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(54) **SEALING STRUCTURE, AND GEAR PUMP HAVING IMPROVED SEALING PERFORMANCE AND HAVING LUBRICATION STRUCTURE**

(57) A gear pump with improved sealing performance includes a pump housing, a drive assembly, a motor assembly, and a sealing assembly. The pump housing has a cavity, a liquid inlet channel, a liquid outlet channel, and a shaft hole. The drive assembly is located in the cavity and is configured to drive liquid from the liquid inlet channel into the cavity and out through the liquid outlet channel. The motor assembly includes an end cover and a motor shaft extending from the end cover. The motor shaft extends into the cavity through the shaft hole and is drivingly connected to the drive assembly. The sealing assembly includes a sealing member and an elastic member. The sealing member is annularly arranged around a periphery of the motor shaft to seal the shaft hole. The elastic member elastically supports the sealing member to limit a position of the sealing member.

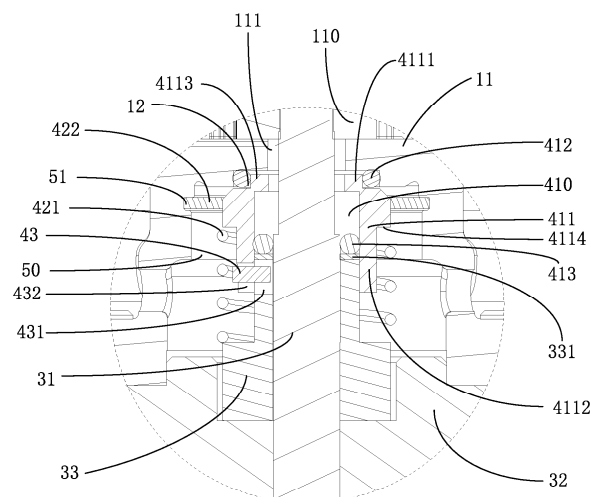


FIG. 4

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Description**TECHNICAL FIELD**

[0001] The present invention relates to the field of pump body sealing technology, specifically to a sealing assembly, and a gear pump with improved sealing performance and a lubrication structure.

BACKGROUND

[0002] During operation, a pump body primarily achieves fluid pumping through volume changes in a liquid inlet cavity and a liquid outlet cavity within its cavity. Specifically, a motor shaft can drive moving components inside the cavity to facilitate fluid flow. For example, in a gear pump, the motor shaft drives the rotation of gears, while in a vane pump, the motor shaft drives the rotation of an impeller. The motor shaft typically extends into the cavity through a shaft hole in a pump housing.

[0003] In existing technologies, a sealing ring can be installed around the motor shaft to seal the shaft hole. However, vibrations generated during motor operation inevitably transfer to the sealing ring, often causing it to loosen and fail after prolonged use of the pump, thereby affecting the pump's operational lifespan.

SUMMARY

[0004] A primary object of the present invention is to propose a gear pump with improved sealing performance, aiming to address the issue in existing technologies where prolonged use of a pump body leads to easy sealing failure due to vibration.

[0005] To achieve the above object, the present invention propose a gear pump with improved sealing performance, including: a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole;

a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel;

a motor assembly including an end cover and a motor shaft extending from the end cover, the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and

a sealing assembly including a sealing component and an elastic component, the sealing component being annularly disposed around an outer periphery of the motor shaft to seal the shaft hole, and the elastic component elastically supporting the

sealing component to limit the sealing component.

[0006] In one embodiment, the pump housing includes a housing plate facing the end cover, the shaft hole is provided on the housing plate, the elastic component includes a compression spring extending in an axial direction, one end of the compression spring elastically abuts against the sealing component, and another end of the compression spring is connected to the motor assembly.

[0007] In one embodiment, the sealing component includes a sleeve, a first sealing ring and a second sealing ring; the sleeve is sleeved on the outer periphery of the motor shaft and has a first end adjacent to the housing plate and a second end adjacent to the end cover; a sealing cavity is defined between an inner periphery of the sleeve and the outer periphery of the motor shaft; the sealing cavity is in communication with the cavity; the first sealing ring is disposed between the first end and the housing plate; the second sealing ring is disposed between the second end and the motor shaft; and the first sealing ring and the second sealing ring are configured to jointly seal the sealing cavity.

[0008] In one embodiment, a side of the housing plate facing the end cover is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole; the first end is provided with an annular step inserted into the sealing groove; and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.

[0009] In one embodiment, the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft.

[0010] In one embodiment, a bearing is provided on the end cover, the motor shaft extends from the bearing, a portion of the bearing is inserted into the open end, and a side of the second sealing ring facing away from the sealing cavity abuts against the bearing.

[0011] In one embodiment, a washer is provided on an end side of the bearing facing the housing plate, and the second sealing ring presses against the washer.

[0012] In one embodiment, a first limiting groove is provided on an outer peripheral side of the bearing, a second limiting groove is provided on a peripheral side of the sleeve, each of the first limiting groove and the second limiting groove extends in the axial direction, and the sealing assembly further includes a limiting post inserted into the first limiting groove and the second limiting groove.

[0013] In one embodiment, a bearing surface facing the end cover is annularly provided on an outer periphery of the sleeve; the one end of the compression spring abuts against the bearing surface, and the another end of the compression spring abuts against the motor assembly.

[0014] In one embodiment, a bearing is provided on the end cover, the bearing has an opening groove facing the housing plate, the opening groove is annularly disposed around the outer periphery of the motor shaft, and an end of the compression spring abutting against the motor assembly is inserted into the opening groove and abuts against a bottom of the opening groove.

[0015] In one embodiment, a third sealing ring is also sleeved on the motor shaft, and the third sealing ring is clamped between an inner periphery of the shaft hole and an outer periphery of the motor shaft.

[0016] In one embodiment, the elastic component further includes a snap spring, the snap spring is annularly disposed extending in a circumferential direction and having a gap, and the snap spring is sleeved on an outer periphery of the sleeve and connected to the motor assembly.

[0017] In one embodiment, the motor assembly further includes a wall portion disposed between the housing plate and the end cover, the wall portion surrounds an outer periphery of the sealing component and is connected to the end cover, an inner periphery of the wall portion is concavely provided with an installation groove extending in the circumferential direction, and an outer periphery of the snap spring is embedded in the installation groove.

[0018] In one embodiment, the drive assembly includes a driving gear and a driven gear meshing with each other, the motor shaft is keyed to the driving gear, and the driving gear and the driven gear divide the cavity into a liquid inlet cavity adjacent to the liquid inlet channel and a liquid outlet cavity adjacent to the liquid outlet channel.

[0019] In a technical solution provided by the present invention, the sealing component to seal the shaft hole is sleeved on the motor shaft of the pump body, and the sealing component is elastically supported by the elastic component to achieve positioning. As a result, on one hand, the elastic component ensures reliable positioning of the sealing component while facilitating the assembly and disassembly of the sealing assembly. On the other hand, the elastic component can also absorb vibration energy generated during motor operation, mitigating the adverse effects of motor vibration on the sealing component, reducing instances of seal loosening and sealing failure, thereby extending the service life of the pump body.

[0020] In a technical solution provided by the present invention, the sealing assembly includes the third sealing ring and the sealing component, offering dual sealing functionality. The third sealing ring is annularly arranged around the periphery of the motor shaft, and sandwiched between the inner periphery of the shaft hole and the outer periphery of the motor shaft. The sealing component is positioned on the side of the third sealing ring opposite to the pump housing and features the sealing cavity. When the third sealing ring fails to seal, the sealing cavity is in communication with the

chamber, achieving the purpose of dual sealing, thereby enhancing the sealing performance of the structure and extending the service life of the pump body.

[0021] In a technical solution provided by the present invention, the inner wall of the cavity facing the driving gear and the driven gear is provided with a liquid guiding groove. The liquid guiding groove directs liquid from the meshing gap between the driving gear and the driven gear, which is used for conveying liquid, into the gap between the end sides of the driving gear and the driven gear and the inner wall. The liquid in the gap serves a lubricating function, reducing frictional resistance between the inner wall and the driving and driven gears, minimizing wear during the operation of the driving and driven gears, thereby enhancing the working efficiency and service life of the gear pump.

BRIEF DESCRIPTION OF DRAWINGS

[0022] To provide a clearer explanation of the technical solutions in the embodiments of the present invention or in the prior art, the following will briefly introduce the drawings required for describing the embodiments. Obviously, the drawings in the following description are merely some embodiments of the present invention. It is understandable to those of ordinary skill in the art that other drawings can be obtained based on the structures shown in these drawings without creative effort.

FIG. 1 is a perspective schematic view of a gear pump with improved sealing performance provided by an embodiment of the present invention;

FIG. 2 is a front view of a pump body in FIG. 1;

FIG. 3 is a cross-sectional view of the pump body in FIG. 2;

FIG. 4 is an enlarged schematic view of area A in FIG. 3;

FIG. 5 is an exploded perspective schematic view of the pump body in FIG. 1;

FIG. 6 is a perspective schematic view of a sealing assembly in accordance with an embodiment in FIG. 5;

FIG. 7 is an exploded perspective schematic view of the sealing assembly in FIG. 6;

FIG. 8 is a cross-sectional view of the gear pump in FIG. 1;

FIG. 9 is an exploded perspective schematic view of the gear pump in FIG. 1;

FIG. 10 is a perspective schematic view of a housing body in FIG. 9; and

FIG. 11 is a perspective schematic view of a cover body and a mounting seat in FIG. 9.

Reference numerals:

[0023] 1-pump body; 10-pump housing; 110-cavity; 111-shaft hole; 11-housing plate; 12-sealing groove; 20-drive assembly; 21-drive gear; 22-driven gear; 30-motor assembly; 31-motor shaft; 32-end cover; 33-bearing; 331-washer; 40-sealing assembly; 41-sealing component; 410-sealing cavity; 411-sleeve; 4111-first end; 4112-second end; 4113-annular step; 4114-bearing surface; 412-first sealing ring; 413-second sealing ring; 42-elastic component; 421-compression spring; 422-snap spring; 43-limiting post; 431-first limiting groove; 432-second limiting groove; 50-wall portion; 51-installation groove.

[0024] The realization of the objects, functional features, and advantages of the present invention will be further explained in conjunction with the embodiments and with reference to the accompanying drawings.

DETAILED DESCRIPTION

[0025] The technical solutions in the embodiments of the present invention will be described clearly and completely in conjunction with the accompanying drawings in the embodiments of the present invention. Obviously, the described embodiments are only a part of the embodiments of the present invention, not all of them. Based on the embodiments of the present invention, all other embodiments obtained by those of ordinary skill in the art without creative efforts shall fall within the protection scope of the present invention.

[0026] It should be noted that if directional indications (such as top, bottom, left, right, front, back, etc.) are involved in the embodiments of the present invention, these directional indications are only used to explain the relative positional relationships and movements between components in a specific posture (as shown in the accompanying drawings). If the specific posture changes, the directional indications will change accordingly.

[0027] Besides, if descriptions such as "first", "second", etc., are involved in the embodiments of the present invention, these terms are used for descriptive purposes only and should not be construed as indicating or implying relative importance or implicitly specifying the quantity of the indicated technical features. Thus, features defined with "first", "second", etc., may explicitly or implicitly include at least one such feature. Furthermore, the meaning of "and/or" appearing throughout the text includes three parallel options. Taking "A and/or B" as an example, it includes option A, option B, and an option where both A and B are satis-

fied. Additionally, technical solutions from various embodiments may be combined, but this must be based on what can be achieved by those of ordinary skill in the art. When the combination of technical solutions results in contradictions or is unachievable, such a combination should be considered non-existent and not within the scope of protection claimed by the present invention.

[0028] Referring to FIG. 1 to FIG. 3, the present invention discloses a pump body 1, specifically providing a gear pump with enhanced sealing performance. In detail, the pump body 1 includes a pump housing 10, a drive assembly 20, a motor assembly 30, and a sealing assembly 40. The shape and material of the pump housing 10 are not limited, and it has a cavity 110. The pump housing 10 is provided with a liquid inlet channel 101, a liquid outlet channel 102, and a shaft hole 111. The liquid inlet channel 101 is in communication with the cavity 110. The drive assembly 20 is arranged inside the pump housing 10 and is configured to drive liquid to flow from the liquid inlet channel 101 into the cavity 110 and then out through the liquid outlet channel 102. The specific structure of the drive assembly 20 can be configured according to the type of the pump body 1, for example, it may include two meshing gears, or a meshing external gear ring and internal gear, among others.

[0029] In the present embodiment, the drive assembly 20 is driven to move by the motor assembly 30. Specifically, the motor assembly 30 includes an end cover 32 and a motor shaft 31 extending from the end cover 32. The motor shaft 31 extends into the cavity 110 through the shaft hole 111 and is drivingly connected to the drive assembly 20, thereby causing the drive assembly 20 to move liquid, achieving the purpose of pumping liquid. In one embodiment, the drive assembly 20 includes an impeller. The motor shaft 31 is drivingly connected to the impeller to drive the impeller to rotate.

[0030] In another embodiment, referring to FIG. 3, the drive assembly 20 includes a driving gear 21 and a driven gear 22 that mesh with each other. The motor shaft 31 is key-connected to the driving gear 21. The driving gear 21 and the driven gear 22 divide the cavity 110 into a liquid inlet cavity adjacent to the liquid inlet channel 101 and a liquid outlet cavity adjacent to the liquid outlet channel 102. When the motor shaft 31 rotates, it drives the driving gear 21 and the driven gear 22 to rotate, wherein the volume of the liquid inlet cavity decreases, drawing liquid from the liquid inlet channel 101; and the volume of the liquid outlet cavity increases, discharging liquid into the liquid outlet channel 102. In the present embodiment, the pump body 1 is a gear pump, which offers the advantages of simple structure and stable operation.

[0031] Furthermore, referring to FIG. 3 and FIG. 4, the sealing assembly 40 includes a sealing component 41 and an elastic component 42. The sealing compo-

nent 41 is annularly arranged around a periphery of the motor shaft 31, and the structure of the sealing component 41 can vary as long as it is capable of sealing the shaft hole 111. The elastic component 42 elastically supports the sealing component 41 to limit the position of the sealing member. The type of the elastic component 42 is not limited; for example, it can be a compression spring 421, a coil spring, or an elastic rubber pad. Preferably, the elastic component 42 has a structure that can stably support the sealing component 41 without hindering the rotation of the motor shaft 31. The elastic component 42 can elastically support the sealing component 41 axially to absorb axial vibrations of the motor shaft 31. It can also elastically support the sealing component 41 radially to absorb radial vibrations of the motor shaft 31. In the present embodiment, on one hand, the elastic component 42 achieves reliable positioning of the sealing component 41 while facilitating the assembly and disassembly of the sealing assembly 40. On the other hand, the elastic component 42 can absorb vibration energy generated during motor operation, mitigating the adverse effects of motor vibrations on the sealing component 41, reducing instances of seal loosening and failure, thereby extending the service life of the pump body 1.

[0032] Specifically, in one embodiment, referring to FIG. 4 to FIG. 7, the pump housing 10 includes a housing plate 11 facing the end cover 32. The housing plate 11 is provided with the shaft hole 111. The housing plate 11 can be integrally formed on the pump body 1 or assembled to the pump housing 10, as long as it maintains the sealing of the cavity 110. The integral molding of the pump housing 10 can provide the cavity 110 with good sealing performance. Alternatively, assembling the pump housing 10 to the cavity 110 facilitates the installation of the internal drive assembly 20 in the cavity 110. In the present embodiment, the housing plate 11 is part of the pump housing 10 and is provided with the shaft hole 111. The end cover 32 of the motor assembly 30 is spaced apart from the housing plate 11 in an axial direction. The motor shaft 31 of the motor assembly 30 extends from the end cover 32, passes through the sealing assembly 40, and then through the shaft hole 111, entering the cavity 110.

[0033] The elastic component 42 includes a compression spring 421 extending along the axial direction. One end of the compression spring 421 elastically abuts against the sealing component 41, while another end of the compression spring 421 is connected to the motor assembly 30. As a result, the compression spring 421 elastically presses the sealing component 41 against the shaft hole 111 in a direction from the end cover 32 toward the housing plate 11, achieving a sealing effect. In the present embodiment, during the installation of the pump body 1, the compression spring 421 and the sealing component 41 can first be sequentially sleeved around the periphery of the motor shaft 31, followed by the installation of the pump housing 10,

making the operation simple and convenient. After installation, the elastic pressure of the compression spring 421 reliably presses the sealing component 41 against the shaft hole 111, thereby sealing the shaft hole 111. During operation of the pump body 1, the compression spring 421 can effectively absorb axial vibrations generated by the motor assembly 30, reducing the shaking effect of the motor assembly's vibrations on the sealing component 41, lowering the likelihood of the sealing component 41 loosening due to vibrations, enhancing the sealing performance of the sealing assembly 40, and extending the service life of the pump body 1.

[0034] Based on the previous embodiment, the sealing component 41 can be directly configured as a sealing ring. The sealing ring is accommodated in the shaft hole 111 and directly abuts against the compression spring 421. As a result, the sealing ring is axially movable along the axis. Although the structure is simple, once the sealing ring loosens from the shaft hole 111, it will lead to leakage.

[0035] Therefore, in a preferred embodiment, the sealing component 41 includes a sleeve 411, a first sealing ring 412, and a second sealing ring 413. The sleeve 411 is sleeved around the periphery of the motor shaft 31. The sleeve 411 has a first end 4111 adjacent to the housing plate 11 and a second end 4112 adjacent to the end cover 32. A sealing cavity 410 is defined between an inner periphery of the sleeve 411 and an outer periphery of the motor shaft 31. The sealing cavity 410 is in communication with the cavity 110. The first sealing ring 412 is disposed between the first end 4111 and the housing plate 11. The second sealing ring 413 is disposed between the second end 4112 and the motor shaft 31. The first sealing ring 412 and the second sealing ring 413 are used together to block the sealing cavity 410. In the present embodiment, the sleeve 411 is in direct contact with the compression spring 421, and the sealing cavity 410 being in communication with the cavity 110 is formed therein. The first sealing ring 412 and the second sealing ring 413 are disposed at two axial ends of the sleeve 411, respectively, to seal the sealing cavity 410 from both ends, achieving excellent sealing performance. This arrangement avoids direct contact between the compression spring 421 and the sealing rings, which could easily cause axial displacement and deformation of the sealing rings, leading to sealing failure.

[0036] Based on the previous embodiment, referring to FIG. 4 to FIG. 7, the housing plate 11 has a sealing groove 12 on a side facing the end cover 32, which is annularly arranged around a periphery of the shaft hole 111. The first end 4111 is provided with an annular step 4113 inserted into the sealing groove 12. The first sealing ring 412 is sleeved around a periphery of the annular step 4113 and abuts against a bottom wall of the sealing groove 12 and a side wall of the sealing groove 12. As a result, the first sealing ring 412 is axially lim-

ited by the sleeve 411, making it less prone to axial movement and deformation. Moreover, the first sealing ring 412 provides sealing on both the inner and outer peripheries in the radial direction, as well as on the upper and lower sides, resulting in a larger sealing contact area and better sealing effect. When the hydraulic pressure in the sealing cavity 410 increases, the first sealing ring 412 is pressed more tightly against the housing plate 11, enhancing the sealing effect and improving the sealing performance of the sealing assembly 40.

[0037] In one embodiment, referring to FIG. 4, the sleeve 411 has an open end at its second end 4112. The second sealing ring 413 is positioned in the sealing cavity 410, and is sandwiched between an inner side-wall of the sealing cavity 410 and an outer circumference of the motor shaft 31. In the present embodiment, the sleeve 411 serves to tighten the second sealing ring 413, thereby enhancing its sealing performance. Preferably, the material of the sleeve 411 is elastic, such as rubber or silicone, to increase the frictional resistance against the second sealing ring 413 and reduce its rotation with the motor shaft 31. Alternatively, the sleeve 411 may be made from materials with good thermal conductivity, such as graphite or metal, to lower the frictional heat generated on the second sealing ring 413 during the rotation of the motor shaft 31, thereby extending its service life.

[0038] Furthermore, referring to FIG. 4 to FIG. 7, the end cover 32 is equipped with a bearing 33, from which the motor shaft 31 extends. Part of the bearing 33 is inserted into the open end. A side of the second sealing ring 413 facing away from the sealing cavity 410 abuts against the bearing 33. In the present embodiment, the bearing 33 supports the second sealing ring 413 axially towards an end side of the housing plate 11, serving to axially limit the second sealing ring 413. Moreover, when the hydraulic pressure in the sealing cavity 410 increases, it can press the second sealing ring 413 more tightly against the bearing 33, utilizing the hydraulic pressure to further enhance the sealing performance of the second sealing ring 413.

[0039] Optionally, a washer 331 is provided on the end side of the bearing 33 facing the housing plate 11, and the second sealing ring 413 presses against the washer 331. In this way, the washer 331 serves to smooth the contact surface between the bearing 33 and the second sealing ring 413, preventing wear on the second sealing ring 413. Additionally, it also functions to conduct heat, reducing the temperature rise caused by friction from the relative rotation between the second sealing ring 413 and the motor shaft 31, thereby extending the service life of the second sealing ring 413.

[0040] Based on the aforementioned embodiment, referring to FIG. 4 to FIG. 7, a first limiting groove 431 is provided on an outer peripheral side of the bearing 33. A second limiting groove 432 is formed on a peripheral

side of the sleeve 411. Both the first limiting groove 431 and the second limiting groove 432 extend axially. The sealing assembly 40 further includes a limiting post 43 inserted into the first limiting groove 431 and the second limiting groove 432. In the present embodiment, the cooperation of the limiting post 43 with the first limiting groove 431 and the second limiting groove 432 achieves circumferential positioning of the sleeve 411, preventing it from rotating relative to the bearing 33, thereby enhancing the sealing performance of the sealing component 41. Meanwhile, both the first limiting groove 431 and the second limiting groove 432 are elongated in shape with their length direction extending axially, ensuring that the axial elastic support function of the compression spring 421 remains unaffected.

[0041] Based on the above embodiment, an outer circumference of the sleeve 411 is provided with a bearing surface 4114 facing the end cover 32. One end of the compression spring 421 abuts against the bearing surface 4114, while another end of the compression spring 421 abuts against the motor assembly 30. In this way, the sleeve 411 serves as a guide, allowing the compression spring 421 to be compressed axially.

[0042] Furthermore, a bearing 33 is provided on the end cover 32, which features an opening groove (not shown in the drawings) facing the housing plate 11. The opening groove is arranged around the periphery of the motor shaft 31. One end of the compression spring 421, which abuts against the motor assembly 30, is inserted into the opening groove and presses against its bottom. As a result, the opening groove further guides the compression spring 421 to prevent it from shifting.

[0043] Optionally, a third sealing ring (not shown in the drawing) is also sleeved on the motor shaft 31, positioned between an inner circumference of the shaft hole 111 and the outer circumference of the motor shaft 31. This arrangement provides dual sealing for the shaft hole 111. In the event that the third sealing ring fails, the first sealing ring 412 and the second sealing ring 413 continue to provide sealing, thereby enhancing the sealing performance of the pump body 1 and extending its service life.

[0044] Furthermore, referring to FIG. 3 and FIG. 4, the sealing assembly 40 includes a third sealing ring (not shown in the drawings) sleeved on the motor shaft 31, and a sealing component 41. The third sealing ring is sandwiched between the inner circumference of the shaft hole 111 and the outer circumference of the motor shaft 31. The sealing component 41 is located on a side of the third sealing ring opposite to the pump housing 10, and has a sealing cavity 410. When the third sealing ring fails to seal, the sealing cavity 410 is in communication with the cavity 110. In the present embodiment, the sealing assembly 40 provides a dual sealing effect on the shaft hole 111. After the third sealing ring fails, the first sealing ring 412 and the second sealing ring 413 continue to provide sealing, enhancing

the sealing performance of the pump body 1 and extending its service life.

[0045] In a preferred embodiment, the sealing component 41 includes a sleeve 411, a first sealing ring 412, and a second sealing ring 413. The sleeve 411 is sleeved around a periphery of the motor shaft 31. The sleeve 411 has a first end 4111 adjacent to the shaft hole 111 and a second end 4112 away from the shaft hole 111. A sealing cavity 410 is defined between an inner periphery of the sleeve 411 and an outer periphery of the motor shaft 31. The sealing cavity 410 is configured to be in communication with the cavity 110 through the shaft hole 111. The first sealing ring 412 is disposed between the first end 4111 and the pump housing 10. The second sealing ring 413 is disposed between the second end 4112 and the motor shaft 31. The first sealing ring 412 and the second sealing ring 413 are used together to block the sealing cavity 410. In the present embodiment, the first sealing ring 412 and the second sealing ring 413 are arranged at two axial ends of the sleeve 411, respectively, to seal the sealing cavity 410 from both ends, achieving excellent sealing effect. This arrangement ensures that when the third sealing ring fails, the sealing component 41 can continue to function, thereby extending the sealing performance of the cavity 110.

[0046] In a preferred embodiment, the sealing assembly 40 further includes an elastic component 42. The elastic component 42 elastically supports the sealing component 41 to limit the position of the sealing component 41. The type of the elastic component 42 is not limited and may include, for example, a compression spring 421, a coil spring, or an elastic rubber pad. Preferably, the elastic component 42 has a structure capable of stably supporting the sealing component 41 while not hindering the rotation of the motor shaft 31. The elastic component 42 can elastically support the sealing component 41 in an axial direction to absorb vibrations of the motor shaft 31 along the axis. Alternatively, the elastic component 42 can elastically support the sealing component 41 in a radial direction to absorb vibrations of the motor shaft 31 along the radius. In the present embodiment, on one hand, the elastic component 42 ensures reliable positioning of the sealing component 41 while facilitating the assembly and disassembly of the sealing assembly 40. On the other hand, the elastic component 42 can also absorb vibration energy generated during motor operation, mitigating the adverse effects of motor vibrations on the sealing component 41, reducing instances of seal loosening and sealing failure, thereby extending the service life of the pump body 1.

[0047] Specifically, in one embodiment, referring to FIG. 4 to FIG. 7, the pump housing 10 includes a housing plate 11 facing the end cover 32, with the shaft hole 111 opened on the housing plate 11. The housing plate 11 can be integrally formed with the pump body 1 or assembled to the pump housing 10, as long as it main-

tains the sealing of the cavity 110. An integrally formed pump housing 10 can provide the cavity 110 with excellent sealing performance. Conversely, assembling the pump housing 10 to the cavity 110 facilitates the installation of the internal drive assembly 20. In the present embodiment, the housing plate 11 is part of the pump housing 10 and is provided with the shaft hole 111. The end cover 32 of the motor assembly 30 is spaced apart from the housing plate 11 in the axial direction. The motor shaft 31 of the motor assembly 30 extends from the end cover 32, passes through the sealing assembly 40, and then through the shaft hole 111, entering the cavity 110.

[0048] The elastic component 42 includes a compression spring 421 extending axially. One end of the compression spring 421 elastically abuts against the sealing component 41, while another end of the compression spring 421 is connected to the motor assembly 30. In this way, the compression spring 421 elastically presses the sealing component 41 against the shaft hole 111 in a direction extending from the end cover 32 toward the housing plate 11, achieving a sealing effect. In the present embodiment, during the installation of the pump body 1, the compression spring 421 and the sealing component 41 can first be sequentially sleeved around the periphery of the motor shaft 31, followed by the installation of the pump housing 10, making the operation simple and convenient. After installation, the elastic pressure of the compression spring 421 reliably presses the sealing component 41 against the shaft hole 111, thereby sealing the shaft hole 111. During operation of the pump body 1, the compression spring 421 effectively absorbs axial vibrations generated by the motor assembly 30, reducing the shaking effect of the motor assembly's vibrations on the sealing component 41, lowering the likelihood of the sealing member loosening due to vibrations, enhancing the sealing performance of the sealing assembly 40, and extending the service life of the pump body 1.

[0049] Based on the above embodiment, referring to FIG. 4 to FIG. 7, a side of the housing plate 11 facing the end cover 32 is provided with a sealing groove 12 circumferentially arranged around the periphery of the shaft hole 111. The first end 4111 is provided with an annular step 4113 inserted into the sealing groove 12. The first sealing ring 412 is sleeved around a periphery of the annular step 4113 and abuts against a bottom wall of the sealing groove 12 and a side wall of the sealing groove 12. As a result, the first sealing ring 412 is axially constrained by the sleeve 411, making it less prone to axial movement and deformation. Moreover, the first sealing ring 412 provides sealing on both the inner and outer peripheries in the radial direction, as well as on the upper and lower sides, resulting in a larger sealing contact area and better sealing effect. When the hydraulic pressure in the sealing cavity 410 increases, the first sealing ring 412 is pressed more

tightly against the housing plate 11, enhancing the sealing effect and improving the sealing performance of the sealing assembly 40.

[0050] In one embodiment, referring to FIG. 4, the sleeve 411 has an open end at its second end 4112. The second sealing ring 413 is positioned in the sealing cavity 410, and is sandwiched between an inner side-wall of the sealing cavity 410 and an outer circumference of the motor shaft 31. In the present embodiment, the sleeve 411 serves to tighten the second sealing ring 413, thereby enhancing its sealing performance. Preferably, the material of the sleeve 411 is elastic, such as rubber or silicone, to increase the frictional resistance against the second sealing ring 413 and reduce its rotation with the motor shaft 31. Alternatively, the sleeve 411 may be made from materials with good thermal conductivity, such as graphite or metal, to lower the frictional heat generated on the second sealing ring 413 during the rotation of the motor shaft 31, thereby extending its service life.

[0051] Furthermore, referring to FIG. 4 to FIG. 7, the end cover 32 is equipped with a bearing 33, from which the motor shaft 31 extends. Part of the bearing 33 is inserted into the open end. A side of the second sealing ring 413 facing away from the sealing cavity 410 abuts against the bearing 33. In the present embodiment, the bearing 33 supports the second sealing ring 413 axially towards an end side of the housing plate 11, serving to axially limit the second sealing ring 413. Moreover, when the hydraulic pressure in the sealing cavity 410 increases, it can press the second sealing ring 413 more tightly against the bearing 33, utilizing the hydraulic pressure to further enhance the sealing performance of the second sealing ring 413.

[0052] Optionally, a washer 331 is provided on the end side of the bearing 33 facing the housing plate 11, and the second sealing ring 413 presses against the washer 331. In this way, the washer 331 serves to smooth the contact surface between the bearing 33 and the second sealing ring 413, preventing wear on the second sealing ring 413. Additionally, it also functions to conduct heat, reducing the temperature rise caused by friction from the relative rotation between the second sealing ring 413 and the motor shaft 31, thereby extending the service life of the second sealing ring 413.

[0053] Based on the aforementioned embodiment, referring to FIG. 4 to FIG. 7, a first limiting groove 431 is provided on an outer peripheral side of the bearing 33. A second limiting groove 432 is formed on a peripheral side of the sleeve 411. Both the first limiting groove 431 and the second limiting groove 432 extend axially. The sealing assembly 40 further includes a limiting post 43 inserted into the first limiting groove 431 and the second limiting groove 432. In the present embodiment, the cooperation of the limiting post 43 with the first limiting groove 431 and the second limiting groove 432 achieves circumferential positioning of the sleeve

411, preventing it from rotating relative to the bearing 33, thereby enhancing the sealing performance of the sealing component 41. Meanwhile, both the first limiting groove 431 and the second limiting groove 432 are elongated in shape with their length direction extending axially, ensuring that the axial elastic support function of the compression spring 421 remains unaffected.

[0054] Based on the above embodiment, an outer circumference of the sleeve 411 is provided with a bearing surface 4114 facing the end cover 32. One end of the compression spring 421 abuts against the bearing surface 4114, while another end of the compression spring 421 abuts against the motor assembly 30. In this way, the sleeve 411 serves as a guide, allowing the compression spring 421 to be compressed axially.

[0055] Furthermore, a bearing 33 is provided on the end cover 32, which features an opening groove (not shown in the drawings) facing the housing plate 11. The opening groove is arranged around the periphery of the motor shaft 31. One end of the compression spring 421, which abuts against the motor assembly 30, is inserted into the opening groove and presses against its bottom. As a result, the opening groove further guides the compression spring 421 to prevent it from shifting.

[0056] Referring to FIG. 4 and FIG. 5, the elastic component 42 further includes a snap ring 422. The snap ring 422 is configured as a ring extending circumferentially with a gap. The snap ring 422 is sleeved around the outer periphery of the sleeve 411 and is connected to the motor assembly 30. In the present embodiment, the elastic component 42 additionally includes the snap ring 422. The snap ring 422 elastically supports the sealing component 41 in the radial direction to absorb the vibration effects of the motor in the radial direction, further enhancing the vibration resistance of the sealing component 41 and reducing the likelihood of sealing failure due to loosening from vibration.

[0057] Based on the aforementioned embodiment, the motor assembly 30 further includes a wall portion 50 disposed between the housing plate 11 and the end cover 32. The wall portion 50 is arranged around a periphery of the sealing component 41 and is connected to the end cover 32. An inner periphery of the wall portion 50 is recessed with an installation groove 51 extending circumferentially. The outer periphery of the snap ring 422 is embedded in the installation groove 51. In the present embodiment, the annular installation groove 51 provided on the wall portion 50 is utilized to radially fix and support the snap ring 422, thereby securely supporting the sleeve 411. Preferably, the wall portion 50 may also be provided with a screw hole and/or a stud for installing the pump body 1.

[0058] The drive assembly 20 is located in the pump housing 10, and is configured to drive liquid from the liquid inlet channel 101 into the cavity 110 and out through the liquid outlet channel 102. The drive assem-

bly 20 includes a driving gear 21 and a driven gear 22 that mesh with each other. One of the driving gear 21 and the driven gear 22 is the driving gear, while the other is the driven gear. The specific structures of the driving gear 21 and the driven gear 22 can be configured according to the type of gear pump 1. For example, the driving gear 21 and the driven gear 22 can be two gears that mesh with each other, or an external gear ring and an internal gear that mesh with each other, among other possibilities. The motor assembly 30 is configured to drive the driving gear among the driving gear 21 and the driven gear 22 to rotate. Preferably, the motor assembly 30 includes an axially extending motor shaft 31, which is key-connected to the driving gear 21 to drive its rotation.

[0059] In the present embodiment, the driving gear 21 and the driven gear 22 rotate about axially extending rotation axes 221, respectively. Specifically, the driving gear 21 and the driven gear 22 separate the cavity 110 into a liquid inlet cavity and a liquid outlet cavity. The pump housing 10 is provided with the liquid inlet channel 101 and the liquid outlet channel 102 on two radially opposite sides thereof. The liquid inlet channel 101 is in communication with the liquid inlet cavity, and the liquid outlet channel 102 is in communication with the liquid outlet cavity.

[0060] A meshing point between the driving gear 21 and the driven gear 22 forms a meshing gap 23, which is located between the liquid inlet cavity and the liquid outlet cavity. When the driving gear 21 and the driven gear 22 rotate, the meshing gap 23 alternately opens towards the liquid inlet cavity and the liquid outlet cavity in sequence, thereby conveying liquid from the liquid inlet cavity to the liquid outlet cavity. In other words, the meshing gap 23 is a liquid transmission space located at the meshing point of the driving gear 21 and the driven gear 22. The function of the meshing gap 23 is to draw in liquid from the liquid inlet cavity when it opens towards the liquid inlet cavity, and to discharge the liquid when it opens towards the liquid outlet cavity.

[0061] In the present embodiment, the pump housing 10 further includes a housing plate 11 and a second inner wall 14 that are axially opposed. The housing plate 11, the second inner wall 14, and the circumferential wall extending between them together enclose and define the cavity 110. It is understandable that the end faces of the driving gear 21 and the driven gear 22 facing the housing plate 11 and the second inner wall 14 should respectively fit against the corresponding housing plate 11 and second inner wall 14 to achieve sealing, thereby separating the liquid inlet cavity from the liquid outlet cavity.

[0062] Based on this, referring to FIG. 8 to FIG. 11, to reduce the friction between an inner wall of the pump housing 10 and the end faces of the driving gear 21 and the driven gear 22, a liquid guiding groove is provided on the housing plate 11 and/or the second inner wall 14. The liquid guiding groove is in communication

with the meshing gap 23, with one end of the liquid guiding groove extending to the end side of the driving gear 21, and another end of the liquid guiding groove extending to the end side of the driven gear 22. As a result, the liquid guiding groove directs liquid from the meshing gap 23, which is used for conveying the liquid between the driving gear 21 and the driven gear 22, into the gaps between the end sides of the driving gear 21 and the driven gear 22 and the inner wall. The liquid in the gaps serves as lubrication, reducing the frictional resistance between the inner wall and the driving gear 21 and the driven gear 22, decreasing wear during the operation of the driving gear 21 and the driven gear 22, thereby enhancing the service life of the gear pump 1.

[0063] In one embodiment, referring to FIG. 8 and FIG. 11, the housing plate 11 is provided with the liquid guiding groove. Specifically, the liquid guiding groove includes a first liquid guiding groove 130 disposed on the housing plate 11. One end of the first liquid guiding groove 130 extends to the end face of the driving gear 21 facing the housing plate 11. Another end of the first liquid guiding groove 130 extends to the end face of the driven gear 22 facing the second inner wall 14. As a result, when the driving gear 21 and the driven gear 22 rotate, the liquid in the guiding groove is carried into the gaps between each end face and the housing plate 11, providing excellent lubrication and maintaining the sealing performance of the driving gear 21 and the driven gear 22.

[0064] Furthermore, the motor assembly 30 further includes an end cover 32, with the motor shaft 31 extending out from the end cover 32. The housing plate 11 faces the end cover 32 and is provided with a shaft hole 111. The motor shaft 31 is inserted into the cavity 110 through the shaft hole 111 and is key-connected to the driving gear 21, thereby driving the rotation of the driving gear 21. One end of the first liquid guiding groove 130 is in communication with the shaft hole 111. As a result, when the gear pump 1 requires cleaning or maintenance, after disassembling the motor, liquid in the cavity 110 can flow out through the shaft hole 111, facilitating its inspection and repair.

[0065] Based on the previous embodiment, referring to FIG. 8, the shaft 221 of the driven gear 22 is at least partially recessed on a side facing the housing plate 11, forming a groove 222. Another end of the first liquid guiding groove 130, opposite to the shaft hole 111, is in communication with the groove 222. In the present embodiment, the groove 222 formed by the shaft 221 accommodates the liquid introduced from the first liquid guiding groove 130, allowing the liquid to gradually seep from a periphery of the shaft 221 into the gap between the end face of the driven gear 22 and the housing plate 11, achieving uniform penetration and thereby enhancing the lubrication effect.

[0066] Based on the aforementioned embodiment, refer to FIG. 8 to FIG. 11, the pump housing 10 includes a housing body 71 and a cover body 72. The

housing body 71 forms the cavity 110 with an opening 53. The opening 53 faces the end cover 32. The cover body 72 is mounted on a side of the housing body 71 where the opening 53 is located. A side of the cover body 72 facing the cavity 110 is provided with the housing plate 11. An inner side of the housing body 71 facing the opening 53 is provided with the second inner wall 14. In the present embodiment, the pump housing 10 adopts a split design, facilitating disassembly for cleaning or maintenance. During disassembly, the motor can be removed first, allowing the liquid in the cavity 110 to flow out through the shaft hole 111. Then, by opening the cover body 72, the drive assembly 20 inside the cavity 110 can be cleaned or inspected. This operation is simple and convenient, and it allows for the orderly drainage of liquid from the cavity 110 without causing environmental contamination.

[0067] Furthermore, referring to FIG. 9, the housing body 71 and the cover body 72 are detachably connected. A sealing ring 54 is provided between the housing body 71 and the cover body 72. The sealing ring 54 is arranged around a periphery of the opening 53. Preferably, an annular groove is provided on an end face of the housing body 71 facing the cover body 72, and the sealing ring 54 is partially accommodated in the annular groove. The annular groove serves to limit position and increase the contact area with the sealing ring 54, thereby enhancing sealing performance. As a result, a good seal is achieved between the housing body 71 and the cover body 72, preventing the liquid in the cavity 110 from leaking at a connection of the housing body 71 and the cover body 72.

[0068] In one embodiment, referring to FIG. 9 to FIG. 11, a mounting seat 60 is arranged between the end cover 32 and the cover body 72. The mounting seat 60 is detachably connected to the end cover 32, for example, it can be connected to the end cover 32 by means of screwing or snapping. The mounting seat 60 can also be integrally formed with the cover body 72. Thus, the housing body 71 is connected through the cover body 72, and an installation cavity 61 is formed inside the mounting seat 60. The motor shaft 31 passes through the installation cavity 61, and a sealing assembly 40 is arranged on the shaft segment within the installation cavity 61, which is used to seal the shaft hole 111. In the present embodiment, the mounting seat 60 serves to mount the entire gear pump 1 to a machine body (such as a beverage preparation device). At the same time, the installation cavity 61 is also constructed in the mounting seat 60 to accommodate the sealing assembly 40 that seals the shaft hole 111. The mounting seat 60 is integrally formed with the cover body 72 to facilitate the assembly and disassembly of the entire gear pump 1.

[0069] Based on the previous embodiment, the sealing assembly 40 includes a sealing component 41 and an elastic component 42 sleeved on the motor shaft 31. One end of the elastic component 42 abuts against the

sealing component 41, causing the sealing component 41 to press against the shaft hole 111. Another end of the elastic component 42 abuts against a bearing 33 mounted on the end cover 32. On one hand, the elastic component 42 serves a positioning function, pressing the sealing component 41 against the shaft hole 111; on the other hand, the elastic component 42 absorbs vibrations from the motor assembly 30, preventing the sealing component 41 from loosening due to impact. Additionally, the elastic component 42 facilitates the assembly and disassembly of the motor shaft 31. For example, when disassembly is required, simply separating the mounting seat 60 from the end cover 32 allows the elastic component 42 to detach from the sealing component 41, making it easy to remove the sealing component 41 and allowing liquid to flow out from the cavity 110.

[0070] The mounting seat 60 can be connected to the machine body in various ways. In a preferred embodiment, a peripheral side of the mounting seat 60 is equipped with a connecting piece 62, which may be a stud, a screw hole, etc. The connecting piece 62 is configured to securely attach the gear pump 1 to the machine body.

[0071] Based on the aforementioned embodiment, a liquid guiding groove is also provided on the second inner wall 14 of the housing body 71. Specifically, the liquid guiding groove includes a second liquid guiding groove 140 disposed on the second inner wall 14. The first liquid guiding groove 130 similarly extends between the end face of the driving gear 21 facing the second inner wall 14 and the end face of the driven gear 22 facing the second inner wall 14. Specifically, referring to FIG. 3, a first opening groove 121 and a second opening groove 122 are recessed on the second inner wall 14. The first opening groove 121 accommodates the motor shaft 31. The second opening groove 122 accommodates the rotating shaft 221 of the driven gear 22. One end of the second liquid guiding groove 140 extends to connect with the first opening groove 121, while another end of the second liquid guiding groove 140 extends to connect with the second opening groove 122. As a result, liquid can not only permeate into the end faces between the driving gear 21 and the driven gear 22 and the second inner wall 14 but also penetrate into the first opening groove 121 and the second opening groove 122. This ensures that the gaps between the first opening groove 121 and the motor shaft 31, as well as between the second opening groove 122 and the rotating shaft 221, are filled with liquid, thereby lubricating the motor shaft 31 and the rotating shaft 221. This further reduces the rotational resistance of the driving gear 21 and the driven gear 22, enhances their operational efficiency, minimizes wear, and extends the service life of the gear pump 1.

[0072] The above description is only a preferred embodiment of the present invention and does not limit the patent scope of the present invention. Any equivalent

structural modifications made under the inventive concept of the present invention, using the content of the specification and drawings, or direct/indirect application in other related technical fields, are included within the scope of patent protection for the present invention.

Claims

1. A gear pump with improved sealing performance, comprising:

a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole;
a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel;
a motor assembly comprising an end cover and a motor shaft extending from the end cover, the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and
a sealing assembly comprising a sealing component and an elastic component, the sealing component being annularly disposed around an outer periphery of the motor shaft to seal the shaft hole, and the elastic component elastically supporting the sealing component to limit the sealing component.

2. The gear pump with improved sealing performance according to claim 1, wherein the pump housing comprises a housing plate facing the end cover, the shaft hole is provided on the housing plate, the elastic component comprises a compression spring extending in an axial direction, one end of the compression spring elastically abuts against the sealing component, and another end of the compression spring is connected to the motor assembly.

3. The gear pump with improved sealing performance according to claim 2, wherein the sealing component comprises a sleeve, a first sealing ring and a second sealing ring; the sleeve is sleeved on the outer periphery of the motor shaft and has a first end adjacent to the housing plate and a second end adjacent to the end cover; a sealing cavity is defined between an inner periphery of the sleeve and the outer periphery of the motor shaft; the sealing cavity is in communication with the cavity; the first sealing ring is disposed between the first end and the housing plate; the second sealing ring is disposed between the second end and the motor shaft; and the first sealing ring and the second

sealing ring are configured to jointly seal the sealing cavity.

4. The gear pump with improved sealing performance according to claim 3, wherein a side of the housing plate facing the end cover is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole; the first end is provided with an annular step inserted into the sealing groove; and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.
5. The gear pump with improved sealing performance according to claim 3, wherein the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft.
6. The gear pump with improved sealing performance according to claim 5, wherein a bearing is provided on the end cover, the motor shaft extends from the bearing, a portion of the bearing is inserted into the open end, and a side of the second sealing ring facing away from the sealing cavity abuts against the bearing.
7. The gear pump with improved sealing performance according to claim 6, wherein a washer is provided on an end side of the bearing facing the housing plate, and the second sealing ring presses against the washer.
8. The gear pump with improved sealing performance according to claim 6, wherein a first limiting groove is provided on an outer peripheral side of the bearing, a second limiting groove is provided on a peripheral side of the sleeve, each of the first limiting groove and the second limiting groove extends in the axial direction, and the sealing assembly further comprises a limiting post inserted into the first limiting groove and the second limiting groove.
9. The gear pump with improved sealing performance according to claim 3, wherein a bearing surface facing the end cover is annularly provided on an outer periphery of the sleeve; the one end of the compression spring abuts against the bearing surface, and the another end of the compression spring abuts against the motor assembly.
10. The gear pump with improved sealing performance according to claim 9, wherein a bearing is provided on the end cover, the bearing has an opening groove facing the housing plate, the opening groove is annularly disposed around the outer per-

iphery of the motor shaft, and an end of the compression spring abutting against the motor assembly is inserted into the opening groove and abuts against a bottom of the opening groove.

11. The gear pump with improved sealing performance according to claim 3, wherein the elastic component further comprises a snap spring, the snap spring is annularly disposed extending in a circumferential direction and having a gap, and the snap spring is sleeved on an outer periphery of the sleeve and connected to the motor assembly.
12. The gear pump with improved sealing performance according to claim 11, wherein the motor assembly further comprises a wall portion disposed between the housing plate and the end cover, the wall portion surrounds an outer periphery of the sealing component and is connected to the end cover, an inner periphery of the wall portion is concavely provided with an installation groove extending in the circumferential direction, and an outer periphery of the snap spring is embedded in the installation groove.
13. A gear pump with improved sealing performance according to any one of claims 1 to 12, wherein the drive assembly comprises a driving gear and a driven gear meshing with each other, the motor shaft is keyed to the driving gear, and the driving gear and the driven gear divide the cavity into a liquid inlet cavity adjacent to the liquid inlet channel and a liquid outlet cavity adjacent to the liquid outlet channel.
14. A sealing assembly for sealing a shaft hole provided on a pump housing, the shaft hole allowing a motor shaft to extend into a cavity in the pump housing, the sealing assembly comprising:

a third sealing ring, the third sealing ring being annularly disposed around an outer periphery of the motor shaft and sandwiched between an inner periphery of the shaft hole and the outer periphery of the motor shaft; and
a sealing component, the sealing component being annularly disposed around the outer periphery of the motor shaft, the sealing component being disposed on a side of the third sealing ring facing away from the pump housing and having a sealing cavity; wherein when the third sealing ring fails, the sealing cavity is in communication with the cavity.
15. The sealing assembly according to claim 14, wherein the sealing component comprises a sleeve, a first sealing ring and a second sealing ring; the sleeve is sleeved on the outer periphery

of the motor shaft and has a first end adjacent to the shaft hole and a second end away from the shaft hole; the sealing cavity is defined between an inner periphery of the sleeve and the outer periphery of the motor shaft; the first sealing ring is disposed between the first end and the pump housing; the second sealing ring is disposed between the second end and the motor shaft; and the first sealing ring and the second sealing ring are configured to jointly seal the sealing cavity.

16. The sealing assembly according to claim 15, wherein a side of the pump housing facing the sealing component is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole; the first end is provided with an annular step inserted into the sealing groove; and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.
17. The sealing assembly according to claim 15, wherein the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity, and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft.
18. The sealing assembly according to claim 17, wherein the motor shaft extends from an end cover; a bearing is provided on the end cover; a portion of the bearing is inserted into the open end; and a side of the second sealing ring facing away from the sealing cavity abuts against the bearing.
19. The sealing assembly according to claim 18, wherein a washer is provided on an end side of the bearing facing the shaft hole, and the second sealing ring presses against the washer.
20. The sealing assembly according to any one of claims 15 to 19, further comprising an elastic component which elastically supports the sealing component to limit the sealing component.
21. The sealing assembly according to claim 20, wherein the elastic component comprises a compression spring extending in an axial direction, one end of the compression spring elastically abuts against the sealing component, and the other end is connected to the motor assembly.
22. The sealing assembly according to claim 20, wherein the elastic component comprises a snap spring, the snap spring is annularly disposed extending in a circumferential direction and having a gap, and the snap spring is sleeved on an outer

periphery of the sleeve and connected to the motor assembly.

23. A gear pump, comprising:

a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole;

a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel; a motor assembly comprising an end cover and a motor shaft extending from the end cover, the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and

a sealing assembly comprising a third sealing ring and a sealing component; the third sealing ring being annularly disposed around an outer periphery of the motor shaft, and sandwiched between an inner periphery of the shaft hole and the outer periphery of the motor shaft; the sealing component being annularly disposed around the outer periphery of the motor shaft; the sealing component being disposed on a side of the third sealing ring facing away from the pump housing and having a sealing cavity; wherein when the third sealing ring fails, the sealing cavity is in communication with the cavity.

24. A gear pump with improved sealing performance, comprising:

a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole;

a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel; a motor assembly comprising an end cover and a motor shaft extending from the end cover, the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and

a sealing assembly comprising a sealing component and an elastic component; the sealing component being annularly disposed around an outer periphery of the motor shaft to seal the shaft hole; the sealing component comprising a sleeve, a first sealing ring and a second sealing ring; the sleeve being sleeved on the outer periphery of the motor shaft; a sealing cavity being defined between an inner periph-

ery of the sleeve and the outer periphery of the motor shaft; the first sealing ring and the second sealing ring being configured to jointly seal the sealing cavity; the elastic component comprising a compression spring extending in an axial direction; one end of the compression spring elastically abutting against the sleeve, and another end of the compression spring being connected to the motor assembly.

25. The gear pump with improved sealing performance according to claim 24, wherein a bearing surface facing the end cover is annularly provided on an outer periphery of the sleeve; the one end of the compression spring abuts against the bearing surface, and the another end of the compression spring abuts against the motor assembly.

26. The gear pump with improved sealing performance according to claim 25, wherein a step portion is provided on an outer periphery of the end cover, and a side of the step portion facing the end cover in the axial direction constitutes the bearing surface.

27. The gear pump with improved sealing performance according to claim 24, wherein the pump housing comprises a housing plate facing the end cover; the shaft hole is provided on the housing plate; a bearing is provided on the end cover; the motor shaft extends from the bearing; the bearing has an opening groove facing the housing plate; the opening groove is annularly disposed around the outer periphery of the motor shaft; and an end of the compression spring abutting against the motor assembly is inserted into the opening groove and abuts against a bottom of the opening groove.

28. The gear pump with improved sealing performance according to claim 27, wherein the sleeve has a first end adjacent to the housing plate and a second end adjacent to the end cover; the first sealing ring is disposed between the first end and the housing plate; and the second sealing ring is disposed between the second end and the motor shaft.

29. The gear pump with improved sealing performance according to claim 28, wherein a side of the housing plate facing the end cover is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole; the first end is provided with an annular step inserted into the sealing groove; and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.

30. The gear pump with improved sealing performance according to claim 28, wherein the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity, and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft. 5
31. The gear pump with improved sealing performance according to claim 30, wherein a portion of the bearing is inserted into the open end, and a side of the second sealing ring facing away from the sealing cavity abuts against the bearing. 10
32. The gear pump with improved sealing performance according to claim 31, wherein a washer is provided on an end side of the bearing facing the housing plate, and the second sealing ring presses against the washer. 15
33. The gear pump with improved sealing performance according to claim 31, wherein a first limiting groove is provided on an outer peripheral side of the bearing; a second limiting groove is provided on a peripheral side of the sleeve; each of the first limiting groove and the second limiting groove extends in the axial direction; and the sealing assembly further comprises a limiting post inserted into the first limiting groove and the second limiting groove. 20 25 30
34. A gear pump with improved sealing performance, comprising:
a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole; 35
a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel; 40
a motor assembly comprising an end cover and a motor shaft extending from the end cover; the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and 45
a sealing assembly comprising a sealing component and an elastic component; the sealing component being annularly disposed around an outer periphery of the motor shaft to seal the shaft hole; the sealing component comprising a sleeve, a first sealing ring and a second sealing ring; the sleeve being sleeved on the outer periphery of the motor shaft; a sealing cavity being defined between an inner periphery of the sleeve and the outer periphery of the motor shaft; the first sealing ring and the second sealing ring being configured to jointly seal 50 55
- the sealing cavity; the elastic component further comprising a snap spring; the snap spring being annularly disposed extending in a circumferential direction and having a gap; and the snap spring being sleeved on an outer periphery of the sleeve and connected to the motor assembly.
35. The gear pump with improved sealing performance according to claim 34, wherein the pump housing comprises a housing plate facing the end cover; the shaft hole is provided on the housing plate; the motor assembly further comprises a wall portion disposed between the housing plate and the end cover; the wall portion surrounds an outer periphery of the sealing component and is connected to the end cover; an inner periphery of the wall portion is concavely provided with an installation groove extending in the circumferential direction, and an outer periphery of the snap spring is embedded in the installation groove.
36. The gear pump with improved sealing performance according to claim 35, wherein the wall portion is provided with a screw hole and/or a stud for installing the gear pump.
37. The gear pump with improved sealing performance according to claim 35, wherein the housing plate is fixed to a side of the wall portion facing away from the end cover.
38. The gear pump with improved sealing performance according to claim 37, wherein the sleeve has a first end adjacent to the housing plate and a second end adjacent to the end cover; the first sealing ring is disposed between the first end and the housing plate; and the second sealing ring is disposed between the second end and the motor shaft.
39. The gear pump with improved sealing performance according to claim 38, wherein a side of the housing plate facing the end cover is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole, the first end is provided with an annular step inserted into the sealing groove, and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.
40. The gear pump with improved sealing performance according to claim 38, wherein the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity, and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft.

41. The gear pump with improved sealing performance according to claim 40, wherein a bearing is provided on the end cover, the motor shaft extends from the bearing, a portion of the bearing is inserted into the open end, and a side of the second sealing ring facing away from the sealing cavity abuts against the bearing.

42. The gear pump with improved sealing performance according to claim 41, wherein a washer is provided on an end side of the bearing facing the housing plate, and the second sealing ring presses against the washer.

43. The gear pump with improved sealing performance according to any one of claims 37 to 42, wherein the elastic component comprises a compression spring extending in an axial direction; one end of the compression spring elastically abuts against the sleeve, and another end of the compression spring is connected to the motor assembly.

44. A gear pump with improved sealing performance, comprising:

a pump housing having a cavity, the pump housing being provided with a liquid inlet channel communicating with the cavity, a liquid outlet channel, and a shaft hole; the pump housing comprising a housing plate; the shaft hole is provided on the housing plate;

a drive assembly disposed in the cavity, the drive assembly being configured to drive liquid to flow into the cavity from the liquid inlet channel and flow out from the liquid outlet channel; a motor assembly comprising an end cover and a motor shaft extending from the end cover, the end cover being disposed facing the housing plate, the motor shaft extending into the cavity from the shaft hole and being drivingly connected to the drive assembly; and

a sealing assembly comprising a sealing component and an elastic component; the sealing component being configured to seal the shaft hole; the sealing component being annularly disposed around an outer periphery of the motor shaft; the sealing component comprising a sleeve, a first sealing ring, a second sealing ring and a third sealing ring; the sleeve being sleeved on the outer periphery of the motor shaft; a sealing cavity being defined between an inner periphery of the sleeve and the outer periphery of the motor shaft; the first sealing ring and the second sealing ring being configured to jointly seal the sealing cavity; the third sealing ring being sleeved on the motor shaft; the third sealing ring being sandwiched between an inner periphery of the shaft hole and

the outer periphery of the motor shaft; and the elastic component elastically supporting the sleeve to limit the sealing component.

45. The gear pump with improved sealing performance according to claim 44, wherein the elastic component comprises a compression spring extending in an axial direction; one end of the compression spring elastically abuts against the sleeve, and another end of the compression spring is connected to the motor assembly.

46. The gear pump with improved sealing performance according to claim 45, wherein a bearing surface facing the end cover is annularly provided on an outer periphery of the sleeve; the one end of the compression spring abuts against the bearing surface, and the another end of the compression spring abuts against the motor assembly.

47. The gear pump with improved sealing performance according to claim 46, wherein a bearing is provided on the end cover, the motor shaft extends from the bearing, the bearing has an opening groove facing the housing plate, the opening groove is annularly disposed around the outer periphery of the motor shaft, and an end of the compression spring abutting against the motor assembly is inserted into the opening groove and abuts against a bottom of the opening groove.

48. The gear pump with improved sealing performance according to claim 45, wherein the elastic component further comprises a snap spring, the snap spring is annularly disposed extending in a circumferential direction and having a gap, and the snap spring is sleeved on the outer periphery of the sleeve and connected to the motor assembly.

49. The gear pump with improved sealing performance according to claim 48, wherein the motor assembly further comprises a wall portion disposed between the housing plate and the end cover; the wall portion surrounds an outer periphery of the sealing component and is connected to the end cover; an inner periphery of the wall portion is concavely provided with an installation groove extending in the circumferential direction; and an outer periphery of the snap spring is embedded in the installation groove.

50. The gear pump with improved sealing performance according to any one of claims 45 to 49, wherein the sleeve has a first end adjacent to the housing plate and a second end adjacent to the end cover, the first sealing ring is disposed between the first end and the housing plate, and the second sealing ring is disposed between the second end and the

motor shaft.

51. The gear pump with improved sealing performance according to claim 50, wherein a side of the housing plate facing the end cover is provided with a sealing groove annularly disposed around an outer periphery of the shaft hole; the first end is provided with an annular step inserted into the sealing groove; and the first sealing ring is sleeved on an outer periphery of the annular step and abuts against a bottom wall of the sealing groove and a side wall of the sealing groove.

52. The gear pump with improved sealing performance according to claim 50, wherein the second end of the sleeve is an open end; and the second sealing ring is disposed in the sealing cavity, and is sandwiched between an inner side wall of the sealing cavity and the outer periphery of the motor shaft.

53. The gear pump with improved sealing performance according to claim 52, wherein a bearing is provided on the end cover, the motor shaft extends from the bearing, a portion of the bearing is inserted into the open end, a side of the second sealing ring facing away from the sealing cavity abuts against the bearing, a first limiting groove is provided on an outer peripheral side of the bearing, a second limiting groove is provided on a peripheral side of the sleeve, each of the first limiting groove and the second limiting groove extends in the axial direction, and the sealing assembly further comprises a limiting post inserted into the first limiting groove and the second limiting groove.

54. A gear pump with a lubrication structure, comprising:

a pump housing having a cavity, the pump housing comprising a housing plate and a second inner wall arranged opposite to each other in an axial direction; and

a drive assembly disposed in the cavity, the drive assembly comprising a driving gear and a driven gear meshing with each other, each of the driving gear and the driven gear rotating about a rotation axis extending in the axial direction, and a meshing gap being formed at a meshing position of the driving gear and the driven gear;

wherein the housing plate and/or the second inner wall is provided with a liquid guiding groove, the liquid guiding groove is in communication with the meshing gap, and one end of the liquid guiding groove extends to an end side of the driving gear, and another end of the liquid guiding groove extends to an end side of the driven gear.

55. The gear pump with the lubrication structure according to claim 54, wherein the gear pump further comprises a motor assembly; the motor assembly comprises an end cover and a motor shaft extending from the end cover; the housing plate defines a shaft hole; the motor shaft is inserted into the cavity from the shaft hole and is keyed to the driving gear; the liquid guiding groove comprises a first liquid guiding groove provided on the housing plate; and one end of the first liquid guiding groove is in communication with the shaft hole.

56. The gear pump with the lubrication structure according to claim 55, wherein a rotating shaft of the driven gear is at least partially recessed on a side of the driven gear facing the housing plate to form a recess, and another end of the first liquid guiding groove is in communication with the recess.

57. The gear pump with the lubrication structure according to claim 55, wherein the pump housing comprises a housing body and a cover body, the housing body forms the cavity having an opening, the opening faces the end cover, the cover body covers an opening side of the housing body, a side of the cover body facing the cavity has the housing plate, and an inner side of the housing body facing the opening has the second inner wall.

58. The gear pump with the lubrication structure according to claim 57, wherein the housing body and the cover body are detachably connected; a sealing ring is provided between the housing body and the cover body; and the sealing ring is disposed around an outer periphery of the opening.

59. The gear pump with the lubrication structure according to claim 57, wherein a mounting seat is provided between the end cover and the cover body; the mounting seat is detachably connected to the end cover and is integrally formed with the cover body; a mounting cavity is formed inside the mounting seat; the motor shaft passes through the mounting cavity; and a sealing assembly is provided on a shaft section of the motor shaft within the mounting cavity; and the sealing assembly is configured to seal the shaft hole.

60. The gear pump with the lubrication structure according to claim 59, wherein the sealing assembly comprises a sealing component sleeved on the motor shaft, and an elastic component; one end of the elastic component abuts against the sealing component to press the sealing component against the shaft hole, and another end of the elastic component abuts against a bearing provided on the end cover.

61. The gear pump with the lubrication structure according to claim 59, wherein a connecting piece is provided on a peripheral side of the mounting seat, and the connecting piece is configured to connect and fix the gear pump to a machine body. 5
62. The gear pump with the lubrication structure according to any one of claims 55 to 61, wherein the second inner wall is concavely provided with a first opening groove and a second opening groove; the first opening groove accommodates the motor shaft; the second opening groove accommodates the rotating shaft of the driven gear; the liquid guiding groove comprises a second liquid guiding groove provided on the second inner wall; one end of the second liquid guiding groove is in communication with the first opening groove, and another end of the second liquid guiding groove is in communication with the second opening groove. 10
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63. The gear pump with the lubrication structure according to any one of claims 54 to 61, wherein the driving gear and the driven gear separate the cavity into a liquid inlet cavity and a liquid outlet cavity; a liquid inlet channel and a liquid outlet channel are provided on two radially opposite sides of the pump housing, respectively; the liquid inlet channel is in communication with the liquid inlet cavity, and the liquid outlet channel is in communication with the liquid outlet cavity. 25
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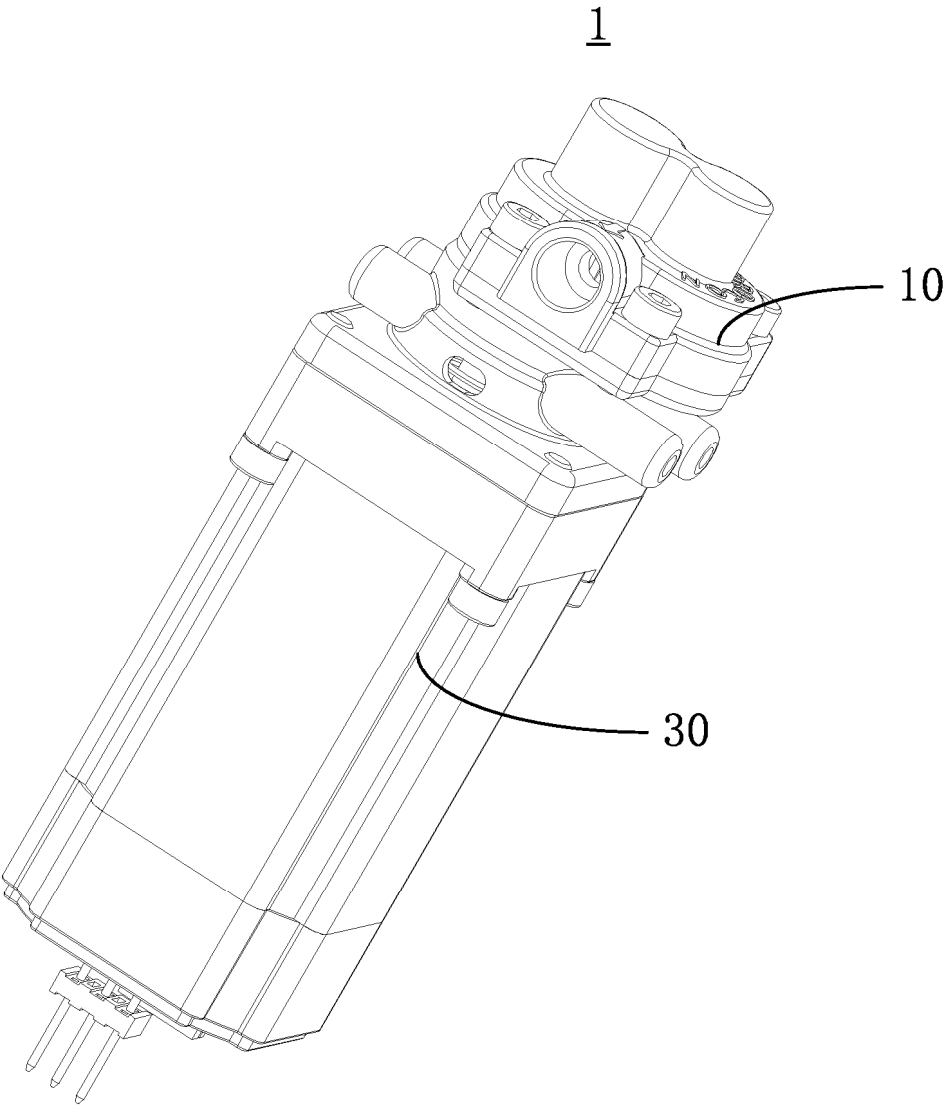


FIG. 1

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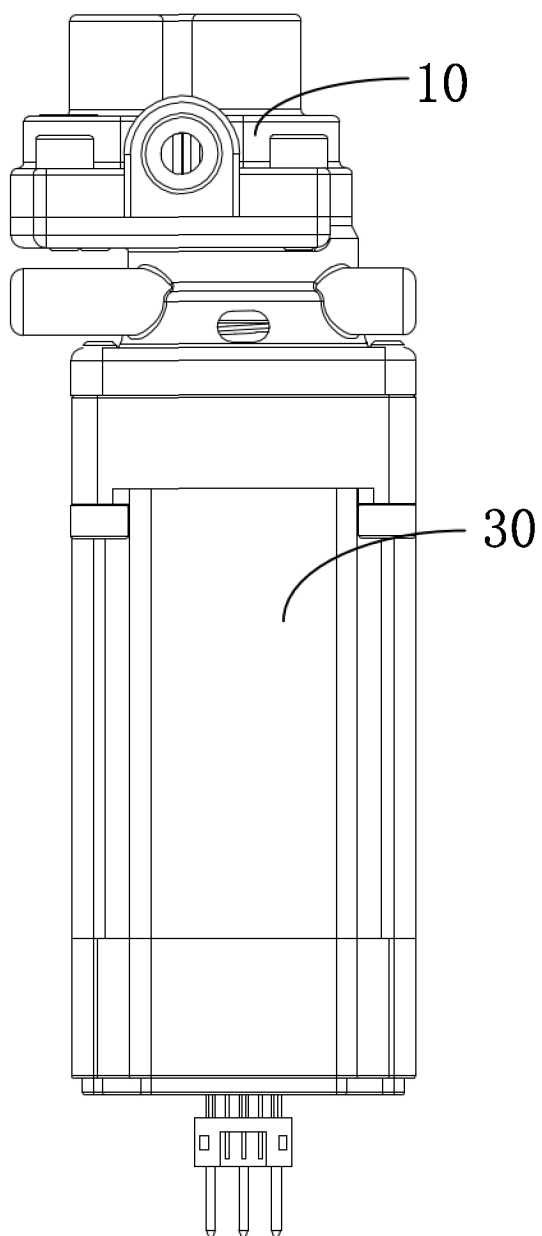


FIG. 2

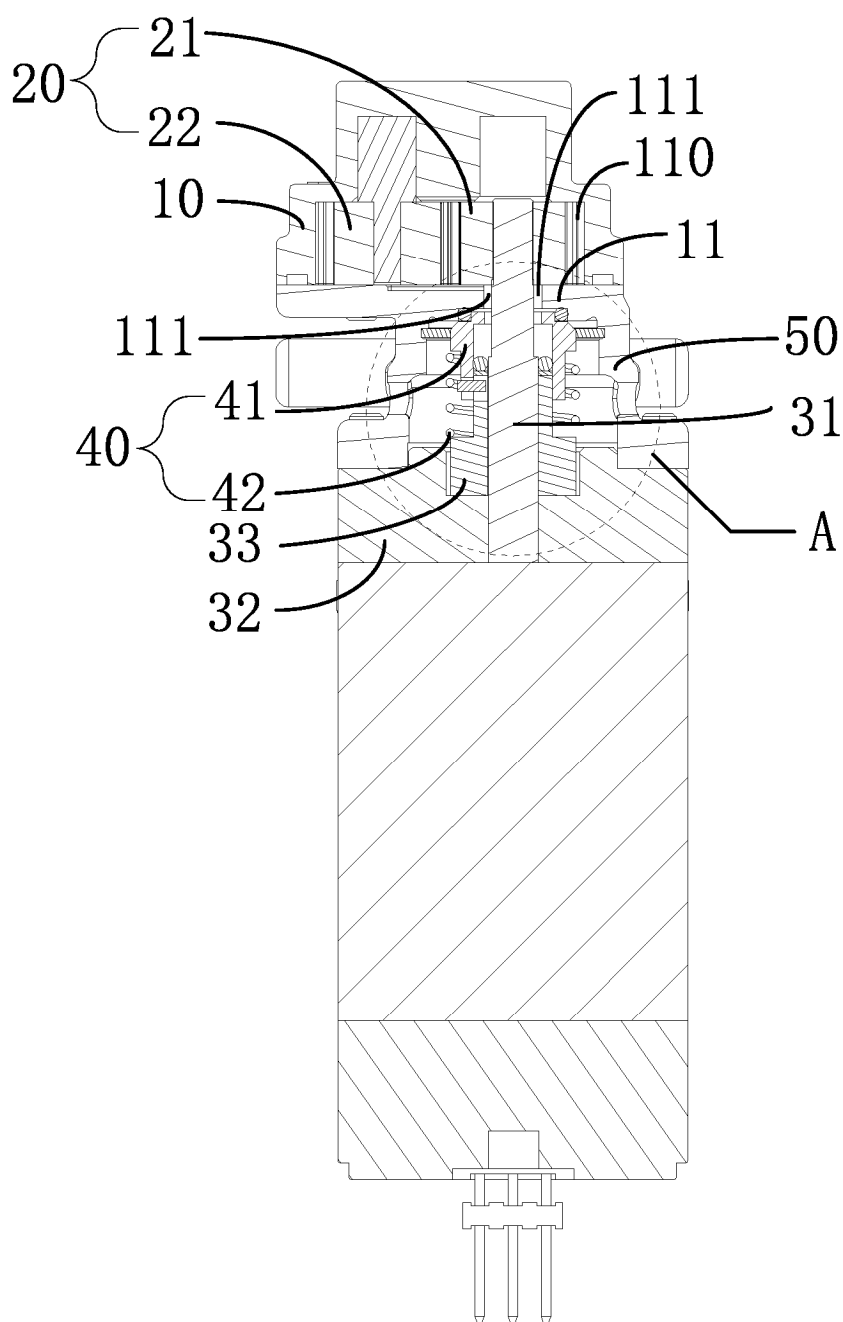


FIG. 3

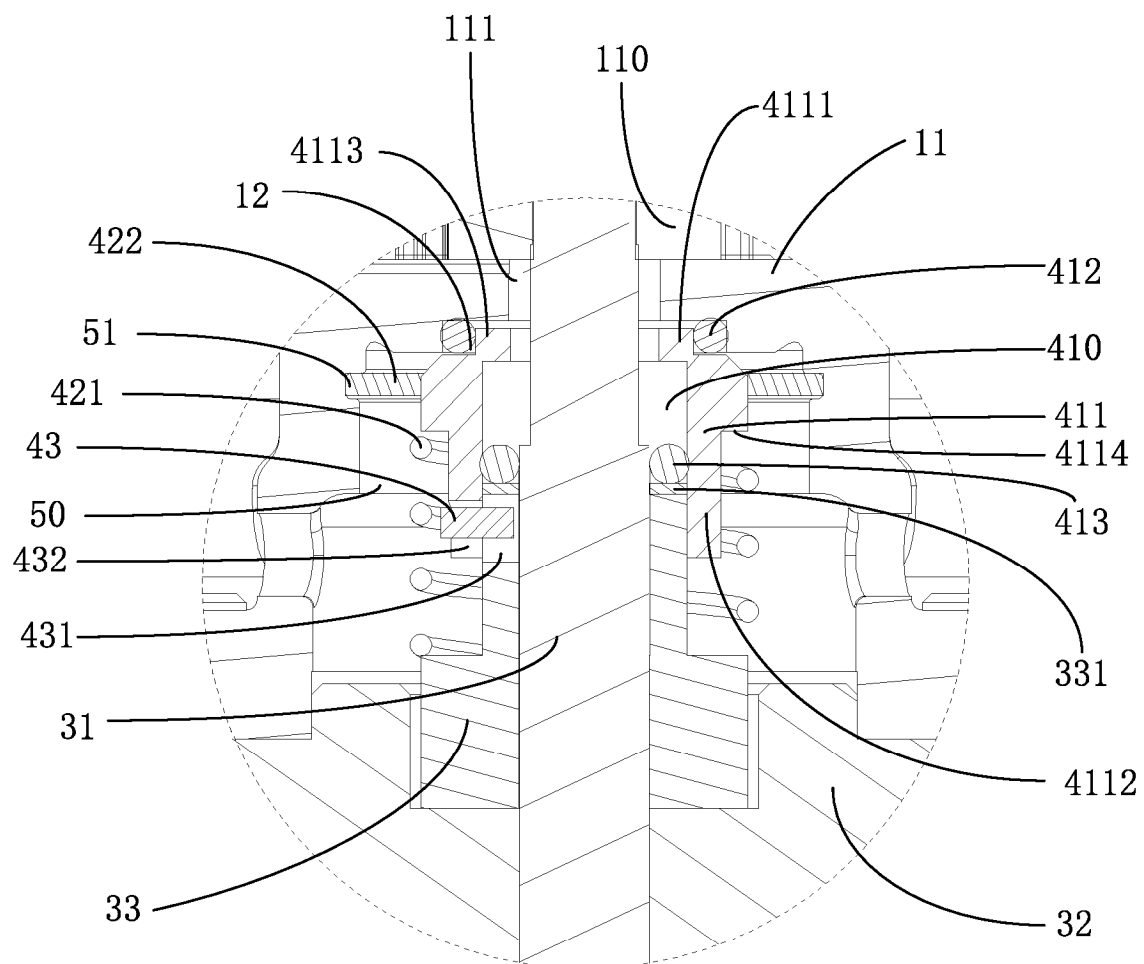


FIG. 4

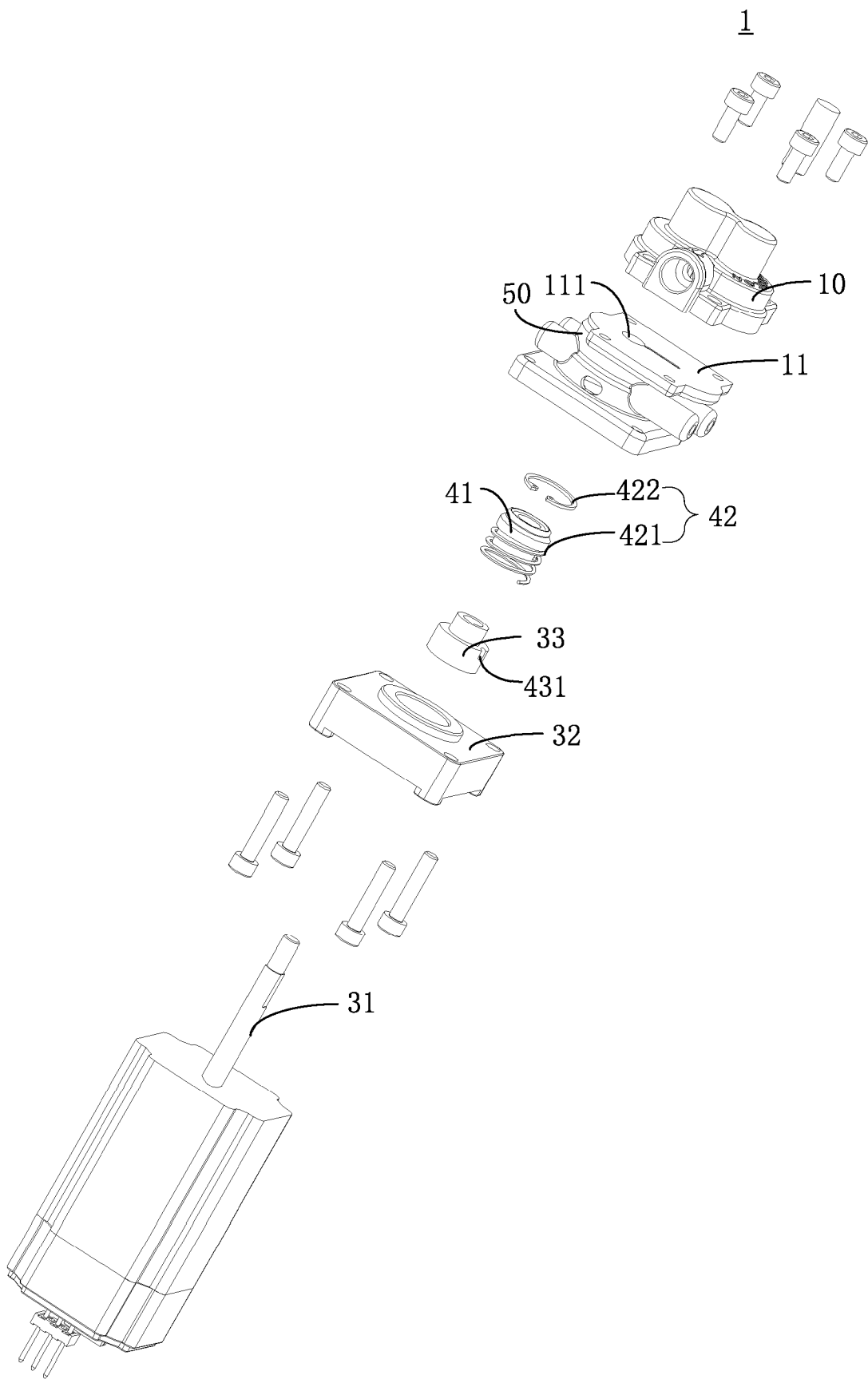


FIG. 5

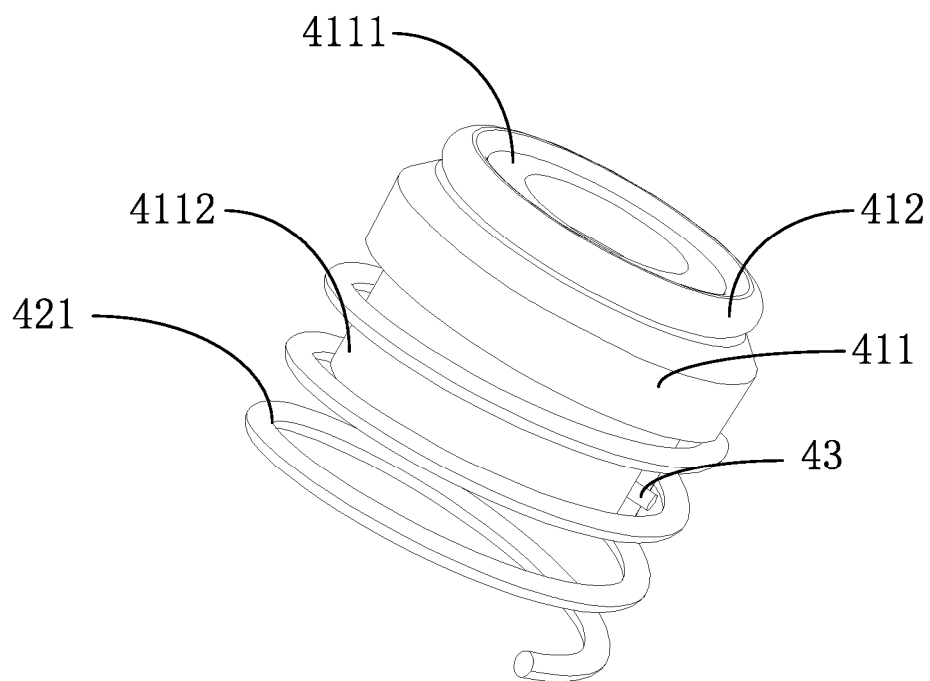


FIG. 6

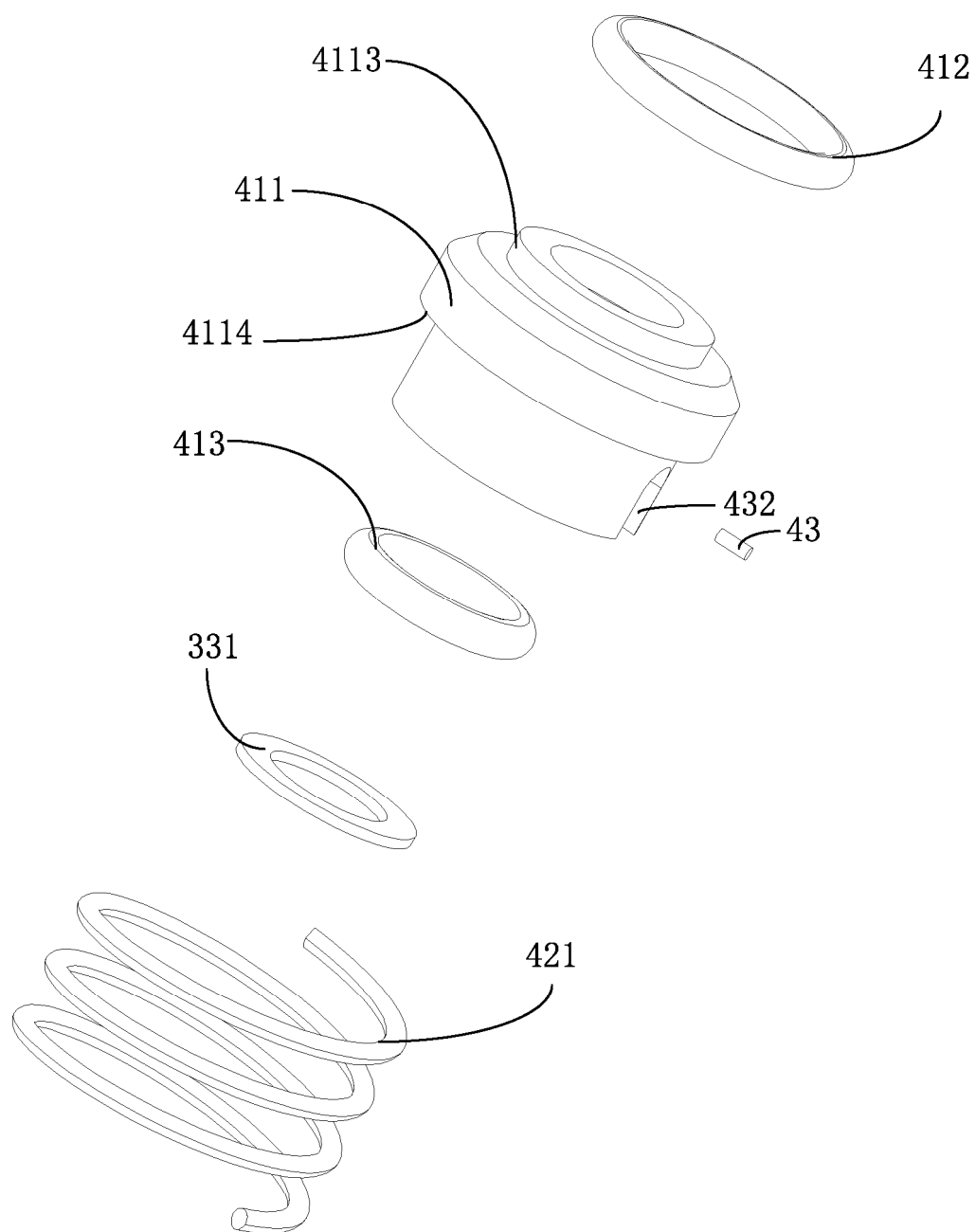


FIG. 7

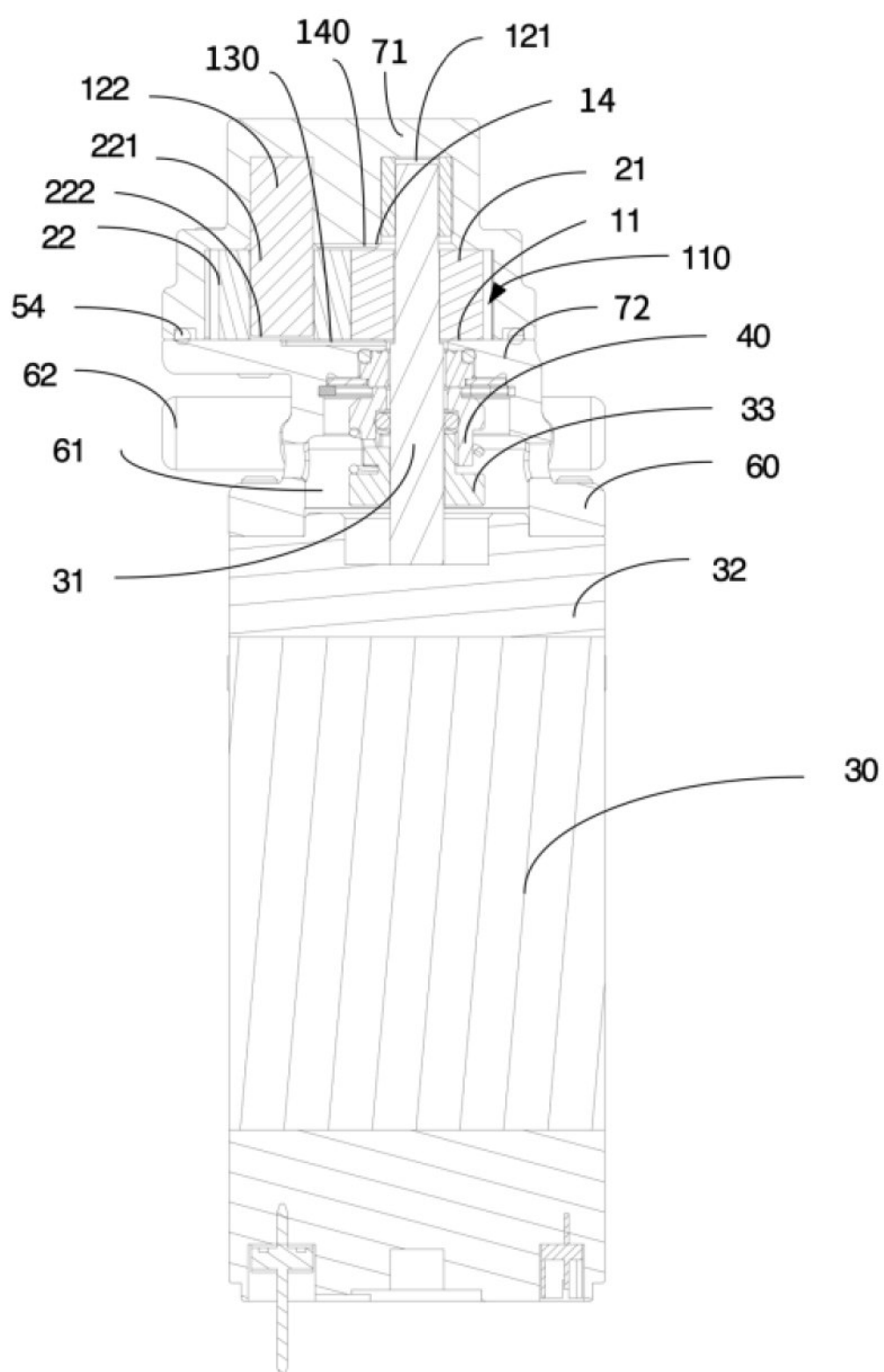


FIG. 8

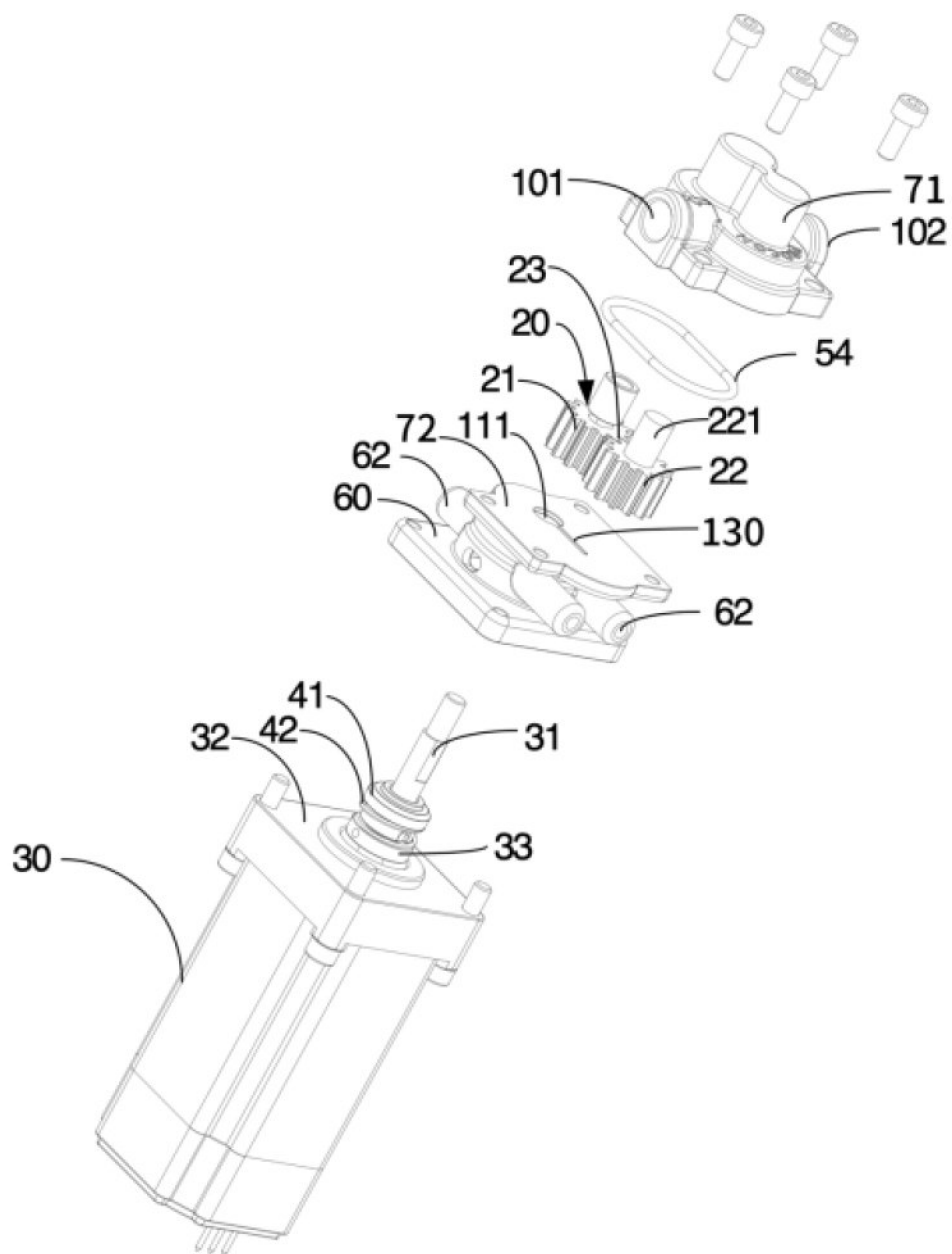


FIG. 9

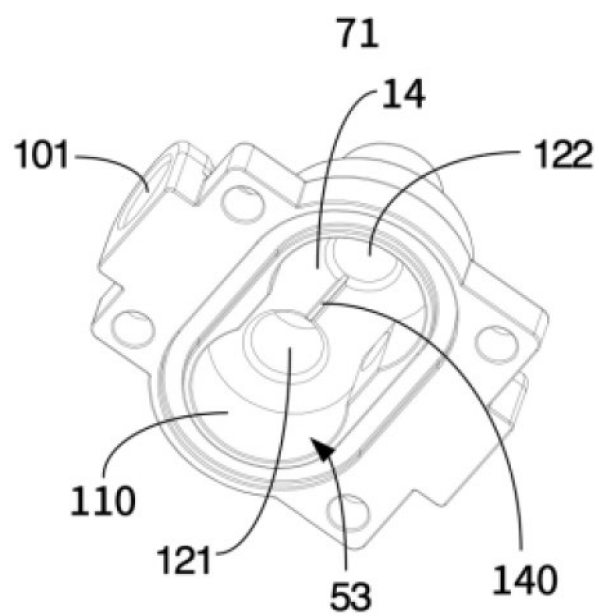


FIG. 10

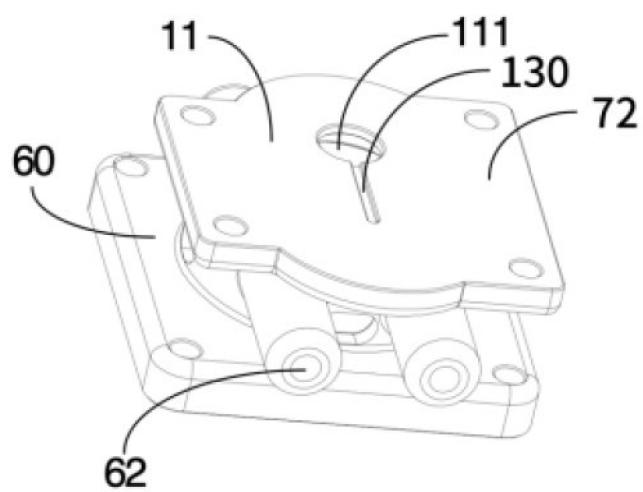


FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/136043

A. CLASSIFICATION OF SUBJECT MATTER

F04C2/18(2006.01)i; F04C29/00(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)

IPC:F04C,F04B

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

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

CNTXT, ENTXTC, DWPI: 齿轮, 泵, 壳, 轴孔, 电机, 电动机, 密封, 弹性件, 弹簧, 压簧, 卡簧, 套筒, O型圈, O形圈, 导液, 槽, gear+, pump, shell, shaft, hole, motor, seal+, elastic+, element, spring, pressure, snap, sleeve, ring, liquid, guide, groove

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 117889081 A (CAYE TECHNOLOGY (SUZHOU) CO., LTD.) 16 April 2024 (2024-04-16) description, paragraphs 37-54, and figures 1-7	1-53
PX	CN 221995227 U (CAYE TECHNOLOGY (SUZHOU) CO., LTD.) 12 November 2024 (2024-11-12) claims 1-10, and figures 1-7	14-23
PX	CN 221400905 U (CAYE TECHNOLOGY (SUZHOU) CO., LTD.) 23 July 2024 (2024-07-23) description, paragraphs 31-45, and figures 1-5	54-63
E	CN 119267214 A (CAYE TECHNOLOGY (SUZHOU) CO., LTD.) 07 January 2025 (2025-01-07) description, paragraphs 36-53, and figures 1-7	1-53
E	CN 119267213 A (CAYE TECHNOLOGY (SUZHOU) CO., LTD.) 07 January 2025 (2025-01-07) description, paragraphs 36-53, and figures 1-7	1-53

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"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	

Date of the actual completion of the international search

13 February 2025

Date of mailing of the international search report

19 February 2025

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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China No. 6, Xitucheng Road, Jimenqiao, Haidian District,
Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/136043

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Information on patent family members

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Form PCT/ISA/210 (patent family annex) (July 2022)