



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
16.09.2015 Bulletin 2015/38

(51) Int Cl.:
F04C 15/00 ^(2006.01) **F04C 2/10** ^(2006.01)

(21) Application number: **15154648.8**

(22) Date of filing: **11.02.2015**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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(30) Priority: **14.03.2014 JP 2014052254**

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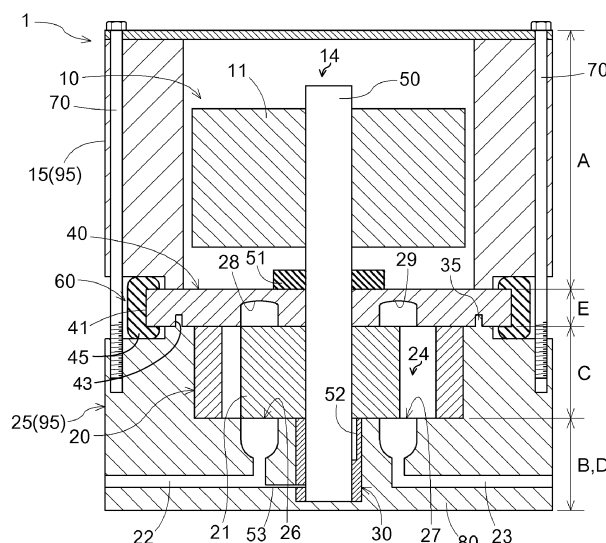
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(54) **Electric pump**

(57) An electric pump (1, 200) includes a motor rotor (11), a pump rotor (21), a rotary shaft (50) being mounted to the motor rotor (11) and the pump rotor (21), a case body (95) including a motor chamber (14) housing the motor rotor (11), a pump chamber (24) housing the pump rotor (21), and a bearing portion (30) cantilevering an end portion of opposing end portions of the rotary shaft (50), the end portion protruding from the pump rotor (21) in a

direction opposite from the motor rotor (11), an inlet passage (22) being provided at the case body (95) and communicating with the pump chamber (24), and an outlet passage (23) being provided at the case body (95) and communicating with the pump chamber (24). The inlet passage (22) and the outlet passage (23) are disposed radially outward of the rotary shaft (50) relative to the bearing portion (30).

FIG. 1



Description

TECHNICAL FIELD

[0001] This disclosure generally relates to an electric pump.

BACKGROUND DISCUSSION

[0002] A known electric pump is used, for example, to supply oil pressure to a device which is driven by operation oil. The constructions of known electric pumps are disclosed in JP2012-189015A (hereinafter referred to as Patent reference 1) and shown in Fig. 3.

[0003] An electric pump unit disclosed in Patent reference 1 includes a motor housing which has a built-in electric motor. The motor housing is fixed to a pump body. A pump chamber is formed within the pump body. A bearing device supporting the electric motor is provided within the motor housing. Another electric pump 100 shown in a side cross-sectional view (longitudinal cross-sectional view) in Fig. 3 includes a motor rotor 111, a bearing portion 130 and a pump rotor 121 along an axial direction of a rotary shaft 150 in the aforementioned order.

[0004] The known electric pump is required to be downsized as much as possible to be mounted to various devices. According to the construction of the electric pump unit disclosed in Patent reference 1, the bearing device is housed within the motor housing so that the electric pump unit is downsized. However, because the electric pump unit is required to secure a space for the bearing device within the motor housing, it is not easy to further downsize the electric pump unit. The electric pump 100 shown in Fig. 3 is required to secure each length of the motor rotor 111, the bearing portion 130 and the pump rotor 121 in the axial direction of the rotary shaft 150. Thus, it is not easy to decrease the length of the electric pump 100 in the axial direction.

[0005] A need thus exists for an electric pump that is downsized to be mounted to the various devices.

SUMMARY

[0006] According to an aspect of this disclosure, an electric pump includes a motor rotor, a pump rotor, a rotary shaft being mounted to the motor rotor and the pump rotor, a case body including a motor chamber housing the motor rotor, a pump chamber housing the pump rotor, and a bearing portion cantilevering an end portion of opposing end portions of the rotary shaft, the end portion protruding from the pump rotor in a direction opposite from the motor rotor, an inlet passage being provided at the case body and communicating with the pump chamber, and an outlet passage being provided at the case body and communicating with the pump chamber. The inlet passage and the outlet passage are disposed radially outward of the rotary shaft relative to the bearing portion.

[0007] According to the aforementioned construction, the bearing portion, the inlet passage and the outlet passage are disposed next to one another along the axial direction of the rotary shaft. Accordingly, the length of the electric pump in the axial direction decreases comparing to a known electric pump which includes the bearing portion and the set of the inlet passage and the outlet passage being disposed in series, or in the axial direction. Thus, the electric pump is downsized.

[0008] According to another aspect of this disclosure, the bearing portion, the inlet passage and the outlet passage are disposed next to one another along an axial direction of the rotary shaft.

[0009] According to the aforementioned construction, the length of the electric pump in the axial direction decreases comparing to the known electric pump which includes the bearing portion and the set of the inlet passage and the outlet passage being disposed in series, or in the axial direction. Thus, the electric pump is downsized.

[0010] According to further aspect of this disclosure, the motor chamber and the pump chamber are partitioned by a plate-shaped partition member.

[0011] According to the aforementioned construction, the length of the partition member which partitions the motor chamber from the pump chamber along the rotary shaft decreases. Thus, the electric pump is downsized.

[0012] According to still further aspect of this disclosure, the partition member includes an annular seal member provided at an outer rim portion of the partition member. The case body includes a motor case defining the motor chamber and a pump case defining the pump chamber. The motor case and the pump case sandwich the seal member and a portion of the partition member, the portion being disposed at an inner circumference of the partition member relative to the seal member, the portion being away from the seal member.

[0013] According to the aforementioned construction, the portion of the partition member being sandwiched by the motor case and the pump case is disposed at the inner portion relative to the second seal member. Accordingly, the bending moment applied to the partition member by the outlet pressure and the inlet pressure of the electric pump decreases. Thus, the deformation of the partition member is prevented. Further, the thickness of the partition member can be thinner so that the electric pump is downsized.

[0014] According to another aspect of this disclosure, the partition member includes a fixing portion for fixing the partition member to one of the motor case and the pump case.

[0015] According to the aforementioned construction, the partition member is positioned and is temporarily fixed to one of the motor case and the pump case before being sandwiched by the motor case and the pump case. Accordingly, the process for sandwiching the partition member by the motor case and the pump case is performed easily.

[0016] According to still another aspect of this disclosure,

sure, the pump chamber includes an inlet port and an outlet port. The partition member includes a plurality of recessed portions disposed at positions facing the inlet port or the outlet port, respectively.

[0017] According to the aforementioned construction, a first recessed portion faces the inlet port while a second recessed portion faces the outlet port so that the contact area of the pump rotor and the partition member can decrease. Thus, the friction caused by the rotation of the pump rotor decreases when the pump rotor is rotated by the rotary shaft.

[0018] According to further aspect of this disclosure, the partition member is made from a metal plate and is formed by stamping.

[0019] According to the aforementioned construction, the forming process of the partition member is easily performed.

[0020] According to another aspect of this disclosure, the electric pump further includes a communication hole extending from the bearing portion to the inlet passage along a radial direction of the rotary shaft.

[0021] According to the aforementioned construction, the bearing portion and the inlet passage are disposed next to each other along the axial direction of the rotary shaft. For example, in a case where the inlet passage is formed by perforating process along the radial direction of the rotary shaft, the inlet passage can be used for forming the communication hole.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] The foregoing and additional features and characteristics of this disclosure will become more apparent from the following detailed description considered with the reference to the accompanying drawings, wherein:

Fig. 1 is a side cross-sectional view of an electric pump according to a first embodiment disclosed here;

Fig. 2 is a side cross-sectional view of an electric pump according to a second embodiment; and

Fig. 3 is a side cross-sectional view of a known electric pump.

DETAILED DESCRIPTION

[0023] An electric pump 1 of a first embodiment will be explained with reference to Fig. 1. The electric pump 1 is configured with an electric motor portion 10, a pump portion 20, a bearing portion 30 and a partition member 40.

[0024] The electric motor portion 10 serves as a driving source of the electric pump 1 and includes a motor rotor 11 which integrally rotates with a rotary shaft 50 and a stator. The motor rotor 11 is attached to the rotary shaft 50 which integrally rotates with the motor rotor 11. The motor rotor 11, the stator and the rotary shaft 50 are provided at a motor chamber 14 which is defined by a motor

case 15.

[0025] The pump portion 20 includes a pump rotor 21, an inlet passage 22 and an outlet passage 23. The pump portion 20 of the first embodiment corresponds to a known trochoid pump. The pump rotor 21 is attached to the rotary shaft 50 which integrally rotates with the pump rotor 21. As described above, the motor rotor 11 is attached to the rotary shaft 50. Thus, the rotary force of the motor rotor 11 is transmitted to the pump rotor 21 via the rotary shaft 50. The pump rotor 21 is housed in a pump chamber 24 which is defined by a pump case 25. A case body 95 is configured with the pump case 25 and the motor case 15.

[0026] Each of the inlet passage 22 and the outlet passage 23 is provided at the case body 95 and communicates with the pump chamber 24. The inlet passage 22 corresponds to an oil passage which delivers and supplies fluid to the pump chamber 24. The outlet passage 23 corresponds to an oil passage which delivers fluid which is discharged from the pump chamber 24.

[0027] The bearing portion 30 cantilevers an end portion of opposing end portions of the rotary shaft 50, the end portion protruding from the pump rotor 21 in a direction opposite from the motor rotor 11. Accordingly, a first side of the pump rotor 21 in the axial direction is provided with the motor rotor 11 while a second side of the pump rotor 21 in the axial direction is provided with the bearing portion 30. According to the first embodiment, the bearing portion 30 corresponds to a known sliding bearing and rotatably supports the rotary shaft 50. The bearing portion 30 is provided at the case body 95.

[0028] Each of the inlet passage 22 and the outlet passage 23 is disposed at a position which is outward in a radial direction of the rotary shaft 50 relative to the bearing portion 30. Thus, the bearing portion 30, the inlet passage 22 and the outlet passage 23 are disposed next to one another along the axial direction of the rotary shaft 50. Accordingly, the length of the electric pump 1 in the axial direction can decrease.

[0029] The partition member 40 is formed in a plate shape and partitions the motor chamber 14 from the pump chamber 24. The motor rotor 11 is housed in the motor chamber 14. On the other hand, the pump rotor 21 is housed in the pump chamber 24. The pump chamber 24 delivers the fluid supplied to and discharged from the pump portion 20. The partition member 40 liquid-tightly partitions the motor chamber 14 from the pump chamber 24 to prevent the fluid within the pump chamber 24 from entering into the motor chamber 14. According to the first embodiment, a first seal member 51 is provided at the rotary shaft 50 to prevent the fluid from reaching a side or a surface of the partition member 40 which is close to the motor chamber 14. The first seal member 51 is made from, for example, an elastic member.

[0030] The partition member 40 includes an annular second seal member 45 which is disposed at an outer rim portion 41 of the partition member 40. The outer rim portion 41 corresponds to an outer circumferential sur-

face of the plate-shaped partition member 40. The second seal member 45 covers the outer circumferential surface of the partition member 40 while protruding from the outer circumferential surface in opposing directions and in the axial direction by a predetermined amount. The second seal member 45 is made from, for example, an elastic member, similarly to the first seal member 51.

[0031] The partition member 40 includes a fixing portion which can fix the partition member 40 to one of the motor case 15 and the pump case 25. According to the first embodiment, the partition member 40 is fixed to the pump case 25. The partition member 40 is provided with a recessed portion 43 (i.e., serving as a fixing portion) which serves as the fixing portion and is disposed at a surface facing the pump case 25. The pump case 25 includes a protruding portion 35 which faces the recessed portion 43. The protruding portion 35 is engaged with and inserted into the recessed portion 43 so that the partition member 40 is fixed to the pump case 25. Accordingly, the partition member 40 can be positioned and temporarily fixed to the pump case 25. The plural recessed portions 43 and the plural protruding portions 35 are shown in Fig. 1. Alternatively, the partition member 40 is provided with at least one recessed portion 43 and at least one protruding portion 35.

[0032] The motor case 15 and the pump case 25 sandwich the second seal member 45 and a portion of the partition member 40 which is disposed at an inner circumference of the partition member 40 relative to the second seal member 45 and is away from the second seal member 45. The inner circumferential portion of the partition member 40 relative to the second seal member 45 corresponds to a portion which is disposed at a position close to the rotary shaft 50 relative to the portion which is fixed by the second seal member 45. The partition member 40 is provided such that a first surface of the partition member 40 in the axial direction is in contact with the motor case 15 and a second surface of the partition member 40 in the axial direction is in contact with the pump case 25. Thus, the partition member 40 is fixed by the motor case 15 and the pump case 25 to prevent the leakage of the fluid.

[0033] As described above, the partition member 40 can be fixed to either the pump case 25 or the motor case 15 by the application of the fixing portion before the motor case 15 and the pump case 25 are fixed by bolts 70. Alternatively, the partition member 40 is positioned and temporarily fixed to either the motor case 15 or the pump case 25 by the application of other bolts instead of being fixed by the recessed portion 43 and the protruding portion 35.

[0034] The partition member 40 includes a first recessed portion 28 and a second recessed portion 29 which are disposed at positions facing an inlet port 26 and an outlet port 27 of the pump chamber 24, respectively. The inlet port 26 serves as an opening portion which is provided at the pump chamber 24 and communicated with the inlet passage 22. The outlet port 27

serves as an opening portion which is provided at the pump chamber 24 and communicated with the outlet passage 23. The hydraulic pressure level of the fluid applied to the outlet port 27 is higher than the hydraulic pressure level of the fluid applied to the inlet port 26 by an application of the pump portion 20. Thus, the inlet port 26 and the outlet port 27 are formed not to communicate with each other at the pump portion 24 to prevent the decrease of the hydraulic pressure level applied to outlet port 27. Accordingly, the first and second recessed portions 28, 29 are formed not to communicate with each other. The first recessed portion 28 faces the inlet port 26 while the second recessed portion 29 faces the outlet port 27 so that a contact area of the pump rotor 21 and the partition member 40 can decrease. Thus, the friction caused by the rotation of the pump rotor 21 can decrease when the pump rotor 21 is rotated by the rotary shaft 50.

[0035] As described above, the bearing portion 30 corresponds to the known sliding bearing. According to the first embodiment, the fluid travels from the pump chamber 24 to the bearing portion 30 to reduce the frictional resistance of the bearing portion 30 and to prevent the abrasion of the bearing portion 30. The supplying amount of the fluid can be any amount as long as the bearing 30 can be lubricated.

[0036] In order to guide the fluid which serves as lubricant oil from the area of the pump chamber 24 where the higher pressure is applied, that is, the outlet port 27 of the pump chamber 24, to the bearing portion 30, a guide portion 52 is provided at the bearing portion 30 and is disposed along the rotary shaft 50. The length of the guide portion 52 favorably corresponds to a length which is from one-third to a half of the bearing portion 30 in the axial direction. Accordingly, the fluid can be delivered to the bearing portion 30 automatically in accordance with the rotation of the pump rotor 21 so that the bearing portion 30 can be lubricated.

[0037] A communication hole 53 is provided to be extended from the bearing portion 30 to the inlet passage 22 along the radial direction of the rotary shaft 50. As described above, the fluid including the higher fluid pressure by the application of the pump portion 20 than the fluid housed in the inlet port 26 is delivered to the bearing portion 30. Accordingly, the communication hole 53 returns the fluid delivered to the bearing 30 via the guide portion 52 to the inlet passage 22 automatically.

[0038] For purposes of understanding, the same components as those described in Fig. 1 are marked with the same reference numerals in Fig. 3. An electric pump 100 shown in Fig. 3 is provided with a rotor motor 111 and a pump rotor 121. The motor rotor 111 is disposed at a first side of a bearing portion 130 in the axial direction of a rotary shaft 150. The pump rotor 121 is disposed at a second side of the bearing portion 130 in the axial direction of the rotary shaft 150. Accordingly, the electric pump 100 is configured with the motor rotor 111, the bearing portion 130 and the pump rotor 121 which are disposed in the aforementioned order in the axial direction of the

rotary shaft 150 so that an inlet passage 122 and an outlet passage 123 cannot be disposed next to the bearing portion 130 to be positioned radially outward of the bearing portion 130. In addition, the bearing portion 130 is disposed between the motor rotor 111 and the pump rotor 121 so that the length of a pump case 125 is secured by the length of the bearing portion 130 in the axial direction.

[0039] The electric pump 1 of the first embodiment shown in Fig. 1 is provided with the motor rotor 11 and the bearing portion 30. The motor rotor 11 is disposed at the first side of the pump rotor 21 in the axial direction of the rotary shaft 50. The bearing portion 30 is disposed at the second side of the pump rotor 21 in the axial direction of the rotary shaft 50. Accordingly, the electric pump 1 is configured with the motor rotor 11, the pump rotor 21 and the bearing portion 30 which are disposed in the aforementioned order in the axial direction of the rotary shaft 50 so that the bearing portion 30 is disposed next to the inlet passage 22 and the outlet passage 23 to be positioned at respective inner portions of the inlet passage 22 and the outlet passage 23 in the radial direction. That is, the inlet passage 22 and the outlet passage 23 are disposed radially outward relative to the bearing portion 30 or are disposed at respective positions which face the bearing 30. Thus, the length of the electric pump 1 in the axial direction is shorter than the length of the electric pump 100 in the axial direction so that the electric pump 1 is downsized.

[0040] In particular, according to the known electric pump 100 shown in Fig. 3, the length of the electric pump 100 along the axial direction of the rotary shaft 150 corresponds to the total length of a first length A of an electric motor portion 110, a second length B of a portion of the pump case 125 supporting the bearing portion 130, a third length C of a pump portion 120 and a fourth length D of a flow passage forming portion 180 where the inlet passage 122 and the outlet passage 123 are provided. On the other hand, according to the electric pump 1 shown in Fig. 1, a fifth length E of the partition member 40 is added between the first length A of the electric motor portion 10 and the length C of the pump portion 20. However, because the bearing portion 30 is provided at the fluid passage forming portion 80, the length of the electric pump 1 can decrease by a length calculated by subtracting the fifth length E of the partition member 40 from the fourth length D of the flow passage forming portion 80 (or the second length B of the portion of the pump case 25 supporting the bearing portion 30).

[0041] Further, as shown in Fig. 3, a first seal member 151 seals the fluid which is supplied from an outlet port 127 of a pump chamber 124 to the bearing portion 130 via a guide portion 152 in order to lubricate the bearing portion 130 of the known electric pump 100. However, a communication hole 153 which returns the fluid reaching the first seal member 151 to the inlet port 126 of the pump chamber 124 cannot be formed in parallel with the axial direction of the rotary shaft 150 because the communication hole 153 communicates with the first recessed por-

tion 128 which is disposed away from the first seal member 151 in the radial direction of the rotary shaft 150, or which is disposed away from the rotary shaft 150 relative to the first seal member 151. Accordingly, a jig supporting the pump case 125 is provided exclusively when the communication hole 153 is formed. On the other hand, the electric pump 1 of the first embodiment includes the communication hole 53 which is disposed in parallel with and to be extended from the inlet passage 22. Thus, a jig supporting the pump case 25 when the inlet passage 22 is formed and the jig supporting the pump case 25 when the communication hole 53 is formed can be integrated with each other, thereby reducing of the manufacturing cost for processing.

[0042] The construction of an electric pump 200 of a second embodiment will be explained. According to the aforementioned first embodiment, the motor chamber 14 and the pump chamber 24 are partitioned by the plate-shaped partition member 40 which includes the first and second recessed portions 28, 29. Alternatively, as shown in Fig. 2, the partition member 40 is formed of a metal plate which is stamped to include the first and second recessed portions 28, 29. The aforementioned partition member 40 can partition the motor chamber 14 from the pump chamber 24.

[0043] In addition, the motor case 15 and the pump case 25 sandwich the second seal member 45 and a portion of the partition member 40 which is disposed close to the rotary shaft 50 relative to an outer rim portion 41 and is away from the second seal member 45. Instead of the first seal member 51 of the first embodiment, a first seal member 54 which is integrally formed with an inner rim portion 42 of the partition member 40 can support the rotary shaft 50. According to the aforementioned construction of the electric pump 200, the pump chamber 24 can be liquid-tightly partitioned by the partition member 40. Thus, the electric pump 200 can prevent the fluid from entering into the motor chamber 14 from the pump chamber 24. When the metal plate is stamped, a protruding portion serving as a fixing portion is formed by punching. The protruding portion is engaged with a recessed portion formed at the pump case 25 so that the partition member 40 is positioned at the pump case 25.

[0044] According to the aforementioned first and second embodiments, the first seal member 51, 54 is provided at a first side of the opposing sides of the partition member 40 in the axial direction, the first side close to the motor chamber 14. Alternatively, for example, in a case where the motor rotor 11 is soaked with oil by an application of the fluid of the pump chamber 24, the first seal member 51, 54 is not provided.

[0045] According to the aforementioned first and second embodiments, the motor case 15 and the pump case 25 sandwich the second seal member 45 and the portion of the partition member 40 which is disposed at the inner circumference of the partition member 40 relative to the second seal member 45 and is away from the second seal member 45. Alternatively, for example, the pump

case 25 includes a recessed portion which is engaged with and is inserted by the partition member 40 so that the outer circumferential surface of the partition member 40 can be inlaid with the recessed portion of the pump case 25. In such a case, a seal member is provided at an opposing surface where the partition member 40 and the motor case 15 face with each other, thereby preventing the fluid from entering into the motor chamber 14 from the pump chamber 24. In addition, the partition member 40 being inlaid with the recessed portion of the pump case 25 and the recessed portion of the pump case 25 can be formed in shapes which are different from the complete round so that the partition member 40 can be positioned and temporarily fixed to the pump case 25 easily.

[0046] According to the first and second embodiments, the first and second recessed portions 28, 29 are provided at the positions which face the inlet port 26 and the outlet port 27 of the pump chamber 24, respectively. Alternatively, the partition member 40 can be constructed without the first and second recessed portions 28, 29.

[0047] According to the first and second embodiments, the communication hole 53 is provided to be extended from the bearing portion 30 to the inlet passage 22 along the radial direction of the rotary shaft 50. Alternatively, for example, a portion of the bearing portion 30 is exposed from a bottom surface of the pump case 25. An oil pan communicating with the inlet passage 22 can collect the fluid dripping from the exposed portion. In such a case, the communication hole 53 does not have to be provided. In a case where the bearing portion 30 includes other lubrication mechanisms, the communication hole 53 does not have to be provided.

[0048] This disclosure is applicable to an electric pump which is driven by an electric motor.

[0049] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. An electric pump (1, 200), comprising:

- a motor rotor (11);
- a pump rotor (21);
- a rotary shaft (50) being mounted to the motor rotor (11) and the pump rotor (21);
- a case body (95) including a motor chamber (14)

housing the motor rotor (11), a pump chamber (24) housing the pump rotor (21), and a bearing portion (30) cantilevering an end portion of opposing end portions of the rotary shaft (50), the end portion protruding from the pump rotor (21) in a direction opposite from the motor rotor (11); an inlet passage (22) being provided at the case body (95) and communicating with the pump chamber (24); and an outlet passage (23) being provided at the case body (95) and communicating with the pump chamber (24); wherein the inlet passage (22) and the outlet passage (23) are disposed radially outward of the rotary shaft (50) relative to the bearing portion (30).

2. The electric pump (1, 200) according to claim 1, wherein the bearing portion (30), the inlet passage (22) and the outlet passage (23) are disposed next to one another along an axial direction of the rotary shaft (50).

3. The electric pump (1) according to claim 1 or 2, wherein the motor chamber (14) and the pump chamber (24) are partitioned by a plate-shaped partition member (40).

4. The electric pump (1, 200) according to claim 3, wherein the partition member (40) includes an annular seal member (45) provided at an outer rim portion (41) of the partition member (40); the case body (95) includes a motor case (15) defining the motor chamber (14) and a pump case (25) defining the pump chamber (24); and the motor case (15) and the pump case (25) sandwich the seal member (45) and a portion of the partition member (40), the portion being disposed at an inner circumference of the partition member (40) relative to the seal member (45), the portion being away from the seal member (45).

5. The electric pump (1, 200) according to claim 4, wherein the partition member (40) includes a fixing portion (43) for fixing the partition member (40) to one of the motor case (15) and the pump case (25).

6. The electric pump (1, 200) according to any one of claims 3 to 5, wherein the pump chamber (24) includes an inlet port (26) and an outlet port (27); and the partition member (40) includes a plurality of recessed portions (28, 29) disposed at positions facing the inlet port (26) and the outlet port (27), respectively.

7. The electric pump (200) according to any one of claims 3 to 6, wherein the partition member (40) is

made from a metal plate and is formed by stamping.

8. The electric pump (1, 200) according to any one of claims 1 to 7, further comprising:

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a communication hole (53) extending from the bearing portion (30) to the inlet passage (22) along a radial direction of the rotary shaft (50).

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FIG. 1

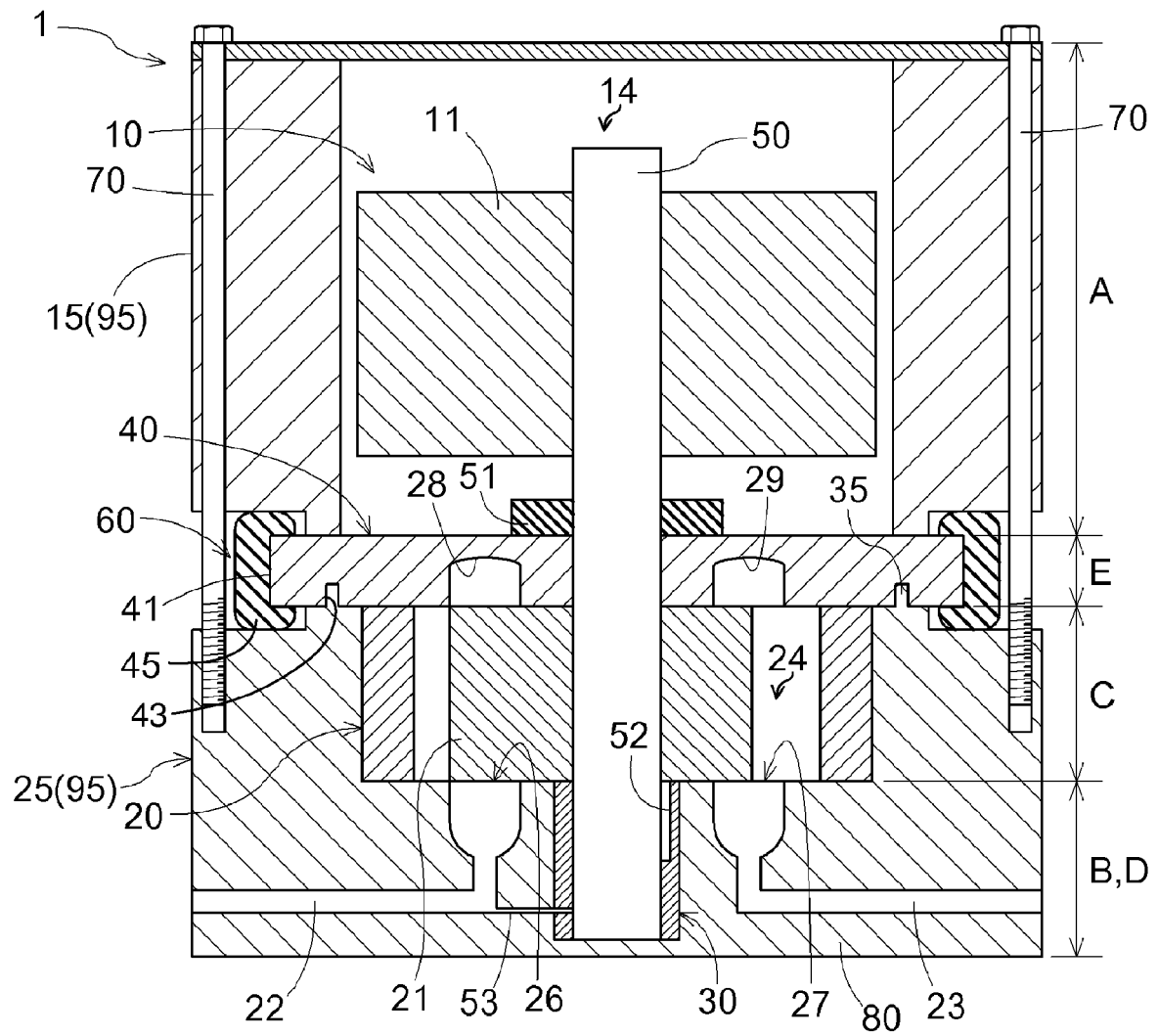


FIG. 2

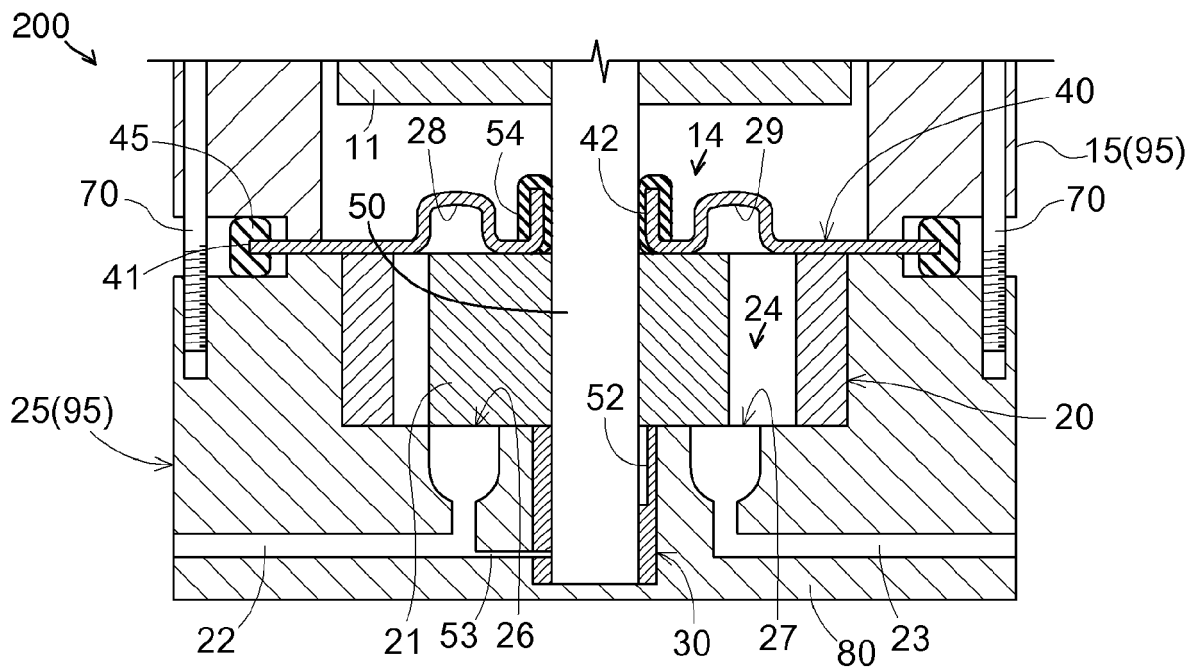
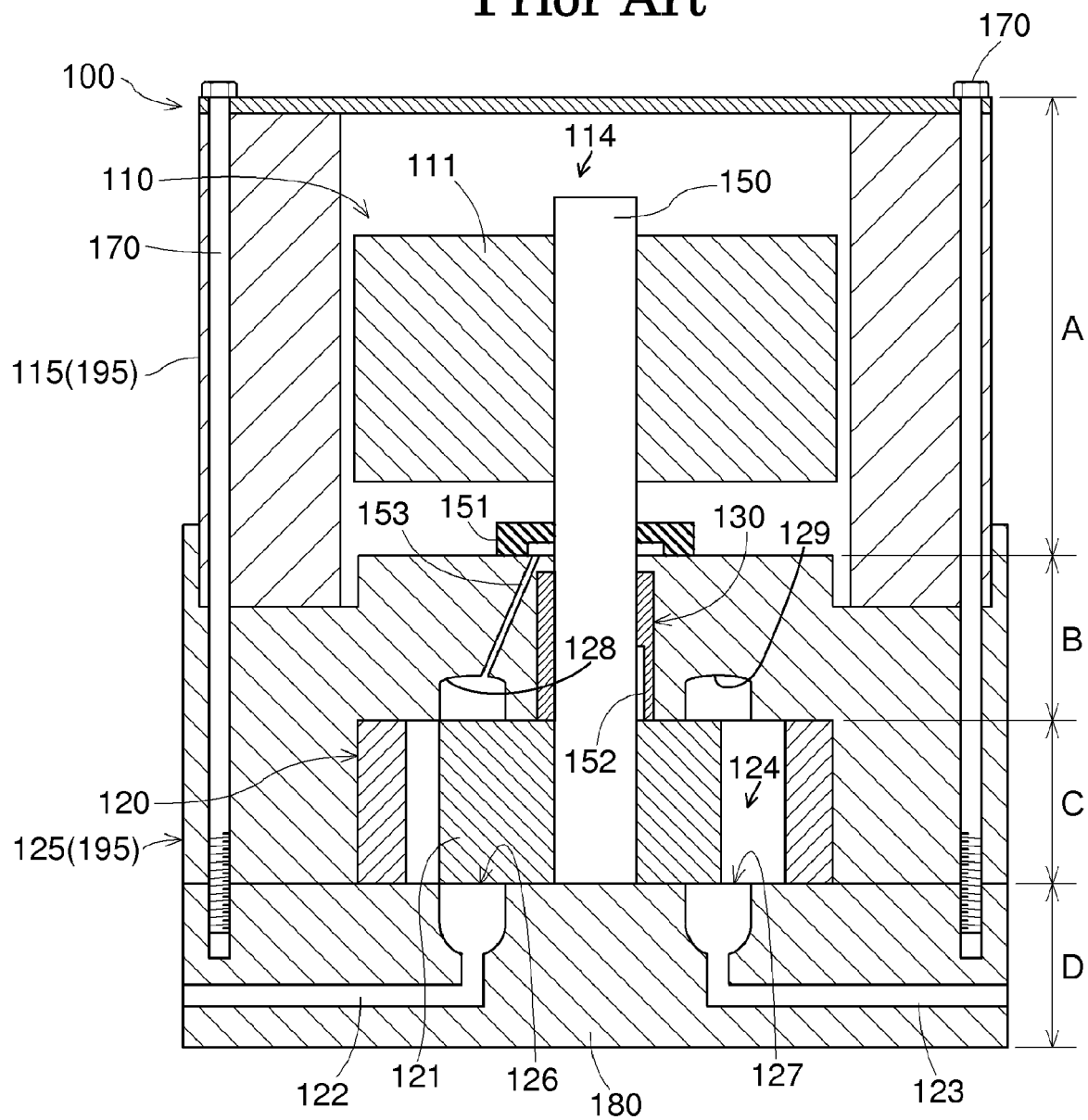


FIG. 3

Prior Art





EUROPEAN SEARCH REPORT

Application Number
EP 15 15 4648

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DOCUMENTS CONSIDERED TO BE RELEVANT			
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			TECHNICAL FIELDS SEARCHED (IPC)
			F04C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		17 April 2015	Durante, Andrea
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 15 4648

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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17-04-2015

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REFERENCES CITED IN THE DESCRIPTION

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