side of the brush card 24A. The

first circumferential wall portion 232A extends forward from an outer circumferential portion of the first rear wall portion 231A in a substantially

cylindrical shape. The through-hole 234A penetrates up and down through the first circumferential wall portion 232A in the vicinity of a lower end portion

of the first circumferential wall portion 232A.

[0013] Further, as shown in Fig. 1, the back cover 23A and the brush card 24A are in contact

with each other at a
substantially annular contact portion 80A which is positioned radially inward of an inner circumferential surface of the first circumferential wall portion 232A. That is, the back cover 23A or the brush card 24A has the contact portion 80A of the substantially annular shape. A gap is provided between the inner circumferential surface of the first circumferential wall portion 232A and the contact portion 80A. Further, the contact portion 80A is disconnected at a position overlapped with the through-hole 234A in the radial direction.

[0014] In the motor 1, if liquid droplets infiltrate radially inward of the contact portion 80A, the droplets flow along an inner surface of the back cover 23A as indicated by the broken line arrow 901A in Fig. 1. And then, the droplets are discharged to the outside of the back cover 23A through the through-hole 234A. Further, if liquid droplets infiltrate between the first circumferential wall portion 232A and the contact portion 80A, the droplets flow along the inner surface of the back cover 23A as indicated by the broken line arrow 902A in Fig. 2. And then, the droplets are discharged to the outside the back cover 23A through the through-hole 234A. Accordingly, the motor 1 is capable of efficiently discharging the droplets from the inside of the back cover 23A. As a result, the motor 1 is capable of suppressing the droplets from adhering to the brush 25A.

[0015] <2. Second embodiment>

<2-1. Overall configuration of motor>

Subsequently, a second embodiment of the present invention will be described.

Fig. 3 is a longitudinal cross-sectional view of a motor 1 according to a second embodiment. The motor of this embodiment is mounted in, for example, a vehicle and is used as a driving source of an engine cooling fan. As illustrated in Fig. 3, the motor 1 has a stationary portion 2 and a rotating portion 3. The stationary portion 2 is fixed to a frame body of an apparatus which is a driving object. The rotating portion 3 is supported to be rotatable with respect to the stationary portion 2.

[0016] The stationary portion 2 of this embodiment includes a housing 21, a plurality of magnets 22, a back cover 23, a brush card 24, a plurality of brushes 25, a connector member 26, a front bearing portion 27, and a rear bearing portion 28. Fig. 4 is a view of the back cover 23, the brush card 24, and the connector member 26 viewed from the front.

The following description will be provided appropriately with reference to Fig. 4 together with Fig. 3.

[0017] The housing 21 is a substantially cup-shaped member which is opened rearward. At least a portion of the rotating portion 3 is accommodated in the housing 21. The housing 21 is formed of, for example, a metal such as a galvanized steel sheet. However, another material such as a resin may also be used as the material of the housing 21.

[0018] As shown in Fig. 3, the housing 21 includes a front wall portion 211 and a front circumferential wall portion 212. The front wall portion 211 extends in a substantially disk-like shape in a direction orthogonal to a central axis 9 in front of an armature 32 which will be described later. A front bearing holding portion 213 which holds the front bearing portion 27 is provided at the center of the front wall portion 211. The front circumferential wall portion 212 extends rearward from an outer circumferential portion of the front wall portion 211 in a substantially cylindrical shape.

[0019] The plurality of magnets 22 are fixed to an inner circumferential surface of the front circumferential wall portion 212. The radially inner surfaces of the plurality of magnets 22 correspond to magnetic pole surfaces which radially oppose the armature 32 which will be described later. The plurality of magnets 22 are arranged at substantially uniform intervals in the circumferential direction so that the magnetic pole surface of N pole and the magnetic pole surface of S pole are alternately arranged. In addition, instead of the plurality of magnets 22, a single annular magnet in which the N poles and the S poles are alternately magnetized in the circumferential direction may be used.

[0020] The back cover 23 is a substantially cup-shaped member which is opened forward. The back cover 23 is disposed rearward of the housing 21. The back cover 23 is formed of, for example, a metal such as a galvanized steel sheet. However, another material such as a resin may also be used as the material of the back cover 23. The plurality of magnets 22, the brush card 24, the plurality of brushes 25, the armature 32 which will be described later, and the commutator 33 which will be described later are accommodated in a casing constituted by the housing 21 and the back cover 23.

[0021] As shown in Figs. 3 and 4, the back cover 23 includes a first rear wall portion 231 and a first

circumferential wall portion 232. The first rear wall portion 231 extends, in the rear side of the brush card 24, in a substantially disk-like shape in a direction orthogonal to the central axis 9. A rear bearing holding portion 233 which holds the rear bearing portion 28 is provided at the center of the first rear wall portion 231. The first circumferential wall portion 232 extends forward from an outer circumferential portion of the first rear wall portion 231 in a substantially cylindrical
shape.

[0022] The first circumferential
wall portion 232 includes a through-hole 234 and a cut-out 235. As shown in Fig. 3, the through-hole 234 penetrates up and down through the first circumferential wall portion 232 in the vicinity of a lower end of the first circumferential wall portion 232. Further, as shown in Fig. 4, the cut-out 235 radially penetrates through the first circumferential wall portion 232 in the upper side of the through-hole 234. In this embodiment, the cut-out 235 is disposed at a position having substantially the same height as that of the central axis 9, that is, at a position separated from the through-hole 234 by about 90 degrees with respect to the central axis
9.

[0023] The brush card 24 is
disposed forward of the first rear wall portion 231 and radially inward of the first circumferential wall portion 232. As a material of the brush card 24, for example, a resin which is an insulator is used. As shown in Figs. 3 and 4, the brush card 24 includes a second rear wall portion 241 and a second circumferential wall portion 242. The second rear wall portion 241 extends, in the front side of the first rear wall portion 231, in a substantially disk-like shape in the direction orthogonal to the central axis 9. A circular hole 243 for disposing the rear bearing holding portion 233 or the commutator 33 which will be described later is provided at the center of the second rear wall portion 241. The second circumferential wall portion 242 extends forward from an outer circumferential portion of the second rear wall portion 241 in a substantially cylindrical shape.

[0024] The plurality of brushes 25
are held by the brush card 24. Each brush 25 is a conductor which is in contact with the commutator 33 which will be described later. As shown in Fig. 3, in this embodiment, the plurality of brushes 25 are disposed forward of the second rear wall portion 241 and radially inward of the second circumferential wall portion 242. Accordingly, liquid droplets are suppressed from adhering to the

brush 25. Each brush 25 includes a contact surface 251 which is in contact with a segment 331 of the commutator 33. Further, each brush 25 is biased radially inward by a spring 252 interposed between the brush 25 and the second circumferential wall portion 242. Accordingly, the contact surface 251 is pressed against the segment 331. As a result, the brush 25 and the segment 331 are electrically connected to each other.

[0025] The connector member 26 is a member which supports lead wires that connect the brushes 25 to an external power source. As a material of the connector member 26, for example, a resin that is an insulator is used. The connector member 26 is disposed in the radially outer side of the brush card 24. Further, the connector member 26 is fixed to the back cover 23 in the state of being fitted to the cut-out 235 of the back cover 23.

[0026] Further, the connector member 26 includes one or a plurality of communication holes 261. The communication hole 261 penetrates through the connector member 26 in the radial direction. The lead wire that extends from the external power source is connected to the brush 25 through the communication hole 251 of the connector member 26.

[0027] The front bearing portion 27 and the rear bearing portion 28 are mechanisms that rotatably support a shaft 31 of the rotating portion 3. As the front bearing portion 27 and the rear bearing portion 28 of this embodiment, for example, a ball bearing which rotates an outer race and an inner race relatively with respect to each other via a spherical body is used. The outer race of the front bearing portion 27 is fixed to the front bearing holding portion 213 of the housing 21. The outer race of the rear bearing portion 28 is fixed to the rear bearing holding portion 233 of the back cover 23. Further, each inner race of the front bearing portion 27 and the rear bearing portion 28 is fixed to the shaft 31. Here, instead of the ball bearing, other types of bearings such as a sliding bearing or a fluid bearing may be used.

[0028] The rotating portion 3 of this embodiment includes the shaft 31, the armature 32, and the commutator 33.

[0029] The shaft 31 is disposed along the central axis 9 that substantially horizontally extends in the front-rear direction. The shaft 31 is supported by the front bearing portion 27

and the rear bearing portion 28, and rotates centered on the central axis 9. Further, the shaft 31 includes a head portion 311 which protrudes more forward than the front wall portion 211 of the housing 21. A component which is a driving object, for example, an impeller is mounted to the head portion 311.

[0030] The armature 32 is disposed radially inward of the plurality of magnets 22. The armature 32 includes an armature core 41 and a coil 42. The armature core 41 is formed of, for example, a laminated steel sheet. The armature core 41 includes a core back 411 of an annular shape, and a plurality of teeth 412 which protrude radially outward from the core back 411. The shaft 31 is press-fitted into the radial inside of the core back 411. The plurality of teeth 412 are arranged at uniform intervals in the circumferential direction. The coil 42 is constituted by a conducting wire wound on the teeth 412.

[0031] The commutator 33 is fixed to the shaft 31 in the rear side of the armature 32. A plurality of conductive segments 331 are provided at uniform intervals in the circumferential direction on an outer circumferential surface of the commutator 33. Further, the conducting wire led out from the coil 42 is electrically connected to each segment 331.

[0032] Driving current supplied from the external power source flows to the coil 42 through the lead wire, the brush 25 and the segment 331. When the drive current is supplied to the coil 42, a magnetic flux is generated in the teeth 412. Further, a circumferential torque is generated by magnetic attraction or magnetic repulsion between the teeth 412 and the magnets 22. As a result, the rotating portion 3 rotates centered on the central axis 9 with respect to the stationary portion 2. Further, when the commutator 33 rotates, the contact surfaces 251 of the respective brushes 25 sequentially come into contact with the plurality of segments 331. Thus, the driving current is sequentially supplied to the plurality of coils 42. Consequently, the rotating portion 3 continuously rotates.

[0033] <2-2. Drainage structure> Subsequently, a drainage structure of the motor 1 according to this embodiment will be described.

[0034] Fig. 5 is a partial

longitudinal cross-sectional view of the back cover 23, the brush card 24 and the connector member 26. As shown in Figs. 4 and 5, the connector member 26 includes a pair of protruding portions 51. The pair of protruding portions 51 protrude radially inward from both circumferential end portions of the connector member 26. On the other hand, the second circumferential wall portion 242 of the brush card 24 includes a pair of recessed portions 52. The pair of protruding portions 51 are fitted into the pair of recessed portions 52, respectively.

[0035] As shown in Fig. 5, in this embodiment, at least one of both end surfaces in the circumferential direction of the protruding portion 51 and the end surface in the radially inner side of the protruding portion 51 are in contact with the surface of the recessed portion 52. That is, the protruding portion 51 and the recessed portion 52 come into contact with each other at a plurality of surfaces which are continuous. Accordingly, infiltration of liquid droplets into the radial inside from the boundary portion between the connector member 26 and the brush card 24 is suppressed.

[0036] Fig. 6 is a top view of the connector member 26. Fig. 7 is a view of the connector member 26, viewed from the front. Fig. 8 is a bottom view of the connector member 26. As shown in Figs. 6 to 8, a flow path groove 60 is provided on the outer surface of the connector member 26. When liquid droplets such as water droplets adhere to the outer surface of the connector member 26, the liquid droplets are collected in the flow path groove 60 by gravity and surface tension.

[0037] The flow path groove 60 includes an upper axial groove 61, a front circumferential groove 62, a lower axial groove 63, and a rear circumferential groove 64. As shown in Figs. 6 and 7, the upper axial groove 61 axially extends on an upper surface of the connector member 26. As shown in Figs. 6 to 8, the front circumferential groove 62 circumferentially and vertically extends on the surface of the front side of the connector member 26. As shown in Figs. 7 and 8, the lower axial groove 63 axially extends on a lower surface of the connector member 26. Further, as shown in Figs. 6 and 8, the rear circumferential groove 64 circumferentially and vertically extends on the surface of the rear side of the connector member 26.

[0038] Liquid droplets collected in the flow path groove 60 flow toward the lower axial groove 63 by gravity.

Particularly, in this embodiment, the upper axial groove 61, the front circumferential groove 62, the lower axial groove 63, and the rear circumferential groove 64 are connected in an annular shape. Therefore, the liquid droplets collected in the upper axial groove 61 reach the lower axial groove 63 even when flowing to any of the front circumferential groove 62 and the rear circumferential groove 64. Accordingly, the liquid droplets are efficiently collected in the lower axial groove 63.

[0039] Further, as shown in Fig. 5, in this embodiment, a base end portion 511 of the protruding portion 51 of the connector member 26 is positioned in the radially outer side than the outer circumferential surface of the second circumferential wall portion 242 of the brush card 24. Accordingly, liquid droplets are suppressed from staying in the boundary between the second circumferential wall portion 242 and the protruding portion 51. Liquid droplets adhering to the outer circumferential surface of the second circumferential wall portion 242 flow toward the upper axial groove 61 along the base end portion 511 of the protruding portion 51 as indicated by the broken line arrow 91 in Fig. 5.

[0040] Further, as shown in Figs. 6 to 8, the connector member 26 of this embodiment includes an inner dike surface 65 in the radially inner side of the flow path groove 60. The inner dike surface 65 extends radially inward from the edge of the radially inner side of the flow path groove 60. Further, the inner dike surface 65 is in contact with the housing 21 or the back cover 23. Accordingly, infiltration of liquid droplets into the radially inner side from the flow path groove 60 is suppressed.

[0041] In addition, as shown in Figs. 5 and 6, the connector member 26 of this embodiment includes a tapered surface 66 in the radially inner side of the upper axial groove 61. The tapered surface 66 is inclined so that the height thereof increases as it heads radially inward from the edge of the radially inner side of the upper axial groove 61. Therefore, even if liquid droplets collected in the upper axial groove 61 overflow from the upper axial groove 61, the liquid droplets return to the upper axial groove 61 due to tapered surface 66. Accordingly, infiltration of liquid droplets into the radially inner side is further suppressed.

[0042] As shown in Fig. 5, the tapered surface 66 is disposed radially inward than the first circumferential

wall portion 232 of the back cover 23. Therefore, liquid droplets that flow toward the base end portion 511 of the protruding portion 51 from the outer circumferential surface of the second circumferential wall portion 242 are collected in the upper axial groove 61 through a space between the first circumferential wall portion 232 and the tapered surface 66 as indicated by the broken line arrow 91 in Fig. 5.

[0043] Further, as shown in Fig. 6, the upper axial groove 61 in this embodiment includes a portion of which the width in the radial direction increases as it heads forward. The flow resistance of the portion increases as it heads toward the rear. Therefore, the liquid droplets collected in the upper axial groove 61 are guided forward as indicated by the broken line arrow 92 in Fig. 6. Further, liquid droplets that flow forward from the upper axial groove 61 flow to the lower axial groove 63 through the front circumferential groove 62.

[0044] Further, as shown in Fig. 8, the connector member 26 of this embodiment includes a guide groove 67 in the radially inner side of the lower axial groove 63. The guide groove 67 extends radially inward from the lower axial groove 63. Further, the lower axial groove 63 of this embodiment includes a portion of which the width in the radial direction increases as it heads toward the guide groove 67. The flow resistance of the portion decreases as it heads toward the guide groove 67. Therefore, the liquid droplets collected in the lower axial groove 63 are guided to the guide groove 67 side as indicated by the broken line arrow 93 in Fig. 8.

[0045] Fig. 9 is a view of the back cover 23, when viewed from the front. The cut-out 235 of the back cover 23 includes an opposing surface 236 positioned in the lower side of the connector member 26. The opposing surface 236 vertically opposes the guide groove 67 of the connector member 26. Further, the inner surface of the back cover 23 includes a flow path surface 70 which continues from the opposing surface 236 to the through-hole 234. Liquid droplets collected in the flow path groove 60 of the connector member 26 flow to the opposing surface 236 from the guide groove 67. Accordingly, the liquid droplets flow down the flow path surface 70 to the through-hole 234 as indicated by the broken line arrows 94 and 95 in Fig. 9 and are discharged to the outside of the back cover 23.

[0046] In this way, in the motor 1

of this embodiment, liquid droplets adhering to the connector member 26 flow down the flow path groove 60 and the flow path surface 70 and are discharged to the outside of the back cover 23 through the through-hole 234. Therefore, in the motor 1, liquid droplets can be suppressed from adhering to the brush 25 without the need for an O-ring or a gasket as an essential component. As a result, the number of components of the motor 1 can be suppressed and the manufacturing cost can also be suppressed.

[0047] Fig. 10 is a partial transverse cross-sectional view of the housing 21, the back cover 23, the brush card 24, and the connector member 26. As shown in Fig. 10, the connector member 26 of this embodiment includes a plate-like protruding portion 262 in the radially inner side of the rear circumferential groove 64. The plate-like protruding portion 262 extends radially inward along the surface in the front side of the first rear wall portion 231. The surface in the rear side of the plate-like protruding portion 262 is in contact with the surface in the front side of the first rear wall portion 231. In addition, the end edge portion in the radially inner side of the plate-like protruding portion 262 is positioned in the radially inner side than the end edge portion in the radially outer side of the brush card 24.

[0048] Therefore, even if liquid droplets infiltrate into the radial inside from a space between the first rear wall portion 231 and the plate-like protruding portion 262, the liquid droplets flow along the surface in the front side of the first rear wall portion 231 as indicated by the broken line arrow 96 in Fig. 10. Accordingly, liquid droplets are suppressed from infiltrating into the front side of the brush card 24. As a result, adhesion of the liquid droplets to the brush 25 is further suppressed.

[0049] Figs. 11 and 12 are partial cross-sectional views of the housing 21, the back cover 23, and the brush card 24. Fig. 12 illustrates a longitudinal cross-section including the through-hole 234. Fig. 11 illustrates a cross-section at a different position in the circumferential direction from that of Fig. 12. As shown in Fig. 11, the first rear wall portion 231 of the back cover 23 includes an inner rear wall portion 81, an inner circumferential wall portion 82, and an outer rear wall portion 83. The inner rear wall portion 81 extends in the direction orthogonal to the center axis 9 in the rear side having a gap from the second rear wall portion 241 of the brush card. The inner circumferential wall portion 82 extends forward from the outer circumferential portion of the inner rear wall portion 81 in a

substantially cylindrical shape. The outer rear wall portion 83 extends radially outward from the front end portion of the inner circumferential wall portion 82. The end edge portion in the radially outer side of the outer rear wall portion 83 is connected to the rear end portion of the first circumferential wall portion 232.

[0050] Further, the brush card 24 includes a leg portion 244 of substantially annular shape. The leg portion 244 extends rearward from the outer circumferential portion of the second rear wall portion 241. Further, in this embodiment, the outer rear wall portion 83 of the back cover 23 and the leg portion 244 of the brush card 24 are in contact with each other at a substantially annular contact portion 80. That is, the back cover 23 or the brush card 24 has the substantially annular contact portion 80. The contact portion 80 is positioned in the radially inner side having a gap from the inner circumferential surface of the first circumferential wall portion 232.

[0051] As shown in Figs. 9 and 11, the flow path surface 70 of the back cover 23 includes a first flow path surface 71 and a second flow path surface 72. The first flow path surface 71 is positioned in the radially outer side than the contact portion 80. Further, the first flow path surface 71 belongs to the inner circumferential surface of the first circumferential wall portion 232 and the surface in the front side of the outer rear wall portion 83. The second flow path surface 72 is positioned radially inward than the contact portion 80. The second flow path surface 72 belongs to the surface on the front side of the inner rear wall portion 81 and the inner circumferential surface of the inner circumferential wall portion 82.

[0052] Liquid droplets infiltrated between the first circumferential wall portion 232 and the contact portion 80 flow down the first flow path surface 71 to the through-hole 234 as indicated by the broken line arrow 94 in Figs. 9 and 12. Further, liquid droplets infiltrated into the radially inner side than the contact portion 80 flow down the second flow path surface 72 to the through-hole 234 as indicated by the broken line arrow 95 in Figs. 9 and 12. In this way, the motor 1 of this embodiment may discharge liquid droplets infiltrated into the back cover 23 through two paths. That is, in the motor 1, liquid droplets that are present in any of the radially outer side and the radially inner side of the contact portion 80 can also be discharged to the outside of the back cover 23 through the through-hole 234. Therefore, in the motor 1, the liquid droplets can be efficiently discharged

from the inside of the back cover 23. As a result, in the motor 1, the liquid droplets can be suppressed from adhering to the brush 25.

[0053] Further, as shown in Fig. 9, the inner circumferential wall portion 82 and the outer rear wall portion 83 are not provided at a position that overlaps with the through-hole 234 in the radial direction. Therefore, as shown in Fig. 12, the contact portion 80 is disconnected at the position that overlaps with the through-hole 234 in the radial direction. Therefore, in the motor 1, liquid droplets that flow down the second flow path surface 72 can flow to the through-hole 234 through the portion where the contact portion 80 is disconnected. Particularly, in this embodiment, as in Fig. 9, the surface in the front side of the inner rear wall portion 81 is a flat surface without stepped portions. Therefore, in the motor 1, liquid droplets can more efficiently flow along the second flow path surface 72 to the through-hole 234.

[0054] Liquid droplets discharged from the through-hole 234 are not only the liquid droplets that are guided to the back cover 23 through the flow path groove 60 of the connector member 26. For example, liquid droplets infiltrated through a through-hole provided in the housing 21 or liquid droplets infiltrated from the boundary portion between the housing 21 and the back cover 23 also flow down the first flow path surface 71 and the second flow path surface 72 and are discharged to the outside of the back cover 23 through the through-hole 234.

[0055] Further, as shown in Fig. 11, in this embodiment, the inner circumferential surface of the first circumferential wall portion 232 of the back cover 23 and the outer circumferential surface of the second circumferential wall portion 242 of the brush card 24 oppose each other via a gap in the radial direction. Accordingly, movement of liquid droplets from the first flow path surface 71 toward the brush 25 is further suppressed.

[0056] Further, as shown in Fig. 11, in this embodiment, the surface in the front side of the first rear wall portion 231 of the back cover 23 and the surface in the rear side of the second rear wall portion 241 of the brush card 24 oppose each other via a gap in the axial direction. Accordingly, movement of liquid droplets from the second flow path surface 72 to the brush 25 is further suppressed. In this embodiment, the gap in the axial direction is formed by allowing the outer rear wall portion 83

of the back cover 23 and the leg portion 244 of the brush card 24 to come into contact with each other. However, one of the outer rear wall portion 83 and the leg portion 244 may also be
omitted.

[0057] Further, the motor 1 of
this embodiment brings cooling air into the housing 21 and the back cover 23 when driving. Specifically, as indicated by the broken line arrow 97 in Fig. 12, gas flows into the back cover 23 through the through-hole 234. The air current occurs due to the rotation of the rotating portion 3. The brush 25 and the coil 42 are cooled by the gas.

[0058] Here, in this embodiment,
the front end portion of the second circumferential wall portion 242 of the brush card 24 is positioned forward than the through-hole 234. Therefore, the gas indicated by the arrow 97 is suppressed from being directly blown to the radial inside of the second circumferential wall portion 242. Therefore, even though liquid droplets are mixed with the gas indicated by the arrow 97, infiltration of the liquid droplets to the radially inner side than the second circumferential wall portion 242 is
suppressed.

[0059] In addition, as illustrated
in Fig. 12, the brush card 24 of this embodiment has an overhang portion 245. The overhang portion 245 protrudes radially outward from the outer circumferential surface of the second circumferential wall portion 242. In addition, the overhang portion 245 is positioned forward than the rear end portion of the through-hole 234. Accordingly, inflow of the gas indicated by the arrow 97 toward the front is further suppressed. Particularly, in this embodiment, the radially outer surface of the overhang portion 245 is an inclined surface 246 which is displaced forward as it heads radially outward. In addition, the surface in the front side of the overhang portion 245 comes into contact with the rear end portion of the housing 21. Accordingly, inflow of the gas toward the front is further
suppressed.

[0060] <3. Modified
Embodiment>
While the exemplary
embodiments of the present invention have been described above, the present invention is not limited to the embodiments described
above.

[0061] Fig. 13 is a partial longitudinal cross-sectional view of a housing 21B, a back cover 23B, and a brush card 24B according to a modified embodiment. In the embodiment of Fig. 13, a gap in the radial direction is interposed between an overhang portion 245B and the inner circumferential surface of a first circumferential wall portion 232B or the inner circumferential surface of a front circumferential wall portion 212B. In this manner, as indicated by the arrow 98 in Fig. 13, liquid droplets infiltrated into the housing 21B can flow down the inner circumferential surface of the front circumferential wall portion 212B and the inner circumferential wall surface of the first circumferential wall portion 232B and can be discharged to the outside of the back cover 23B through a through-hole 234.

[0062] Particularly, in the embodiment of Fig. 13, the surface in the front side of the overhang portion 245B is an inclined surface 246B which is displaced rearward as it heads radially outwards. Therefore, in the structure of the embodiment of Fig. 13, in the radially outer side of the overhang portion 245B, liquid droplets can be guided toward the through-hole 234B more efficiently.

[0063] Fig. 14 is a partial longitudinal cross-sectional view of a housing 21C, a back cover 23C, and a brush card 24C according to another modified embodiment. In the embodiment of Fig. 14, a contact portion 80C between the back cover 23C and the brush card 24C is not disconnected at a position that overlaps with a through-hole 234C in the radial direction. That is, even at the position that overlaps with the through-hole 234C in the radial direction, a first rear wall portion 231C of the back cover 23C and a leg portion 244C of the brush card 24C are in contact with each other.

[0064] However, in the embodiment of Fig. 14, at a position that overlaps with the through-hole 234C in the radial direction, the leg portion 244C of the brush card 24C has a flow path hole 247C that penetrates from the radially inner side than the contact portion 80C to the radially outer side. Therefore, liquid droplets that flow down a second flow path surface 72C can flow toward the through-hole 234 through the flow path hole 247C. In addition, the leg portion 244C may also be provided with a cut-out instead of the flow path hole 247C

[0065] The motor of the present invention may be a motor for rotating an in-vehicle fan or may also be a motor

used for other purposes. For example, the motor of the present invention may also be used as a driving source of power steering of a vehicle. In addition, the motor may also be mounted in home appliances, office automation equipment, medical equipment, and the like to generate various types of driving forces.

[0066] However, the present invention is particularly useful to a motor used in an environment in which liquid droplets are likely to be present. Therefore, the present invention is particularly useful to a motor mounted in a transportation machine such as a car, or a fan motor for cooling a server provided outdoors, a router, a communication base, a switch device, or the like.

[0067] The number of through-holes provided in the back cover may be one as in the above-described embodiments or may also be two or more. In addition, the position of the connector member may not necessarily be the position that is separated from the through-hole by about 90 degrees with respect to the center axis 9. In addition, detailed shapes of the members may also be different from the shapes illustrated in the drawings of the present invention. In addition, the drainage structure of the present invention may also be used in combination with a seal member such as an O-ring or a gasket.

[0068] In addition, the elements that appear in the above-described embodiments and the modified examples may also be appropriately combined in a range in which there is no contradiction.

[Field of Industrial Application]

[0069] The invention may be applied to a motor.

[Reference Signs List]

[0070] 1, 1A MOTOR
2 STATIONARY PORTION
3, 3A ROTATING PORTION
9, 9A CENTRAL

AXIS
21, 21A, 21B,
21C
HOUSING
22
MAGNET
23, 23A, 23B, 23C BACK
COVER
24, 24A, 24B,
24C BRUSH
CARD
25, 25A
BRUSH
26 CONNECTOR
MEMBER
27 FRONT BEARING
PORTION
28 REAR BEARING
PORTION
31
SHAFT
32
ARMATURE
33, 33A
COMMUTATOR
41 ARMATURE
CORE
42
COIL
51 PROTRUDING
PORTION
52 RECESSED
PORTION
60 FLOW PATH
GROOVE
61 UPPER AXIAL
GROOVE
62 FRONT CIRCUMFERENTIAL

GROOVE
63 LOWER AXIAL
GROOVE
64 REAR CIRCUMFERENTIAL
GROOVE
65 INNER DIKE
SURFACE
66 TAPERED
SURFACE
67 GUIDE
GROOVE
70 FLOW PATH
SURFACE
71 FIRST FLOW PATH
SURFACE
72, 72C SECOND FLOW PATH
SURFACE
80, 80A,
80C CONTACT
PORTION
81 INNER REAR WALL
PORTION
82 INNER CIRCUMFERENTIAL WALL
PORTION
83 OUTER REAR WALL
PORTION
211 FRONT WALL
PORTION
212,
212B FRONT CIRCUMFERENTIAL WALL
PORTION
231, 231A, 231C FIRST REAR
WALL PORTION
232, 232A, 232B FIRST
CIRCUMFERENTIAL WALL PORTION
234,
234A, 234B, 234C
THROUGH-HOLE

235
CUT-OUT
241 SECOND REAR WALL
PORTION
242 SECOND CIRCUMFERENTIAL WALL
PORTION
244, 244C LEG
PORTION
245, 245B OVERHANG
PORTION
246, 246B INCLINED
SURFACE
247C
FLOW PATH HOLE
261 COMMUNICATION
HOLE
262
PLATE-LIKE PROTRUDING PORTION

Claims

[Claim 1] A motor comprising:
a rotating portion
supported to be rotatable centered on a central axis which substantially horizontally extends in a front-rear direction, the rotating portion comprising
a commutator;
a substantially
cup-shaped housing which accommodates at least a portion of the rotating
portion;
a substantially
cup-shaped back cover which is disposed rearward of the housing and, together
with the housing, constitutes a
casing;
a brush card which is
disposed in the casing and extends in a direction orthogonal to the central
axis; and
a brush which is
disposed forward of the brush card and is in contact with the commutator,
wherein
the back cover
comprises:
a first rear wall portion which
extends in the direction orthogonal to the central axis in a rear side of the
brush
card;
a first circumferential wall portion of a substantially cylindrical shape, which
extends forward from an outer circumferential portion of the first rear wall
portion;
and

a through-hole which vertically penetrates through the first circumferential wall portion in a vicinity of a lower end portion of the first circumferential wall portion,
the back cover or
the brush card comprises a contact portion of a substantially annular shape at which the back cover and the brush card are in contact with each other in a radially inner side of an inner circumferential surface of the first circumferential wall portion via a gap,
and
the contact portion is disconnected at a position which radially overlaps with the through-hole, or the brush card is penetrated radially outward from the radially inner side than the contact portion at the position which radially overlaps with the through-hole.

[Claim 2] The motor according to claim 1,
wherein
the brush card
comprises:
a second rear wall portion which is disposed forward of the first rear wall portion;
and
a second circumferential wall portion of a substantially cylindrical shape, which extends forward from an outer circumferential portion of the second rear wall portion,
and
the brush is disposed forward of the second rear wall portion and radially inward of the second circumferential wall portion.

[Claim 3] The motor according to claim 2,
wherein
the first rear wall

portion comprises:
an inner rear wall portion which is
positioned rearward of the second rear wall portion via a
gap;
an inner circumferential wall portion
of a substantially cylindrical shape, which extends forward from an outer
circumferential portion of the inner rear wall portion;
and
an outer rear wall portion that
extends radially outward from a front end portion of the inner circumferential
wall portion, and
the outer rear
wall portion and the brush card are in contact with each other in the contact
portion.

[Claim 4] The motor according to claim 3, wherein a front surface of
the inner rear wall portion is a flat surface without a step.

[Claim 5] The motor according to any one of claims 2 to 4,
wherein
the brush card further
comprises a leg portion which extends rearward from an outer circumferential
portion of the second rear wall portion,
and
the first rear wall portion
and the leg portion are in contact with each other in the contact
portion.

[Claim 6] The motor according to any one of claims 2 to 5, wherein a
front end portion of the second circumferential wall portion is positioned
forward than the through-hole.

[Claim 7] The motor according to claim 6,
wherein
the brush card comprises
an overhang portion which protrudes radially outward from an outer
circumferential surface of the second circumferential wall portion,

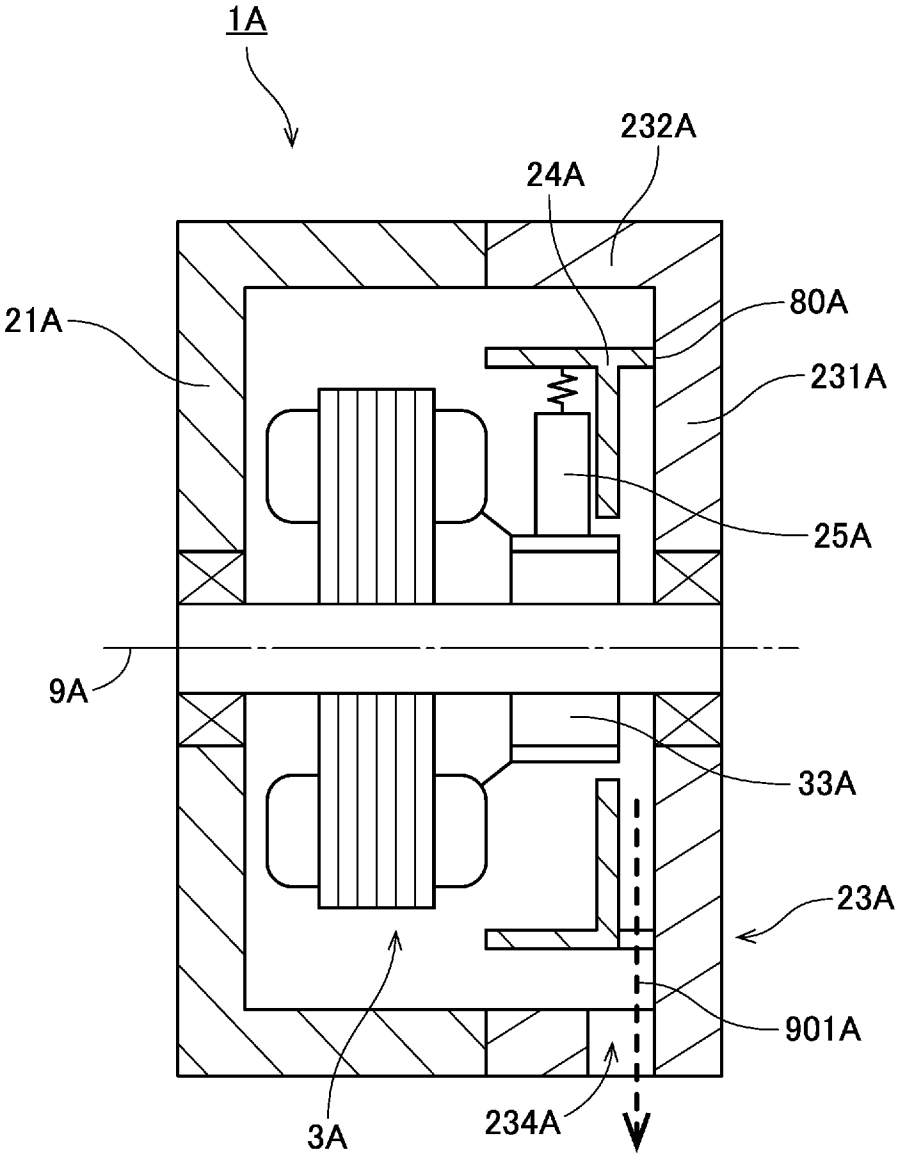
and
the overhang portion is
positioned forward than a rear end portion of the through-hole.

[Claim 8] The motor according to claim 7, wherein a radial gap is interposed between the
overhang portion and the inner circumferential surface of the first circumferential wall portion or an inner circumferential surface of the housing.

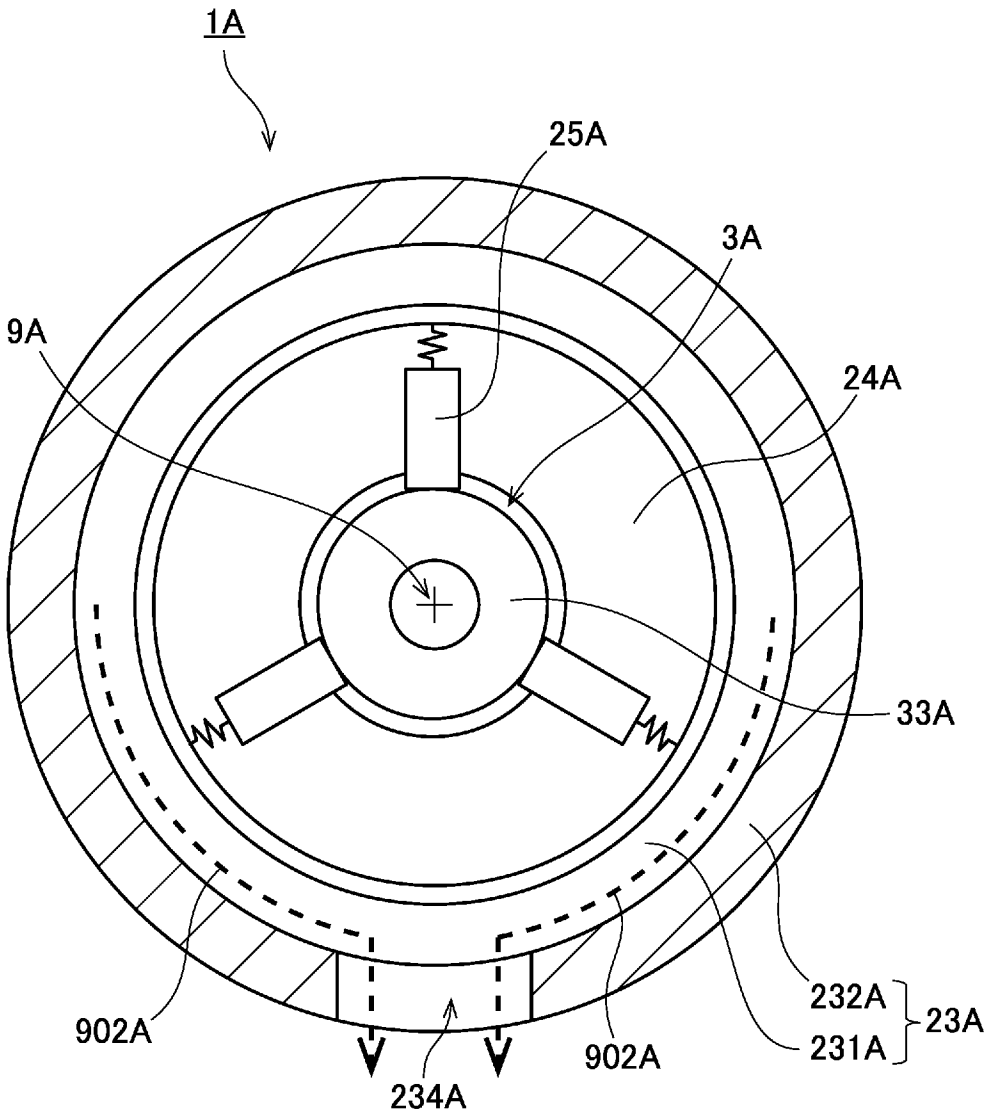
[Claim 9] The motor according to claim 7 or 8, wherein a front
surface of the overhang portion is an inclined surface which is displaced
rearward as it heads radially outward.

[Claim 10] The motor according to any one of claims 1 to 9, wherein gas flows into the casing through the through-hole
due to rotation of the rotating
portion.

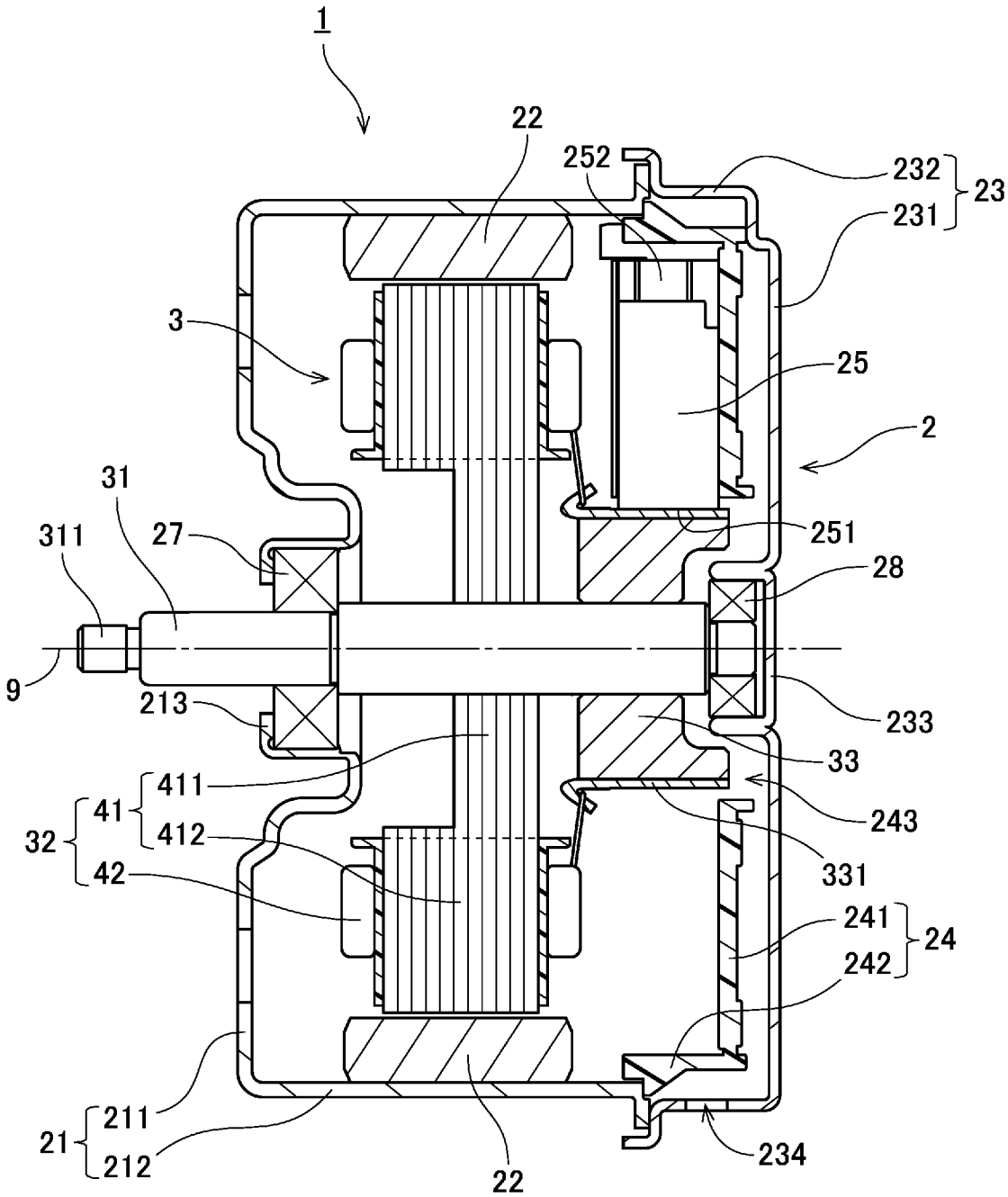
[Fig. 1]



[Fig. 2]



[Fig. 3]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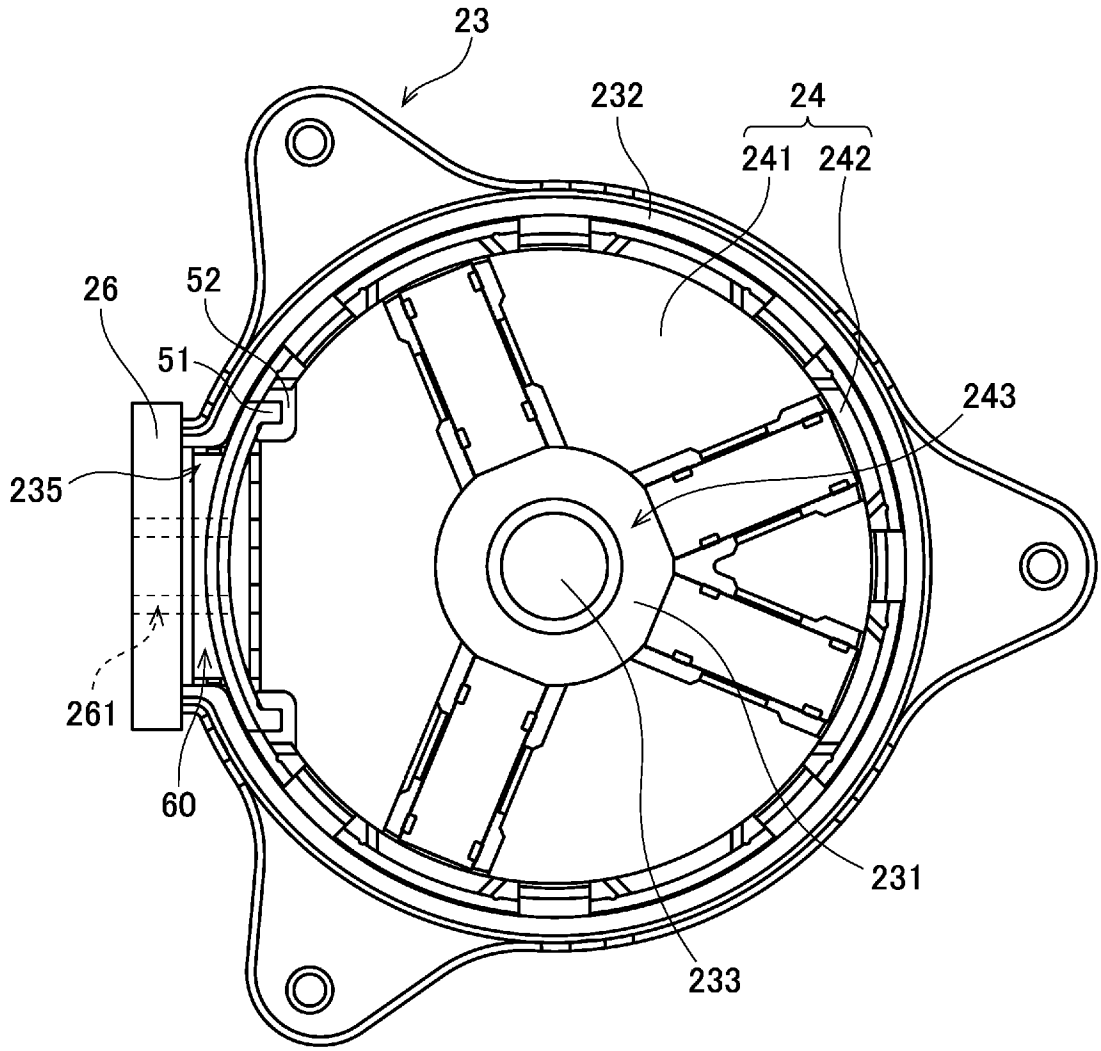
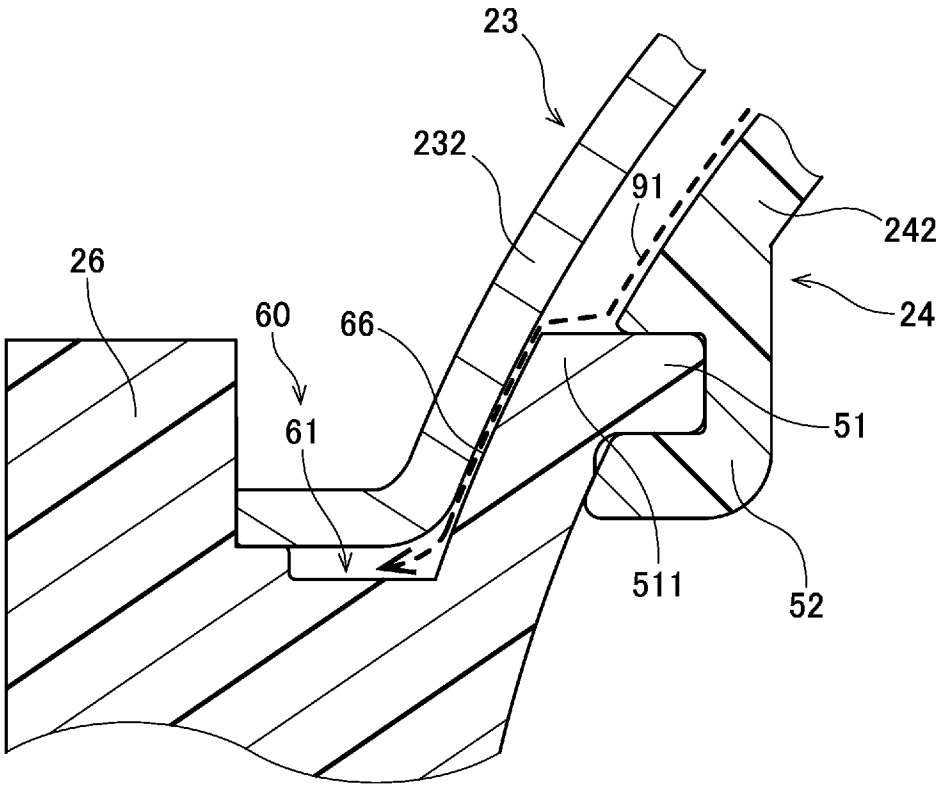
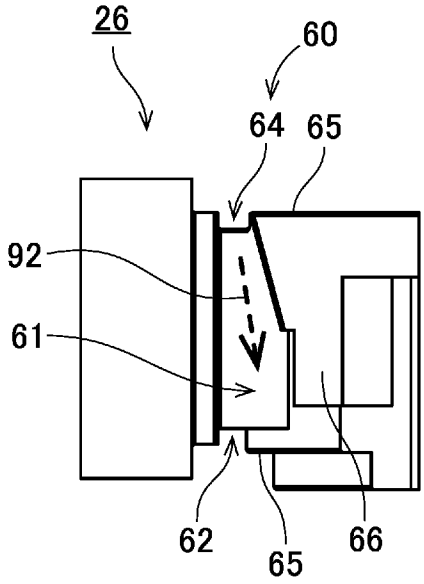
[Fig. 4]



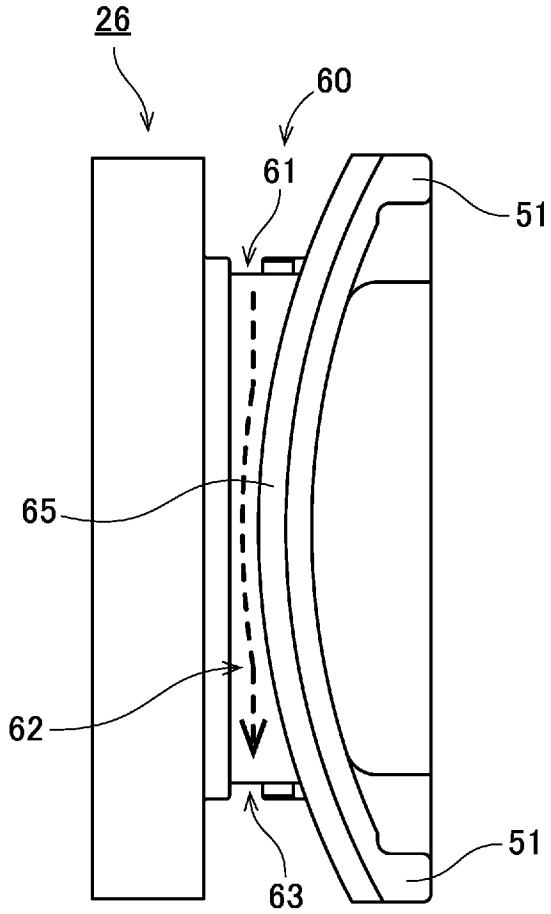
[Fig. 5]



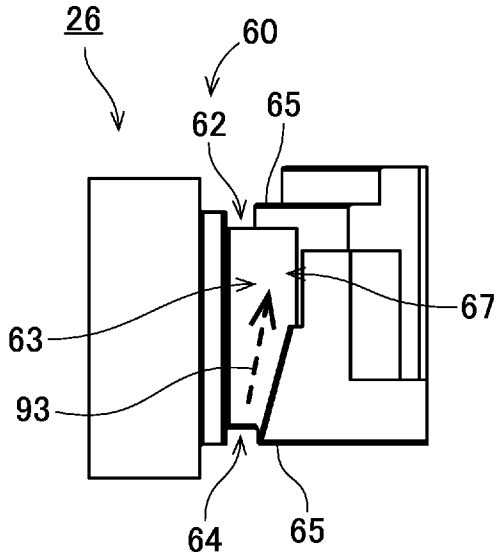
[Fig. 6]



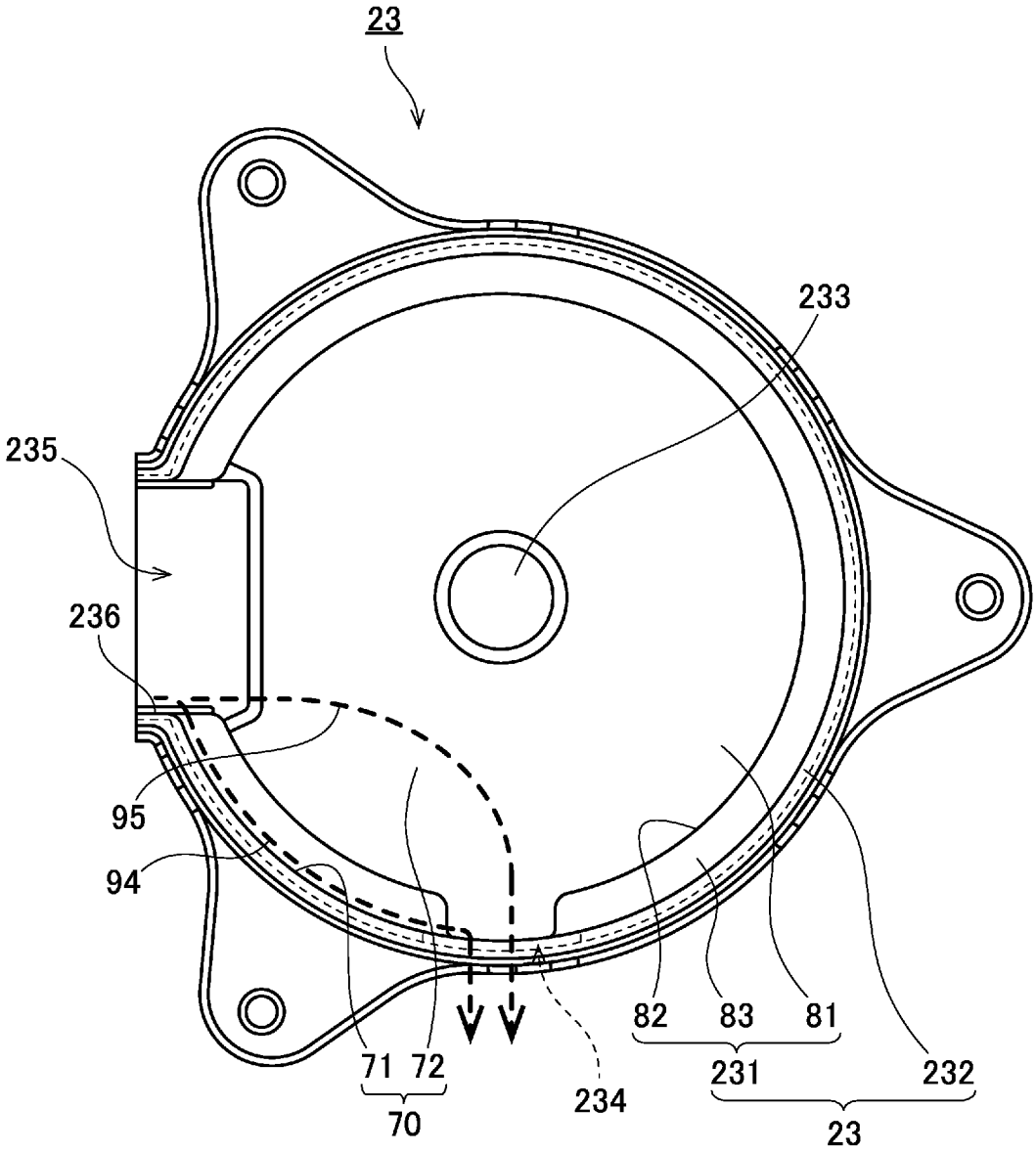
[Fig. 7]



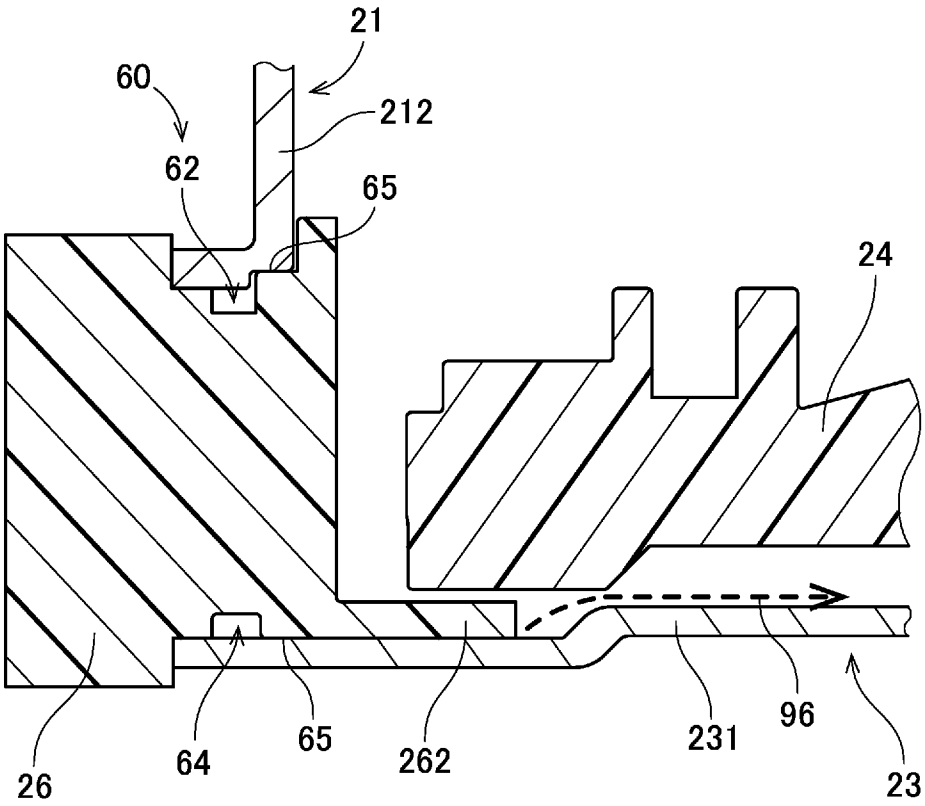
[Fig. 8]



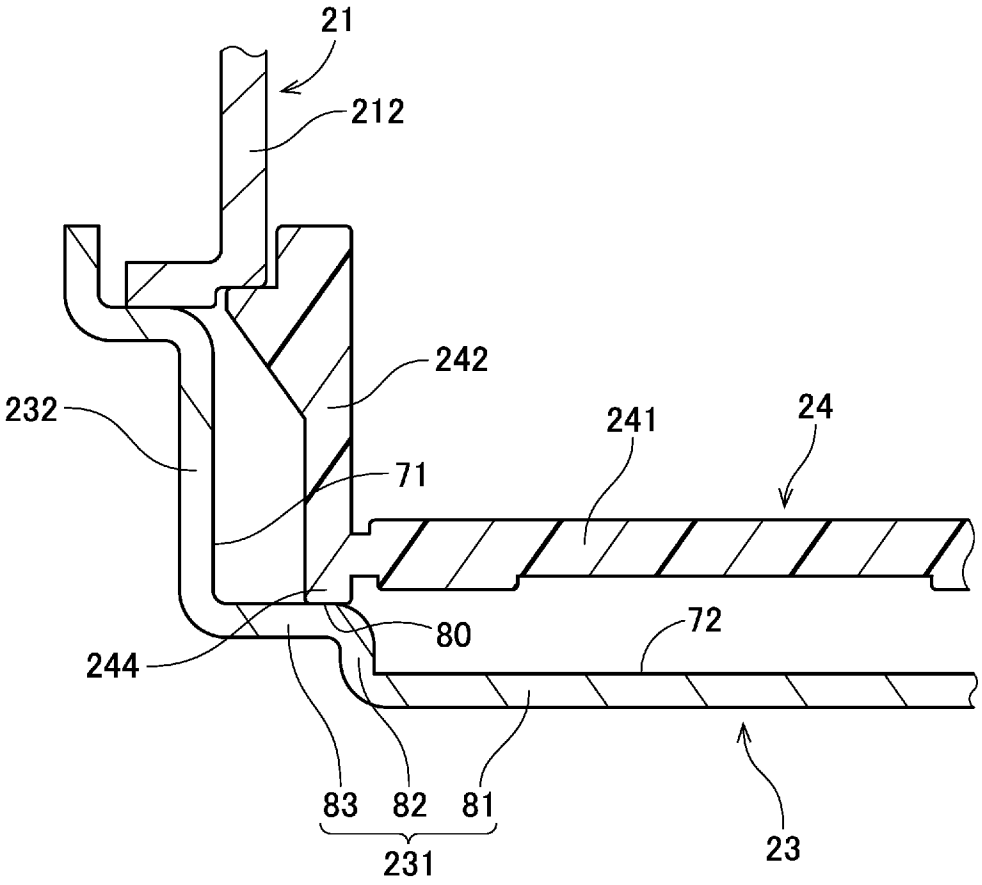
[Fig. 9]



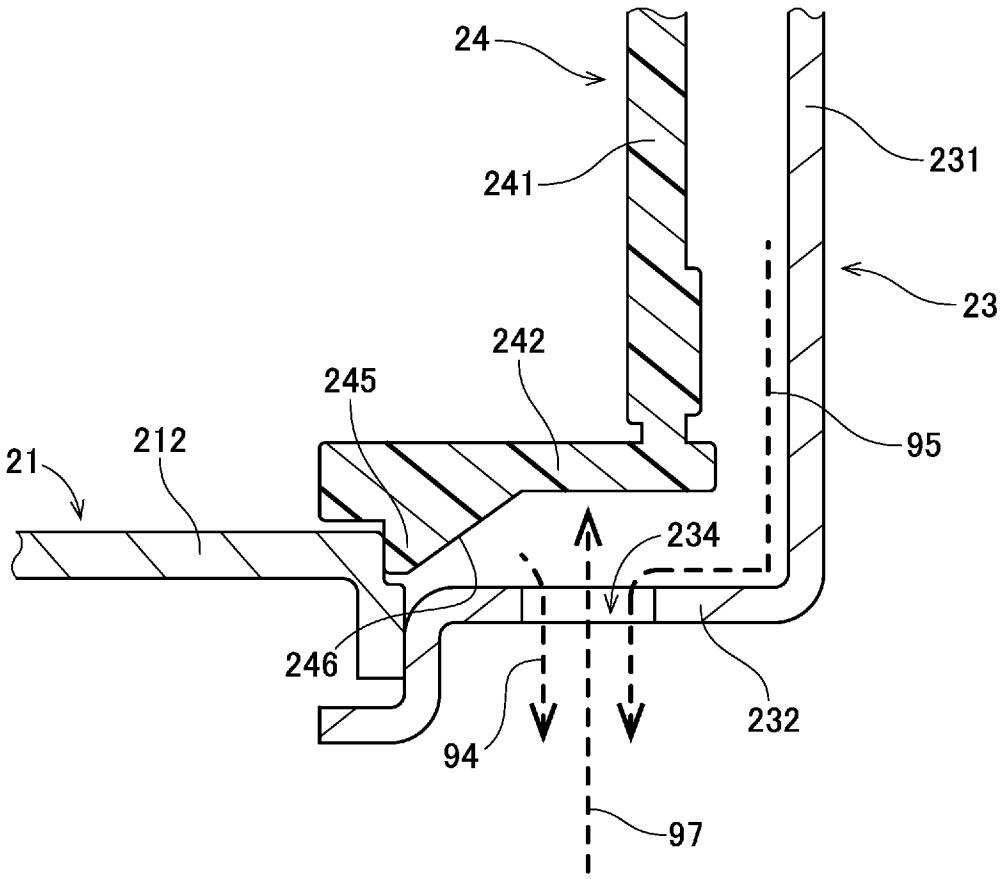
[Fig. 10]



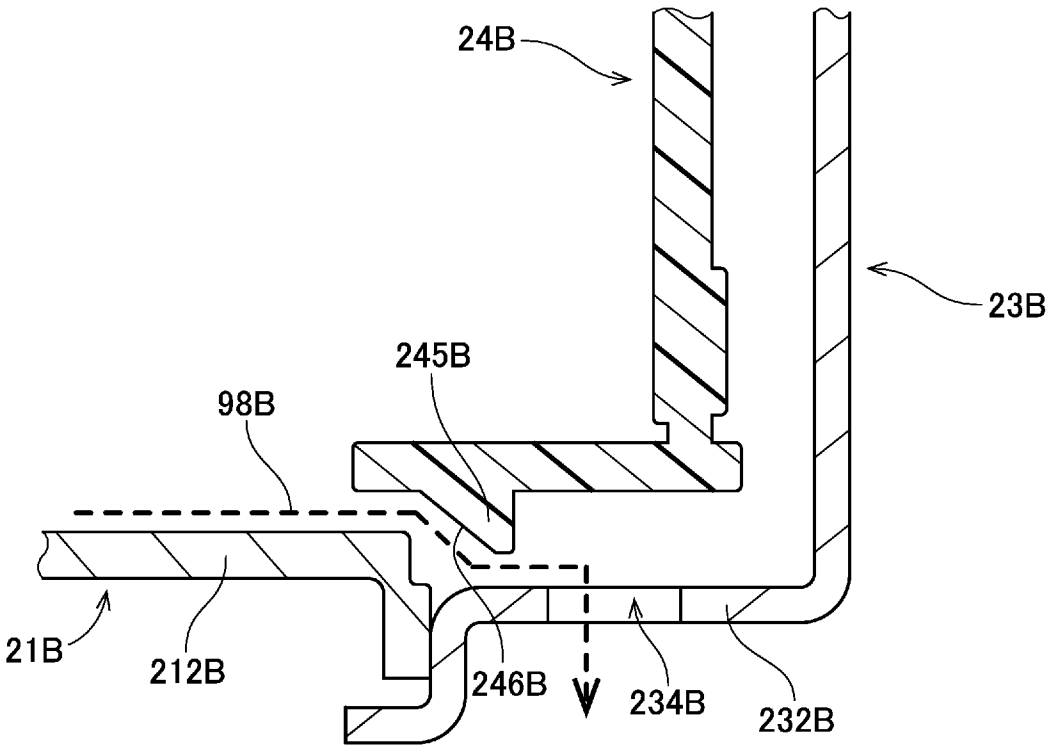
[Fig. 11]



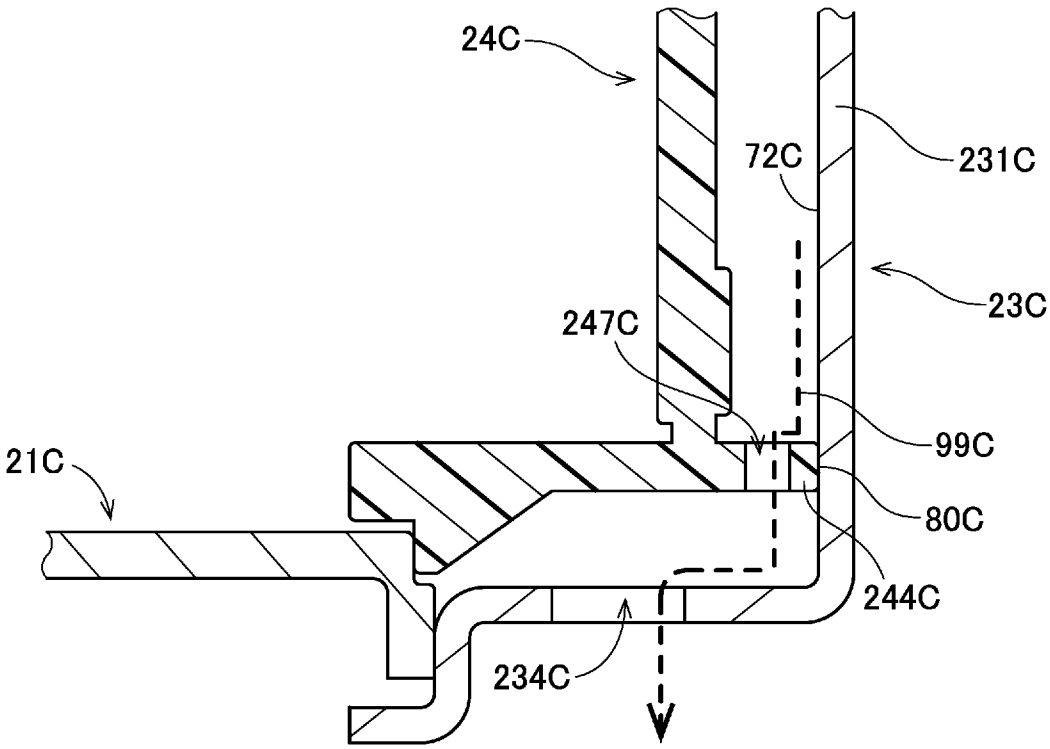
[Fig. 12]



[Fig. 13]



[Fig. 14]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/003162

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. H02K5/10(2006.01)i, H02K5/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. H02K5/10, H02K5/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2013
Registered utility model specifications of Japan 1996-2013
Published registered utility model applications of Japan 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-174589 A (DENSO CORP.) 2006.06.29, Full text; all drawing (No Family)	1-10
A	JP 11-168849 A (JECO CORP.) 1999.06.22, Full text; all drawing (No Family)	1-10
A	CD-ROM of the specification and drawings annexed to the written application of Japanese Utility Model Application No.53489/1993(Laid-open No.23961/1995) (KOKUSAN DENKI CORP.) 1995.05.02, Full text; all drawing (No Family)	1-10

☑ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01.08.2013	13.08.2013

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/003162

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3971349 B2 (ASMO CORP.) 2007.09.05, [0018]-[0019] US 2004/0263009 A1 & US 2006/0192449 A1 & DE 102004030814 A & FR 2856852 A & FR 2886071 A & CN 1578065 A & CN 101083413 A	1-10