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(54) PUMP

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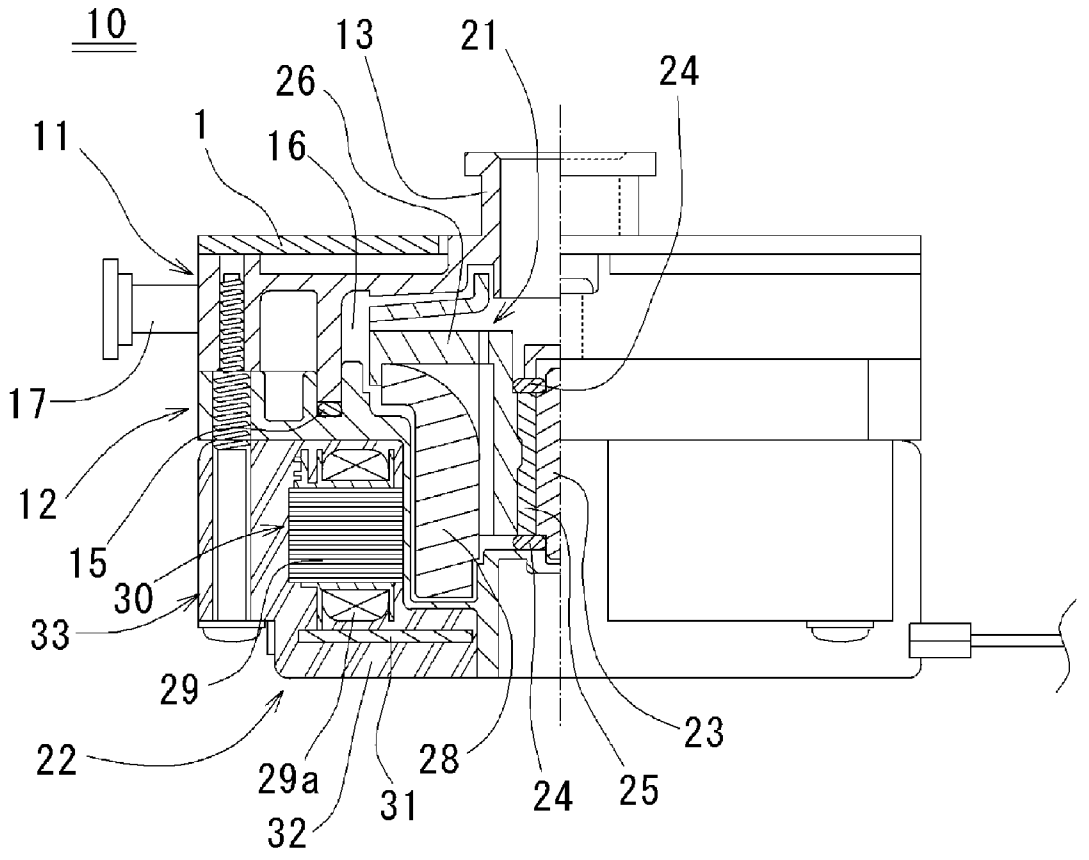
(57) **ABSTRACT**

In a pump having a rotor inside a pump chamber which is formed inside a case which is formed of a resin material, and a resin mold compound in which an armature is molded with resin, a metallic cover is provided on a portion of an outer surface of the case inside the pump, wherein the portion has inferior durability compared with the rest of the outer surface.



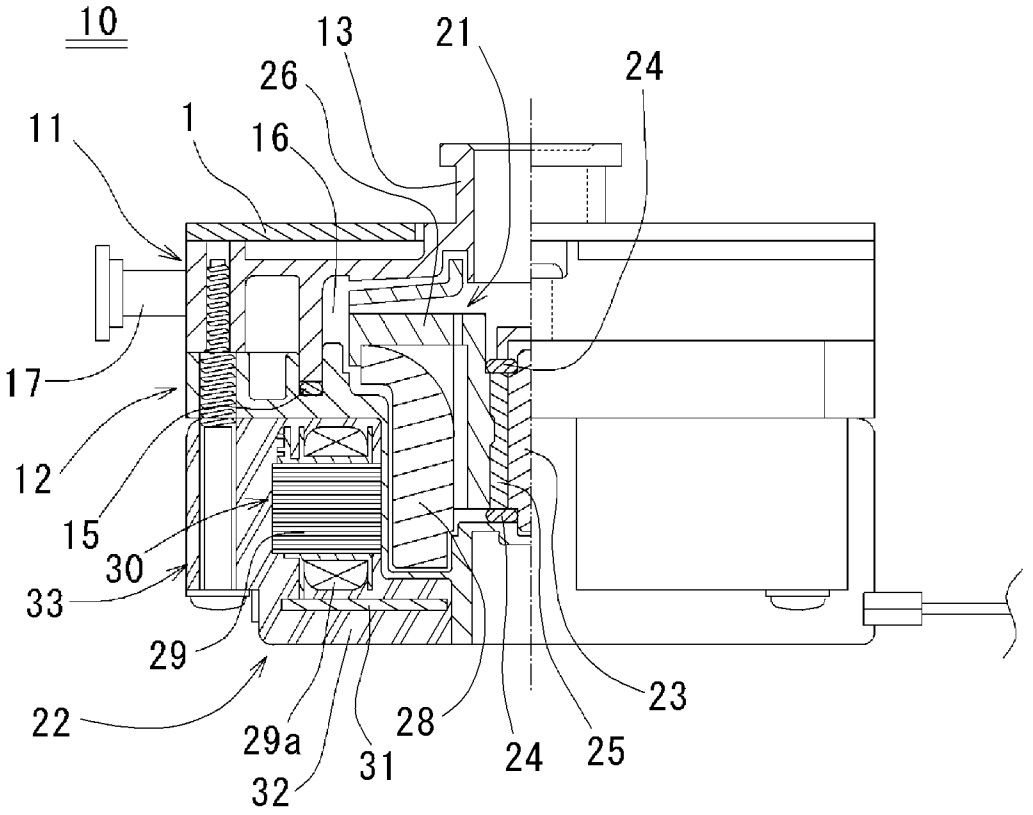


FIG. 1

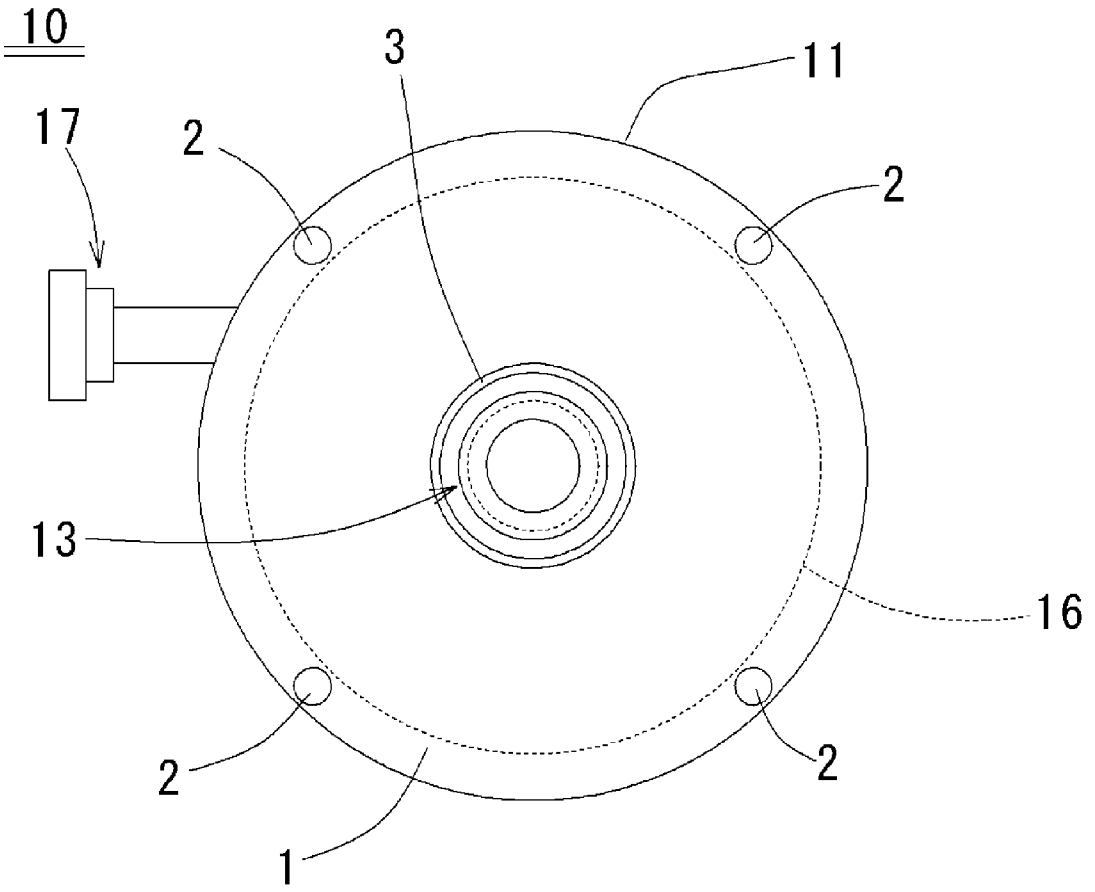


FIG. 2

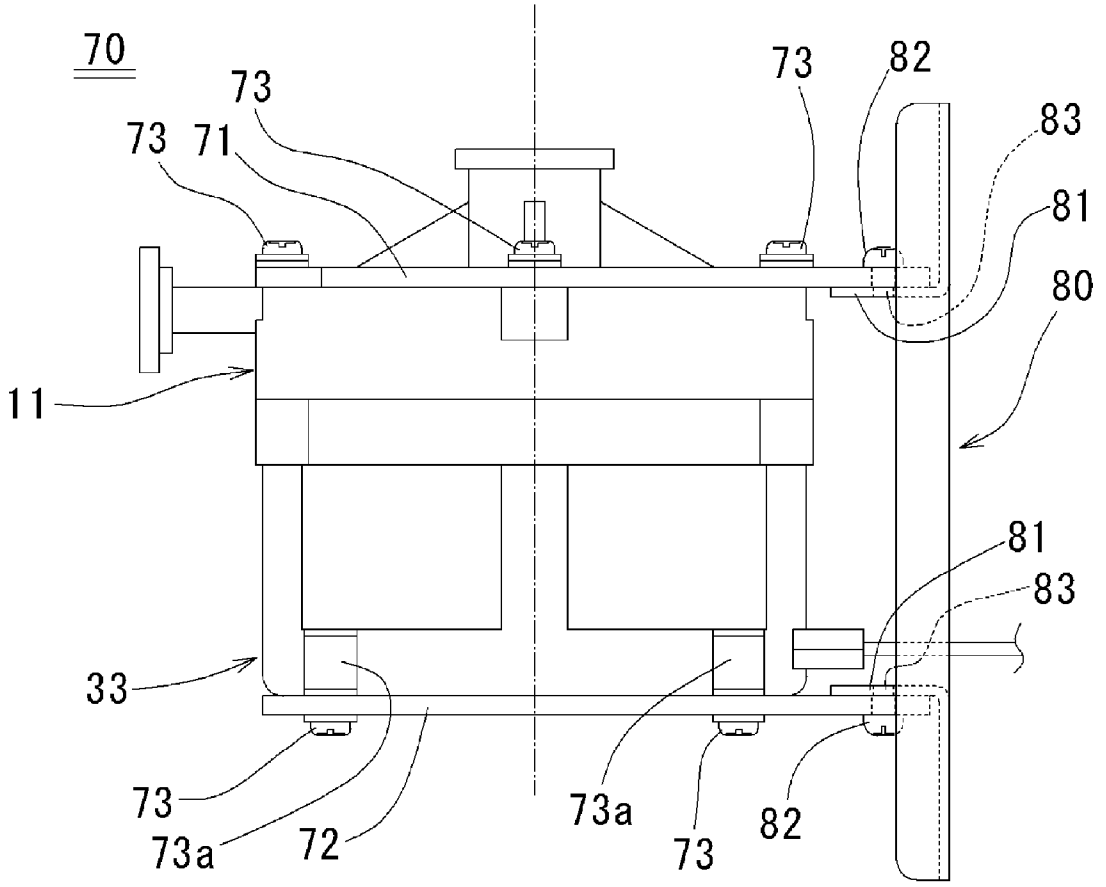


FIG. 3

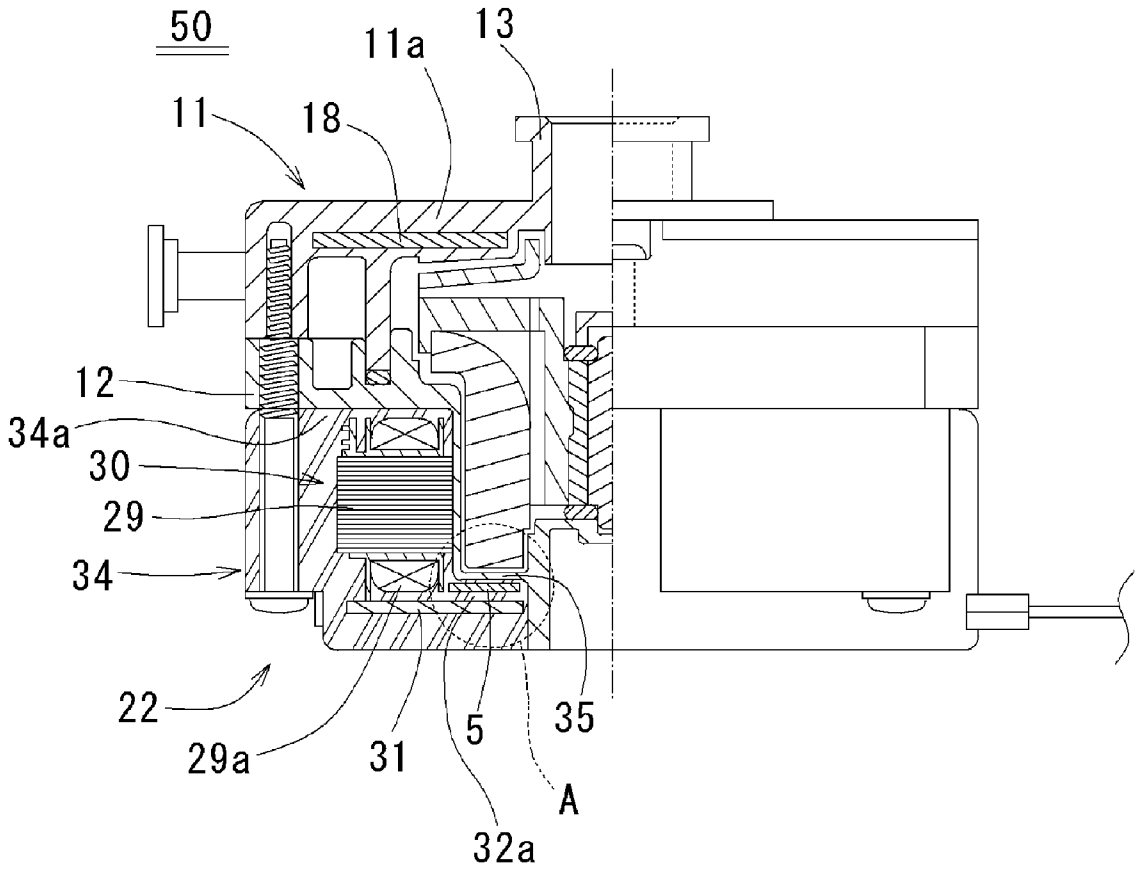


FIG. 4

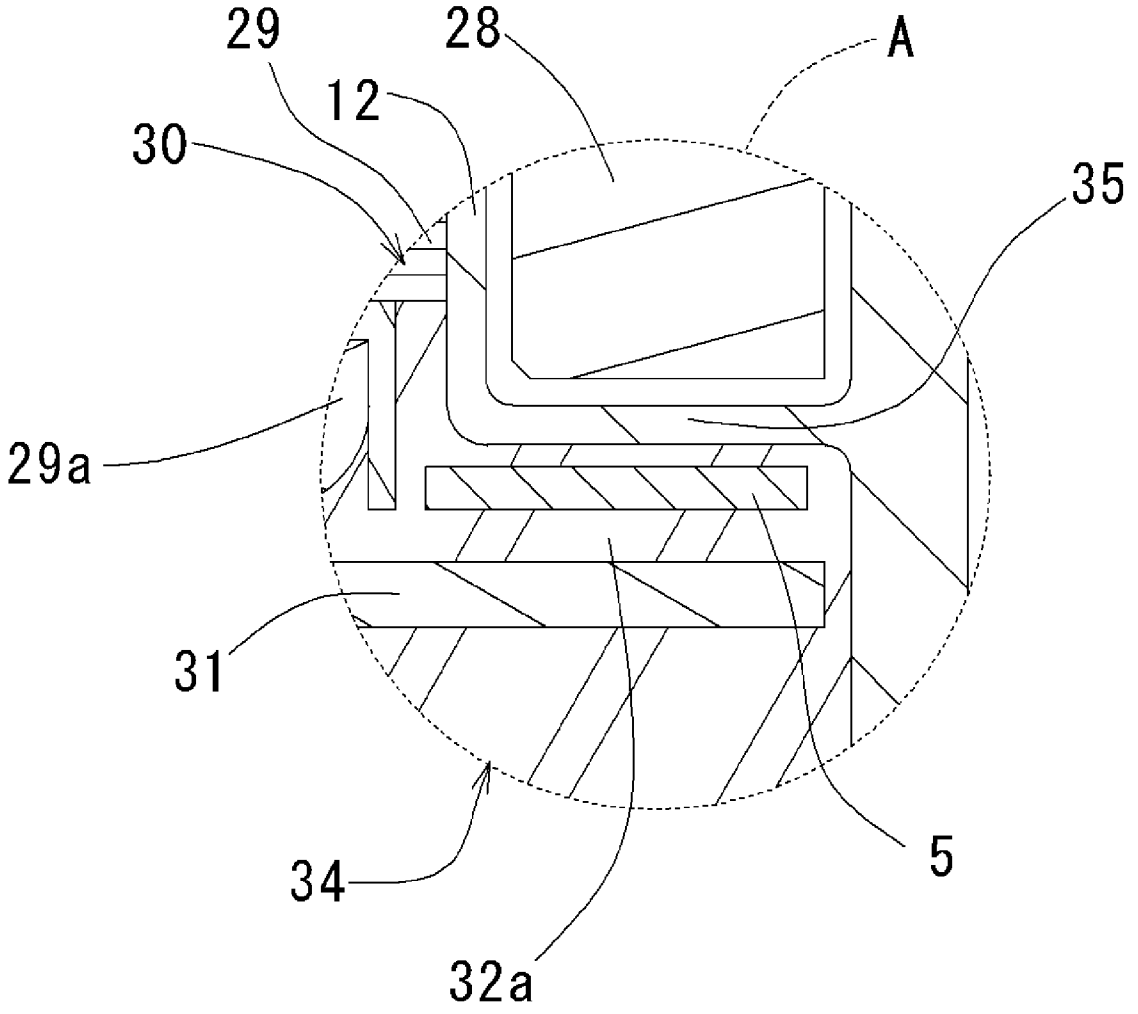


FIG. 5

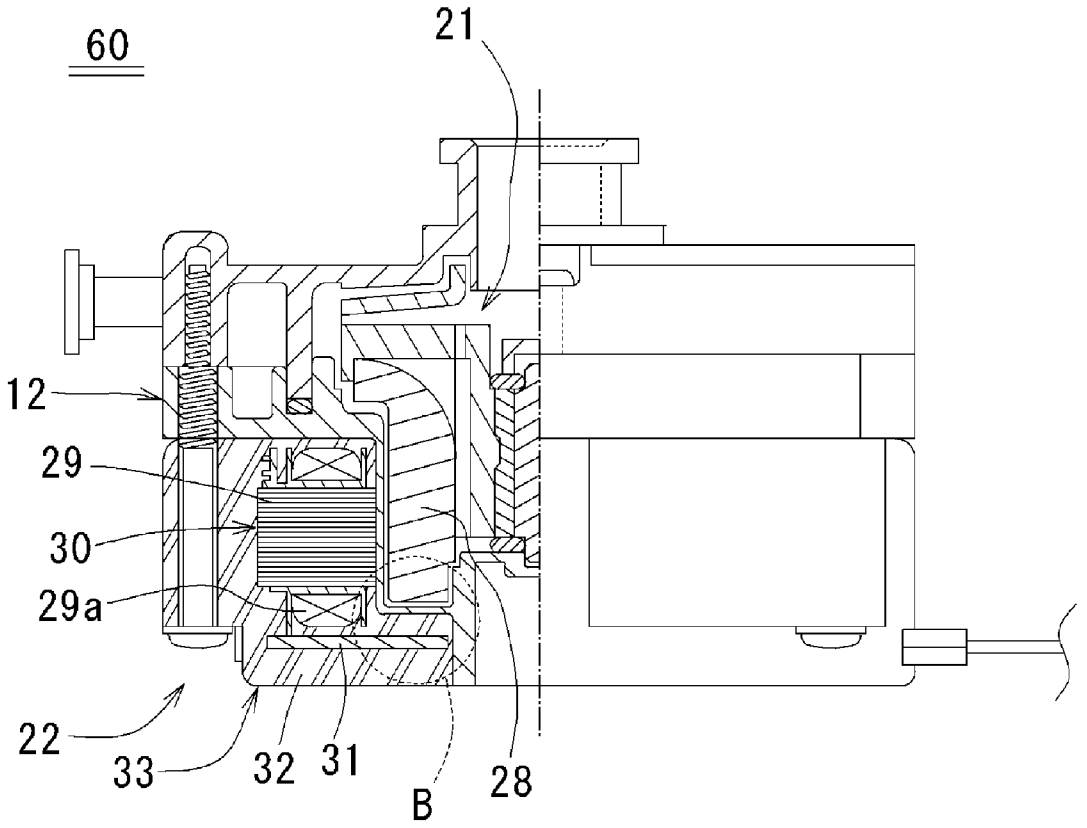


FIG. 6

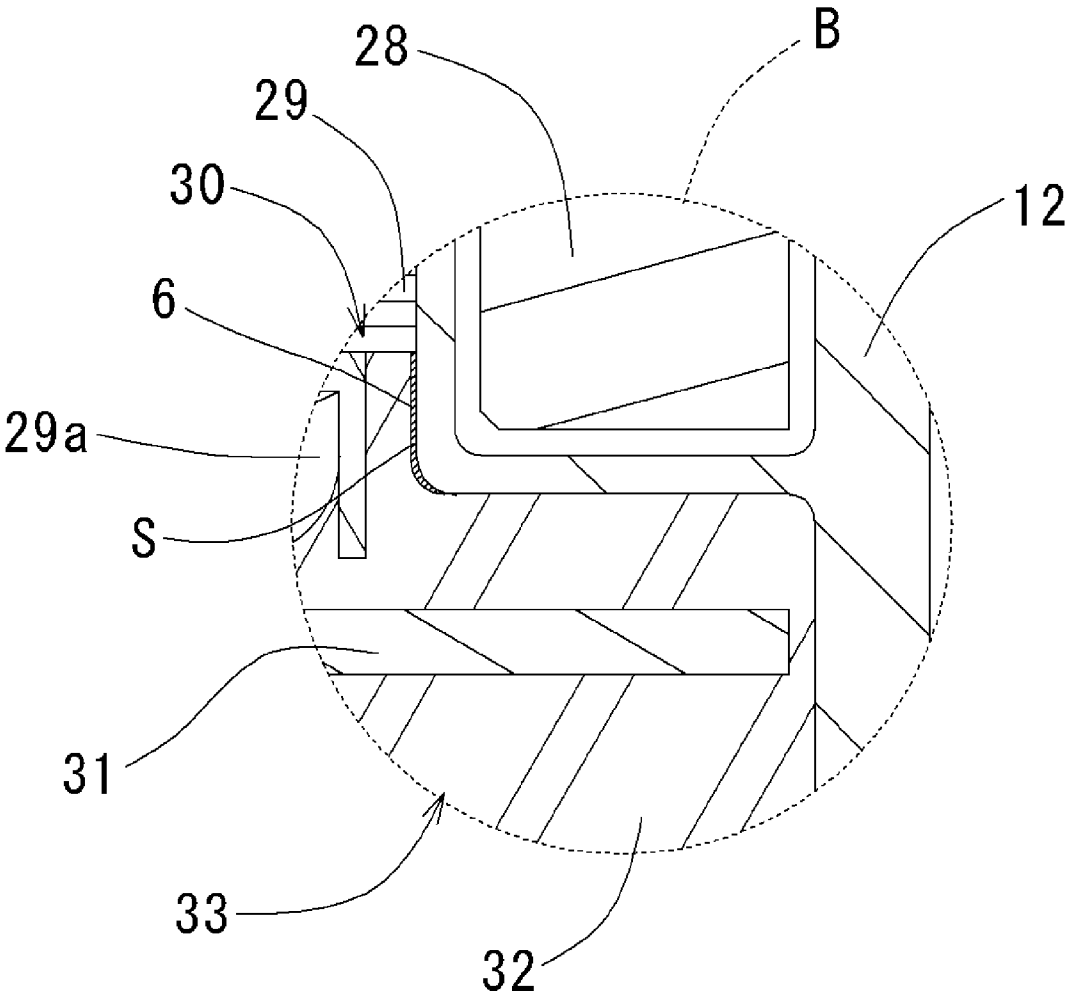
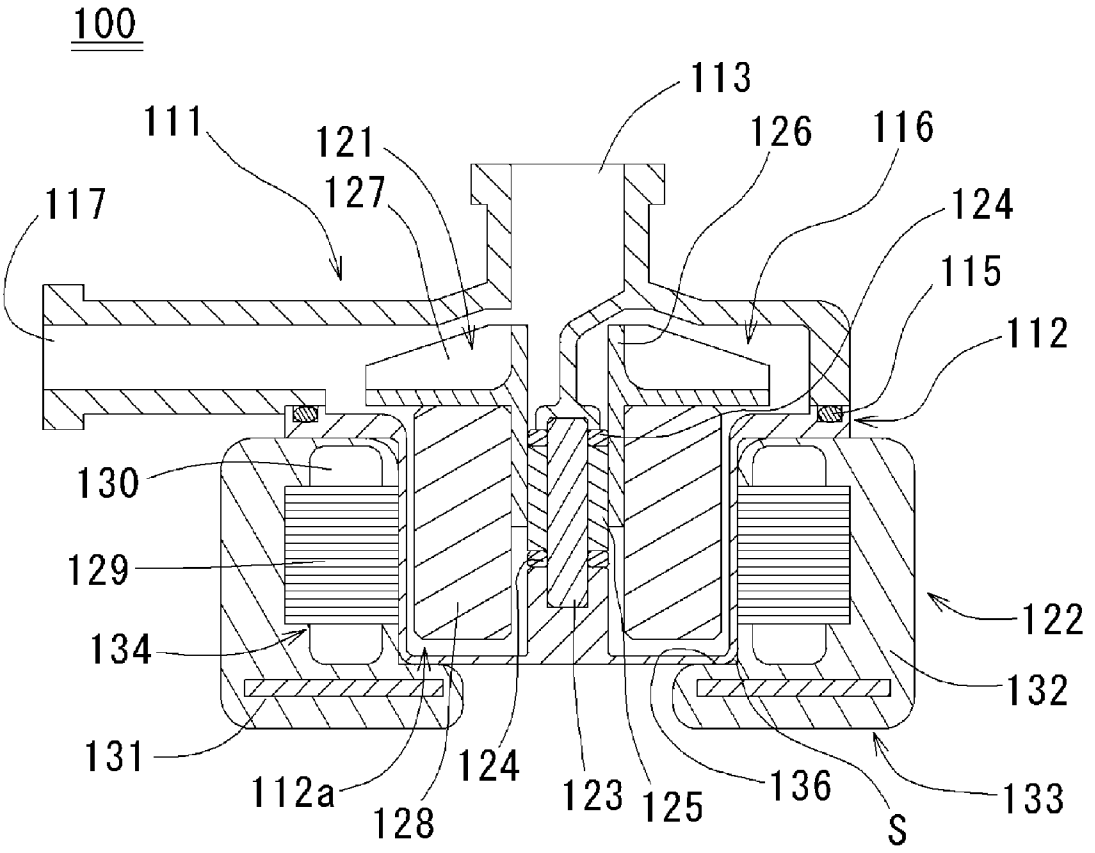


FIG. 7



Prior Art

FIG. 8

PUMP

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

[0002] The present invention relates to pumps, and more particularly to a pump having improved hydraulic pressure resistance by increasing the durability of the exterior and interior of the pump, having therein a case formed of a resin material.

[0003] 2. Description of the Related Art

[0004] There is a growing demand for a device such as a water heater to become smaller in dimensions, lighter in weight and energy efficient. Such demand is also expected of a pump installed in the aforementioned device or the like.

[0005] A pump in general comprises a DC brushless motor having a rotor which is sealed inside a case, a stator affixed outside the case for driving the rotor, and an impeller which is connected to the rotor and is located in a pump chamber therein.

[0006] FIG. **8** is a diagram showing a schematic cross sectional view in an axial direction of an example of a conventional pump. As shown in FIG. **8**, a pump **100** has arranged therein a rotor **121** in an interspace between an upper case **111** and a lower case **112** which are formed of a resin material. The pump **100** also includes an annular shaped stator **122** along an outer circumferential surface of the rotor **121**. A pump having such configuration is commonly referred to as a canned type pump.

[0007] The upper case **111** and the lower case **112** sandwich an O-shaped ring (hereinafter, referred to as an O-ring) **115**, and seal an inner portion of the pump **100**. Also, a pump chamber **116** is provided at an upper portion of the interspace. An intake portion **113** and a discharge portion **117**, which are connected to each other in the pump chamber for, respectively, intaking and discharging fluid, protrude outwardly from the upper case **111**. The aforementioned configuration is to be formed integrally.

[0008] The rotor **121** is supported and allowed to freely rotate in a radial direction by a cylinder shaped sleeve **125** located surrounding a fixed shaft **123** which is affixed at a center of the pump **100** inside the lower case **112**. Also, a thrust washer **124** is provided at top and bottom portions of the sleeve **125** so as to support in the axial direction and allow the rotor to freely rotate.

[0009] The rotor **121** comprises an impeller base portion **126** which is connected to the sleeve **125**, an impeller **127** which is affixed above the impeller base portion **126**, and a rotor magnet **128** which is surroundingly affixed to the rotor **121**. The rotor magnet **128** is provided within a cup shaped portion **112***a* in the lower case **112**.

[0010] The stator **122** comprises an annular shaped resin mold compound **133** including therein a molded resin **132** in which a printed circuit board **131** and an armature **134** which includes therein an annular shaped laminated core **129** and a coil **130** are provided.

[0011] The resin mold compound **133** is located on an outer circumferential surface of the rotor magnet **128** of the rotor **121** and is affixed to the lower case **112**. The resin mold compound **133** and the rotor **121** configure the DC brushless motor. When an electric current is applied to the stator **122** via the printed circuit board **131** from an external power supply (not shown in the figures), the impeller **127** rotates along with the rotor **121**. Due to the rotation of the impeller **127**, fluid is taken in through the intake portion **113** to the pump chamber **116**. Then, the fluid pressured by the impeller **127** will be discharged from the discharge portion **117**.

[0012] For the aforementioned pump **100**, metallic cases having a superior durability than the resin based upper case **111** and the lower case **112** are used so as to sustain expansion, which is caused by the hydraulic pressure, of the resin based upper case **111** and the lower case **112**, and to improve hydraulic pressure resistance of the pump **100**.

[0013] However, forming a metal plate into a three-dimensional case by methods such as pressing and welding will be a difficult task. Further, the pressing process is a costly process. Furthermore, such pump requires countermeasures against increased weight thereof and corrosion.

[0014] Also, according to the pump **100** as shown in FIG. **8**, at a contact portion **136** where the lower case **112** and the annular shaped resin mold compound **133** make contact with each other, the resin mold compound **133** will be affected, via the lower case **112**, by the pressure which is generated within the pump. When the pressure within the pump is increased, due to thin resin layers at the contact portion **136**, the resin mold compound **133** may be damaged (e.g., occurrences of crack). Ultimately, if the pressure continues, the resin mold compound **133** may be detached from the lower case **112**.

[0015] Also, in the pump **100**, a gap S may be generated between an inner circumferential surface of the resin mold compound **133** affixed to the lower case **112** and an outer circumferential surface of the lower case **112**. Each time the case **112** is affected by the pressure from the pump, the gap S may be repeatedly widened. Then, a weld line having a weak connection is likely to be cracked and, thus, water leakage of the pump **100** may occur.

BRIEF SUMMARY OF THE INVENTION

[0016] The present invention relates to a pump having a structure in which a metallic cover is attached to a case, which is formed of a resin material, so as to increase the durability of the pump having therein the case. Also, the present invention relates to the pump having a structure in which a reinforcement board is provided to the case so as to increase the durability of the case inside the pump. The present invention improves, without any significant increase in weight and a production cost thereof, hydraulic pressure resistance of the pump thereby increasing the durability of the pump.

[0017] Further, since the metallic cover is attached to a resin mold compound having molded therein an armature, the durability of the resin mold compound will be increased.

[0018] Furthermore, the metallic cover can be embedded in either the case or the resin mold compound.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0019] FIG. **1** is a diagram showing a schematic cross sectional view, in an axial direction, of a pump according to a first embodiment of the present invention.

[0020] FIG. **2** is a diagram showing a plan view of the pump shown in FIG. **1** as seen from a side of a fluid intake portion.

[0021] FIG. **3** is a diagram showing a plan view, as seen from a side of, a pump according to a second embodiment of the present invention.

[0022] FIG. **4** is a diagram showing a schematic cross sectional view, in the axial direction, of a pump according to a third embodiment of the present invention.

[0023] FIG. **5** is an enlarged view of a portion A shown in FIG. **4**.

[0024] FIG. **6** is a diagram showing a schematic cross sectional view, in the axial direction, of a pump according to a fourth embodiment of the present invention.

[0025] FIG. **7** is an enlarged view of a portion B shown in FIG. **6**.

[0026] FIG. **8** a diagram showing a schematic cross sectional view, in the axial direction, of an embodiment of a conventional pump.

DETAILED DESCRIPTION OF THE INVENTION

[0027] Hereinafter, embodiments of a pump according to the present invention will be described with reference to FIGS.

First Embodiment

[0028] FIG. **1** is a diagram showing a schematic cross sectional view in an axial direction of a pump **10** according to a first embodiment of the present invention. FIG. **2** is a plan view of FIG. **1**. As shown in FIG. **1**, the pump **10** comprises: an upper case **11** and a lower case **12**, which are formed of a resin material; a rotor **21** which rotates around a predetermined central axis J**1**, and which is located in a space generated between the upper case **11** and the lower case **12** which are joined together; and a ring shaped stator **22** which is located along an outer circumference of the rotor **21** and outside of the lower case **12**. The pump **10** is commonly referred to as a canned type pump wherein the lower case **12** is provided between the rotor **21** and the stator **22**. Note that, in the description of the preferred embodiments of the present invention herein, words such as upper, lower, left, right, upward, downward, top, and bottom for describing positional relationships between respective members and directions merely indicate positional relationships and directions in the drawings. Such words do not indicate positional relationships and directions of the members mounted in an actual device.

[0029] The upper case **11** and the lower case **12** sandwich an O-ring **15**, and seal an inner portion of the pump **10**. At an upper portion of an interspace portion generated by the upper case **11** and the lower case **12**, a pump chamber **16** is provided. An intake portion **13** and a discharge portion **17** which are connected to each other in the pump chamber **16** protrude outwardly from the upper case **11**. The aforementioned configuration is to be formed integrally.

[0030] The rotor **21**, sharing the same axis as the central axis J**1**, is supported and allowed to freely rotate, via a sleeve **25** and a thrust washer **24** located at both top and bottom of the sleeve **25**, by a stator shaft **23** fixed between the upper and lower cases **11** and **12**.

[0031] The rotor **21** comprises: an impeller ba**1**se portion **26** which is connected to the sleeve **25** formed of the resin material (e.g., polyphenylene sulfide) having a tribological property; an impeller **27** which is connected to a top portion of the impeller base portion **26**; and a rotor magnet **28** which is located surrounding the sleeve **25**. The rotor magnet **28** is located inside a cup shaped area provided in a center portion of the lower case **12**.

[0032] The stator **22** comprises: an armature **30** including therein an annular shaped laminated core **29** and a coil **29***a*; and a printed circuit board **31**. The printed circuit board **31** and the armature **30** are molded in a molded resin **32** configuring an annular shaped resin mold compound **33**.

[0033] The resin mold compound **33** is located on an outer surface of the lower case **12** which is located along an outer circumferential surface of the rotor magnet **28** in the rotor **21**. The resin mold compound **33** is affixed to, so as to cover, an outer circumferential surface and a portion of a bottom of the cup shaped lower case **12**. Further, the resin mold compound **33** extends radially outwardly from the cup shaped lower case **12** is affixed to, so as to cover, an outer surface forming the pump chamber **16**. Since the outer surface of the lower case **12** and the resin mold compound **33** make contact with each other as described above, the resin mold compound **33** is able to sustain expansion of the lower case **12** even if the pressure within the lower case **12** is increased.

[0034] The motor according to the present invention is a component of the brushless DC motor such that when the stator **22** is supplied with an electric current from the printed circuit board **31**, a rotating magnetic field will be generated in the stator **22**, thereby rotating the rotor **21**. When the rotor **21** rotates, the impeller **27** connected to the rotor **21** rotates. Then the fluid will be sucked in to the inner portion of the pump chamber **16** through the intake portion **13**, directed by the impeller **27** to flow in a predetermined direction, and discharged through the discharge portion **17**.

[0035] In the pump **10** according to the present embodiment, an annular shaped metallic cover **1** is provided covering over an outer surface of the upper case **11**. The metallic cover **11** is secured by a screw **2** at four points to the upper case **11**. Here, the screws **2** each are to be used at points avoiding the pump chamber **16** so as to avoid exposing the screws **2** to the inner portion of the pump chamber **16**. If the screws **2** are exposed to the inner portion of the pump chamber **16**, the fluid inside the inner portion may leak outside thereof. Also, if screws **2** not long enough to penetrate the metallic cover **1** are used, the metallic cover **1** will not be secured to the upper case **11**. Also, providing a layer having an increased thickness for the upper case **11** so that long screws **2** can be used, the dimensions of the pump **10** will be large. In order to solve the aforementioned problems, the screws **2** are provided ideally at points avoiding the pump chamber **16**.

[0036] In general, in a pump, which has a case formed of a resin material, whose rated total head is approximately 13 m or smaller, and whose rated flow is approximately 30 L/min or smaller, a maximum internal pressure of fluid a pump chamber can withstand is between, approximately, 200 KPa to 250 KPa. When the internal pressure is to be greater than 250 KPa, a metallic case will be necessary in order to sustain the expansion. However, when the upper case **11**, which is formed of the resin material, has applied thereon the metallic cover **1** in the pump **10** according to the present embodiment, an internal pressure up to approximately 1000 KPa can be withstood. Therefore, the pump **10** can be used for a pump in which the internal pressure of the fluid in a pump chamber exceeds approximately 250 KPa.

[0037] The metallic cover **1** provides an opening **3** for insertion of the intake portion **13** which protrudes from the upper case **11**. Also, the metallic cover **1** can be easily manufactured by pressing a stainless steel plate or an

aluminum base plate. Also, the metallic cover **1** can be attached to the pump **10** easily. Also, the metallic cover **1** is attached, to the upper case **11**, stretching over a weld line (not shown in the figures) which is generated when the upper case **11** is formed by a die. Since the upper case **11** is most vulnerable at the weld line, when the metallic cover **1** is affixed covering over the weld line on the upper case **11**, damages (e.g., occurrence of crack or expansion) can be prevented.

[0038] The metallic cover **1** is to be secured by the screw **2** at, at least, one point on both sides of the weld line. By this, the metallic cover **1** will be able to prevent damages from being done to the weld line even when the internal pressure within the pump chamber **16** increases.

[0039] The metallic cover **1** increases the durability of the pump **10** having therein the upper case **11** and the lower case **12**, which are formed of the resin material, to an extent of the durability of a pump having therein a metallic case. Further, the metallic cover **1** can easily be manufactured and attached to the cases while keeping a weight increase of the pump **10** to a minimum. Further, the metallic cover **1** can increase the durability of upper case **11** which is repeatedly pressured by the internal pressure of the fluid inside the pump chamber **16**. As a result, a pump having the metallic cover **1** will last long and have an increased durability.

[0040] Further, a metallic cover different from the metallic cover **1** can be provided on a surface, of the lower case **12**, making contact with the armature **30** in the axial direction. Note that the non-metallic-cover-**1**-metallic-cover provides an opening for insertion of the cup shaped lower case **12**. By this, the lower case **12** can be sandwiched from both sides thereof in the axial direction, thereby constrictedly securing the pump chamber **16**. By this, the durability of the pump **10** against the internal pressure of the fluid within the pump chamber **16** will be increased.

Second Embodiment

[0041] Next, a pump according to a second embodiment of the present invention will be described with reference to FIG. **3**. FIG. **3** is a diagram showing a plan view, as seen from a side of, a pump according to a second embodiment of the present invention. In FIG. **3**, elements similar to those illustrated in FIG. **1** are denoted by similar reference numerals, and description thereof is omitted.

[0042] In the first embodiment, the metallic cover **1** covers over only the top surface in the axial direction of the upper case **11**. In the second embodiment, however, a metallic cover is provided on both top and bottom surfaces of a pump **70** so as to sandwich, and to provide additional durability, to the pump **70**. That is, according to FIG. **3**, a metallic cover **71** which covers over a top surface of the upper case **11** and a resin mold compound side metallic cover **72** which covers over a bottom surface of the resin mold compound **33** are provided on the upper case **11**. The metallic cover **71** and the resin mold compound side metallic cover **72** each are secured to the upper case **11** at four points by a screw **73**. A cylinder shaped collar **78** is provided between the resin mold compound side metallic cover **72** and the resin mold compound **33**. The resin mold compound side metallic cover **72** and the resin mold compound **33** each have predetermined points (not shown in the figures) for the screw **73**. Also, the upper case **11** and the metallic cover **71** each have predetermined points (not shown in the figures) for the screw **73**. Since the metallic cover **71** and the resin mold compound side metallic cover **72** are provided, the durability of the upper case **11** and the resin mold compound **33** will be increased. In particular, the resin mold compound side metallic cover **72** affixed to the resin mold compound **33** increases the durability of the resin mold compound **33** so as for the resin mold compound **33** to withstand greater internal pressure of fluid within the pump chamber **16** than the resin mold compound **33** without the resin mold compound side metallic cover **72**.

[0043] Note that, a planar shape of the metallic cover **71** and that of the resin mold compound side metallic cover **72** may be adjusted (e.g., round shape, substantially rectangle, or square) in accordance with a configuration of the pump.

[0044] Also, the metallic cover **71** and the resin mold compound side metallic cover **72** are affixed to a pump base **80** by a plurality of screws **82**. The pump base **80** is used to mount the pump **70** onto an apparatus. The pump base **80** has an extension portion **81**, which extends toward the metallic cover **71** and toward the resin mold compound side metallic cover **72**. A portion of the extension portion **81** overlaps with a portion of the metallic cover **72** and with a portion of the resin mold compound side metallic cover **72**. At the portions where the extension portion **81** and metallic cover **72** overlap one another, and where the extension portion **81** and the resin mold compound side metallic cover **72** overlap one another, openings **83** for insertion of the screws **82** are provided. The pump base **80** is formed by pressing a metal plate. That is, the pump base **80** can be manufactured inexpensively.

[0045] Since a primary object of the pump base **80** is to facilitate the connection between the pump **70** and the apparatus (not shown in the figures) onto which the pump **70** is to be mounted, the metallic cover **71** and the resin mold compound side metallic cover **72** are not designed to withstand a great amount of pressure. However, the metallic cover **71** and the resin mold compound side metallic cover **72** need to sustain expansion which may occur to the upper case **11** and the resin mold compound **33**, and therefore durability thereof against the pressure need to be increased. Thus, the metallic cover **71** and the resin mold compound side metallic cover **72** are designed to be thicker than a thickness of the plate forming the pump base **80**. The thickness of the metallic cover **71** and that of the resin mold compound side metallic cover **72** each are, preferably, greater than, approximately, 2 mm. When the thickness of the metallic cover **71** and that of the resin mold compound side metallic cover **72** each are greater than approximately 2 mm, the metallic cover **71** and the resin mold compound side metallic cover **72** can sustain an expansion, of the uppercase **11** and the resin mold compound **33**, caused by the internal pressure within the pump chamber **16**. When the metallic cover **71** and the resin mold compound side metallic cover **72** each having a thickness smaller than, approximately, 2 mm are used, it is preferable that a rib is provided to the metallic cover **71** and the resin mold compound side metallic cover **72** in order to increase the durability of the metallic cover **71** and the resin mold compound side metallic cover **72**. When such rib is provided to the metallic cover **71** and the resin mold compound side metallic cover **72** each having the thickness smaller than approximately 2 mm, the metallic cover **71** and the resin mold compound side metallic cover **72** will have the durability equivalent to that of the

metallic cover **71** and the resin mold compound side metallic cover **72** having the thickness of, or greater than, approximately 2 mm.

[0046] Also, the metallic cover **71** and the resin mold compound side metallic cover **72** have preferably a same shape with one another. When the metallic cover **71** and the resin mold compound side metallic cover **72** have the same shape, they can be manufactured by using the same die, thereby reducing the production cost thereof. That is, pumps according to the present embodiment can be provided at low cost. When the metallic cover **71** and the resin mold compound side metallic cover **72** are manufactured by using the same die, the resin mold compound side metallic cover **72** will have an opening for the intake portion and an opening for a drainage plug in a same manner as the metallic cover **71**. In order to prevent the resin mold compound **33** from being exposed externally through the openings and to increase the durability of the resin mold compound **33**, a rib will be provided to the openings.

Third Embodiment

[0047] FIG. **4** is a diagram showing a schematic cross sectional view in the axial direction of a pump **50** according to a third embodiment of the present invention. FIG. **5** is an enlarged view of a portion A shown in FIG. **4**. As shown in FIG. **4**, the pump **50** is a canned type pump, wherein the pump **50** has a common structure as the pump **10** according to the first embodiment. In FIG. **4**, elements similar to those illustrated in FIG. **1** are denoted by similar reference numerals, and the description of the structure of the pump **50** is omitted.

[0048] The pump **50** according to the third embodiment comprises a stator **22** including an annular shaped resin mold compound **34** having therein the molded resin **32** in which the armature **30** and the printed circuit board **31** are provided. In the armature **30**, the ring shaped laminated core **29** and the coil **29***a* are provided.

[0049] The resin mold compound **34** includes therein an annular shaped reinforcement board **5** which is formed of a metal plate. The reinforcement board **5** is located at a molded resin portion **32***a*, in the resin mold compound **34**, between a cup shaped bottom portion **35** and the lower case **12**. The contact between the resin mold compound **34** and the lower case **12** is similar to the contact between the resin mold compound **33** and the lower case **12** according to the first embodiment.

[0050] The reinforcement board **5** which is formed of a non-magnetic material (e.g., stainless steel or aluminum alloy). The reinforcement board **5** is formed by embedding (e.g., insert molding) in the molded resin **32** when the resin mold compound **34** is formed by molding the stator **22** and the printed circuit board **31**. The reinforcement board **5** is located near or attached to an electronic component which is mounted on the printed circuit board **31** and emits heat so as for the electronic component to alleviate the heat.

[0051] The reinforcement board **5** can: increase the durability of the molded resin portion **32***a* having an inferior durability compared with the rest of the molded resin **32**; and alleviate the pressure conducted to the resin mold compound **34** from the bottom portion **35**. That is, the reinforcement board **5** prevents damages (e.g., occurrence of crack) from being done to the resin mold compound **34**, thereby preventing the stator **22** from being damaged, and prevents the resin mold compound **34** from being detached from the lower case **12**.

[0052] Also, in order to increase the durability of the pump **50**, an annular shaped reinforcement board **18** is provided by an insertion molding so as to surround a protruding portion of the intake portion **13**.

Fourth Embodiment

[0053] FIG. **6** is a diagram showing a schematic cross sectional view in the axial direction of a pump **60** according to a fourth embodiment of the present invention. FIG. **7** is a diagram showing an enlarged portion B shown in FIG. **6**. The pump **60** as shown in FIG. **6** is a canned type pump having a common structure as the pumps **10** and **50**, respectively, according to the first and the third embodiments. In FIG. **6**, elements similar to those illustrated in FIG. **4** are denoted by similar reference numerals, and the description of the structure of the pump **60** is omitted.

[0054] The pump **60** according to the fourth embodiment comprises, similarly as the pump **10** described above, the stator **22** and the printed circuit board **31** which are molded in the molded resin **32** forming the annular shaped resin mold compound **33**, wherein the stator **22** includes the ring shaped laminated core **29** and the coil.

[0055] The resin mold compound **33** is affixed along the outer circumferential surface of the rotor magnet **28** of the rotor **21**, and along the outer circumferential surface of the lower case **12**. There is a minute gap S between the inner circumferential surface of the resin mold compound **33** and the outer circumferential surface of the lower case **12**.

[0056] A filler **6** is provided in the gap S between the resin mold compound **33** and the lower case **12** of the pump **60** according to the present embodiment of the invention. The filler **6** is provided by applying it on the internal circumferential surface of the resin mold compound **33** and/or the outer circumferential surface of the lower case **12** before the resin mold compound **33** is attached to the lower case **12**.

[0057] The filler **6** may be an oil, a rubber or a resin substance. A silicon (e.g., rubber or resin) filler is beneficial in that, when applied on the lower case **12**, the expansion of the lower case **12** can be sustained. Also, the silicon case **12** can be easily applied and is inexpensive.

[0058] By this, the expansion of the lower case **12** due to the internal pressure of the fluid within the pump chamber **16** can be sustained, thereby preventing the occurrence of a crack at the weld line of the lower case **12**.

[0059] As described above, the pump according to the present invention provides: (1) the metallic cover **1** on the surface of the upper case formed of the resin material; (2) the metallic cover **1** on the surface of the upper case **11** and on the surface of the resin mold compound **33**; (3) the reinforcement board **5** in the resin mold compound **33** at the portion thereof where the resin mold compound **33** and the lower case **12** make contact with each other; and (4) the filler **6** in the gap S between resin mold compound **33** and the lower case **12**. Note, however, that aforementioned **4** elements each can be applied separately or simultaneously.

[0060] While the invention has been described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is understood that numerous other modifications and variations can be devised without departing from the scope of the invention. Further, the present invention can be applied to an automatic feed water pump, an axial pump,

or to a pump commonly referred to as a reversible pump, having therein a plurality of discharge portions, in which fluid inside the pump is directed to a predetermined discharge portion by an impeller provided therein.

[0061] Further, the stator **22** according to the present invention is not necessarily limited to as described above. The stator **22** can be formed by, after attaching the armature **30** to the lower case **12**, filling a space, which is generated by an exterior wall integrally formed with the lower case **12**, with a potting material. The space generated by the exterior wall can be provided separately from the lower case **12** or can be attached to the uppercase **11**.

[0062] Although the forgoing description assumes that a metallic plate (e.g., metallic cover and reinforcement board) is, in order to reinforce the durability of the pump, provided to the upper case the lower case and the resin mold compound, this is not limited thereto. Since an object of the invention is to provide an element to the upper case, the lower case and the resin mold compound so as to increase the durability of the upper case, the lower case and the resin mold compound, the element can be formed of a resin material having a high degree of hardness or a carbon fiber. For example, a reinforcement element for covering over the upper case, the lower case and the resin mold compound can be in any shape if the element is able to cover over the lower case and the resin mold compound.

[0063] The pump according to the present invention can be used for a water heater which is used for a heating system, a bath room and a kitchen.

What is claimed is:

1. A pump, comprising:
- a pump chamber formed, for forming therein a pathway for fluid, inside a case formed of a resin material;
- at least one intake portion connected to the pump chamber for intaking therein the fluid;
- at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;
- a rotor located inside the pump chamber and having therein a rotor magnet, wherein the rotor rotates along a predetermined rotary shaft;
- an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction;
- a stator located opposing to the rotor magnet while having a gap therebetween and located outside of the pump chamber, wherein the stator includes therein an armature which is a generator of a magnetic field; and
- a metallic cover affixed, for increasing durability of the case, to a portion of the case to which an internal pressure generated by the fluid inside the pump chamber is applied.

2. The pump according to claim **1**, wherein the metallic cover covers over a weld line generated on a surface of the case, and is affixed to the case on one side and the other side of the weld line.

3. The pump according to claim **1**, wherein the internal pressure of the fluid inside the pump chamber is greater than approximately 250 KPa.

4. The pump according to claim **1**, wherein the metallic cover is affixed to the case by a screw at a portion of the case radially outside of the pump chamber.

5. The pump according to claim **1**, wherein:
- the case includes an upper case and a lower case in an axial direction; the lower case is cup shaped for containing therein the rotor; and
- the metallic cover is affixed to a top surface in an axial direction of the upper case.

6. The pump according to claim **1**, wherein:
- the metallic cover is located on top side and bottom side in an axial direction of the case; and
- the case is, due to the metallic cover provided thereto, constrictedly secured in the axial direction.

7. The pump according to claim **1**, wherein:
- the stator includes therein a resin mold compound having formed therein an armature molded with the resin material; and
- the resin mold compound is located for making contact with an outer surface of the case.

8. The pump according to claim **5**, wherein:
- the stator includes therein a resin mold compound having formed therein an armature molded with the resin material; and
- the resin mold compound is located for making contact with at least an outer circumferential surface of the cup shape of the lower case.

9. The pump according to claim **7**, wherein a resin-mold-compound-side metallic cover is affixed to an outer surface of the resin mold compound so as to cover over the outer surface of the resin mold compound.

10. The pump according to claim **9**, wherein the case and the resin mold compound are, due to the metallic cover and the resin mold compound side cover respectively provided thereto, constrictedly secured in the axial direction.

11. The pump according to claim **8**, wherein a resin-mold-compound-side metallic cover is affixed to the outer surface of the resin mold compound so as to cover over the outer surface of the resin mold compound.

12. The pump according to claim **11**, wherein the case and the resin mold compound are, due to the metallic cover and the resin mold compound side cover respectively provided thereto, constrictedly secured in the axial direction.

13. The pump according to claim **10**, wherein the metallic cover and the resin mold compound side metallic cover each are affixed to a pump base to which a corresponding pump is attached.

14. The pump according to claim **9**, wherein a shape of the metallic cover and that of the resin mold compound side metallic cover are substantially identical.

15. The pump according to claim **14**, wherein:
- the metallic cover has formed thereon an opening at an area thereof corresponding to the intake portion; and
- provided is a rib for preventing an exposure, to an outside of the pump, of the resin mold compound at an area of the opening, and for increasing durability of the resin mold compound.

16. A pump, comprising:
- a pump chamber formed inside a case, formed of a resin material, for forming a pathway for fluid;
- at least one intake portion connected to the pump chamber for intaking therein the fluid;
- at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;
- a rotor located inside the pump chamber and having therein a rotor magnet, the rotor rotating along a predetermined rotary shaft;
- an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction; and
- a stator located opposing to the rotor magnet, while having a gap therebetween, outside of the pump cham-

ber, wherein the stator includes therein an armature which is a generator of a magnetic field, wherein:

the stator includes therein a resin mold compound having formed therein an armature molded with the resin material;

the resin mold compound and the case make contact with each other and are affixed to each other; and

a metallic cover, for increasing durability of the resin mold compound, is affixed to a portion of the resin mold compound.

17. A pump, comprising:

a pump chamber formed inside a case, formed of a resin material, for forming a pathway for fluid;

at least one intake portion connected to the pump chamber for intaking therein the fluid;

at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;

a rotor located inside the pump chamber and having therein a rotor magnet, wherein the rotor rotates along a predetermined rotary shaft;

an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction;

a stator located opposing to the rotor magnet, while having a gap therebetween, outside of the pump chamber;

the stator including therein a resin mold compound molding therein an armature which is a generator of a magnetic field;

the resin mold compound located such that a portion thereof makes contact with an outer surface of the case; and

a reinforcement board embedded in the portion of the resin mold compound making contact with the case.

18. The pump according to claim **14**, wherein:

the case includes an upper case and a lower case in an axial direction;

the lower case is cup shaped for containing therein the rotor;

the resin mold compound is provided so as to cover over at least a portion of a circumferential surface and a portion of a bottom surface of the cup shaped lower case; and

a reinforcement board is embedded at a bottom portion of the cup shaped lower case opposing the rotor magnet.

19. The pump according to claim **18**, wherein:

the resin mold compound has embedded therein a control circuit board below the stator;

the control circuit board has a surface facing the bottom portion of the cup shaped lower case in the axial direction; and

the reinforcement board is embedded between the bottom portion and the control circuit board in the axial direction.

20. The pump according to claim **17**, wherein the reinforcement board is formed of a material selected from the group consisting of stainless steel and aluminum alloy.

21. The pump according to claim **17**, wherein:

a case side reinforcement board is embedded for increasing durability of the case against an internal pressure of the fluid inside the pump chamber; and

the case side reinforcement board is provided at an area surrounding the intake portion of the case.

22. A pump, comprising:

a pump chamber formed inside a case, formed of a resin material, for forming a pathway for fluid;

at least one intake portion connected to the pump chamber for intaking therein the fluid;

at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;

a rotor located inside the pump chamber and having therein a rotor magnet, wherein the rotor rotates along a predetermined rotary shaft;

an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction;

a stator located opposing to the rotor magnet, while having a gap therebetween, outside of the pump chamber, wherein the stator includes therein an armature which is a generator of a magnetic field;

a metallic cover affixed, for increasing durability of the case, to a portion of the case to which an internal pressure generated by the fluid inside the pump chamber is applied; and

a case side reinforcement board being embedded for increasing durability of the case against an internal pressure of the fluid inside the pump chamber, wherein the case side reinforcement board is provided at an area surrounding the intake portion of the case.

23. The pump according to claim **22**, wherein:

the stator includes therein a resin mold compound having formed therein an armature molded with the resin material; and

the resin mold compound is located for making contact with an outer surface of the case.

24. A pump, comprising:

a pump chamber formed inside a case, formed of a resin material, for forming a pathway for fluid;

at least one intake portion connected to the pump chamber for intaking therein the fluid;

at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;

a rotor located inside the pump chamber and having therein a rotor magnet, wherein the rotor rotates along a predetermined rotary shaft;

an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction;

a stator located opposing to the rotor magnet, while having a gap therebetween, outside of the pump chamber;

the stator including therein a resin mold compound molding therein an armature which is a generator of a magnetic field;

the resin mold compound located such that a portion thereof makes contact with an outer surface of the case; and

a filler provided in a space between the resin mold compound and the outer surface of the case.

25. The pump **25** according to claim **24**, wherein:

the case includes an upper case and a lower case in an axial direction;

the lower case is cup shaped for containing the rotor via a gap surrounding a circumferential surface and a bottom surface of the rotor magnet in the rotor;

the resin mold compound is provided so as to cover over at least a portion of a circumferential surface and a portion of a bottom surface of the cup shaped lower case; and

a filler is provided at a portion of a space between an outer circumferential surface and a bottom surface of the cup shaped lower case, and an inner circumferential surface of the resin mold compound.

26. The pump according to claim **24**, wherein the filler is provided covering over a weld line generated on the case and on the resin mold compound.

27. The pump according to claim **24**, wherein the filler is silicon based.

28. The pump according to claim **1**, wherein the metallic cover is thicker than, approximately, 2 mm.

29. The pump according to claim **1**, wherein:

the metallic cover is thinner than, approximately, 2 mm; and

the metallic cover has provided thereon a rib so as to increase durability of the metallic cover.

30. A pump, comprising:

a pump chamber formed inside a case, formed of a resin material, for forming a pathway for fluid;

at least one intake portion connected to the pump chamber for intaking therein the fluid;

at least one discharge portion connected to the pump chamber for discharging therefrom the fluid;

a rotor located inside the pump chamber and having therein a rotor magnet, wherein the rotor rotates along a predetermined rotary shaft;

an impeller rotating along with the rotor so as to direct the fluid to a predetermined direction;

a stator located opposing to the rotor magnet, while having a gap therebetween, outside of the pump chamber, wherein the stator includes therein an armature which is a generator of a magnetic field; and

a reinforcement element affixed, for increasing durability of the case, to a portion of the case to which an internal pressure generated by the fluid inside the pump chamber is applied.

31. The pump according to claim **30**, wherein:

the stator includes therein a resin mold compound having formed therein an armature molded with the resin material; and

the resin mold compound is located for making contact with an outer surface of the case.

32. The pump according to claim **1**, wherein the pump is used for a water heater used for a heating system operable to simultaneously distribute hot water to a plurality of outlets.

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