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(54) DIAPHRAGM PUMP

(57) The present disclosure provides a diaphragm pump, which includes a pump core base, a pump core opposite to the pump core base, and a diaphragm fixed to the pump core and configured for cooperating with the pump core base. The pump core base can include a water inlet passage and a water outlet passage. The pump core base further include an inlet check valve at an end of the water inlet passage and an outlet check valve at a first end of the water outlet passage. The pump core base further includes a groove at a second end of the water outlet passage opposite to the first end. The diaphragm include a convex portion cooperated with the groove which is configured to push fluid in the groove outward from the water outlet passage.

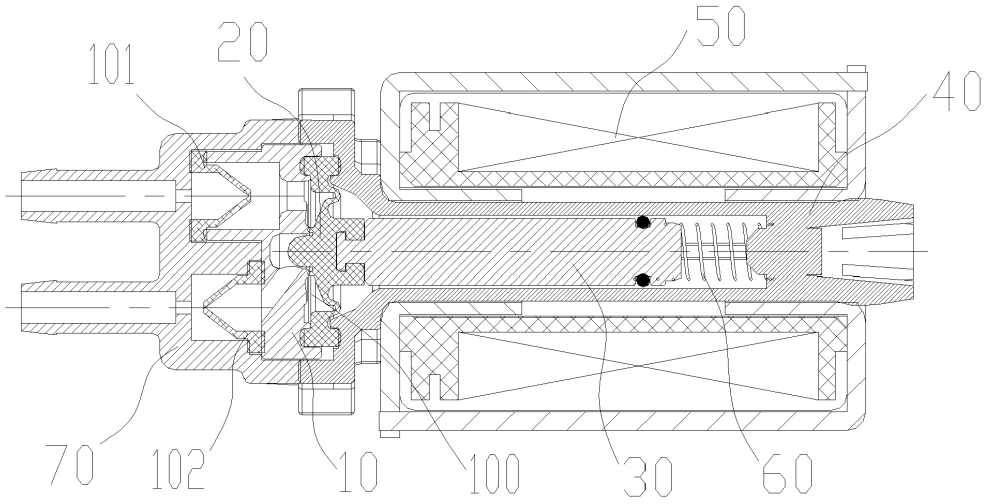

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a technical field of flow control, in particular, to a diaphragm pump.

BACKGROUND

[0002] A diaphragm pump can be configured for adjusting a flow rate of a fluid by a pressure difference, so that the fluid can be suck into the diaphragm pump and then discharge. The diaphragm pump can include a diaphragm and a pump core base, and a sealing chamber can be formed between the diaphragm and the pump core base. When the diaphragm vibrates, the pressure in the sealing chamber can be controlled to achieve controlling of the flow rate of the fluid.

[0003] In the prior art, when the fluid in the sealing chamber discharge from a water outlet passage of the pump core base, an end surface of the diaphragm toward the pump core base can be flat, and a vibration of the diaphragm toward the pump core base can achieve a one-time pushing of the fluid in the sealing chamber.

[0004] However, only one sealing chamber is formed between the diaphragm and the pump core base. When the diaphragm pump is in operation, the pressure difference in the sealing chamber is not large enough, which causes the overall pressure of the diaphragm pump low and a self-priming force weak. Furthermore, a stability of the pressure difference of the sealing chamber is poor, easily leading to the flow rate of the fluid unstable.

SUMMARY

[0005] The present disclosure provides a diaphragm pump, which can improve a pressure difference of a chamber between the pump core base and the diaphragm and its stability thereof.

[0006] A diaphragm pump can include a pump core base, a pump core opposite to the pump core base, and a diaphragm fixed to the pump core and configured for cooperating with the pump core base. The pump core base can include a water inlet passage and a water outlet passage. The pump core base further include an inlet check valve at an end of the water inlet passage and an outlet check valve at a first end of the water outlet passage. The pump core base further includes a groove at a second end of the water outlet passage opposite to the first end. The diaphragm include a convex portion cooperated with the groove which is configured to push fluid in the groove outward from the water outlet passage.

[0007] Furthermore, the convex portion extends into the groove.

[0008] Furthermore, the convex portion is a plunger toward the pump core base.

[0009] Furthermore, the diaphragm is configured to drive the convex portion to insert into the groove until the convex portion is in clearance fit with the groove.

[0010] Furthermore, the pump core base includes a first sealing portion and the diaphragm includes a second sealing portion. The first sealing portion cooperates with the second sealing portion to make a sealing effect between the convex portion and the groove.

[0011] Furthermore, the first sealing portion is a sealing ring on an outer periphery of the groove and the second sealing portion is a sealing block at an outer periphery of the convex portion.

[0012] Furthermore, the sealing ring is convexly arranged outward to the diaphragm.

[0013] Furthermore, the water outlet passage is inclined, and the second end of the water outlet passage is not completely covered by the convex portion when the convex portion enters into the groove and the water outlet passage communicates with the groove.

[0014] Furthermore, the diaphragm cooperates with the pump core base to form a water chamber. The diaphragm includes a bending portion away from the pump core base. And a cavity is formed by the bending portion and communicates with the water chamber.

[0015] Furthermore, the diaphragm pump further include: a magnetic isolation tube; an excitation coil sleeved on the magnetic isolation tube; a spring disposed in the magnetic isolation tube and abutting against the pump core; and a pump body. The pump body and the magnetic isolation tube are connected with each other, and both are configured to limit the inlet check valve and the outlet check valve on the pump core base.

[0016] The diaphragm pump has the following advantages. The diaphragm includes the convex portion cooperated with the groove at the second end of the water outlet passage, which is configured to push fluid in the groove outward from the water outlet passage. That is, through the structural of the convex portion, the diaphragm pump can work to achieve a second pushing of the fluid. Thereby, the pressure of the outlet water can be increased and the stability of the pressure difference can be improved during the operation of the diaphragm pump.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a cross-sectional view of a diaphragm pump in an embodiment of the present disclosure.

FIG. 2 is a cross-sectional view of a pump core base and a diaphragm in the diaphragm pump of FIG. 1.

FIG. 3 is a cross-sectional view of a pump core base in the diaphragm pump of FIG. 1.

FIG. 4 is a perspective view of a diaphragm in the diaphragm pump of FIG. 1 from another view angle.

Fig. 5 is a cross-sectional view of a diaphragm in the diaphragm pump of Fig. 1.

DETAILED DESCRIPTION

[0018] In the following, many embodiments of the present disclosure will be clearly and completely described with reference to the drawings. Obviously, the described embodiments are only a part of the embodiments of the present disclosure, but not all the embodiments. Based on the embodiments of the present disclosure, all other embodiments obtained by one in the art without creative efforts can be within the protection scope of the present disclosure.

[0019] Unless defined otherwise, all technical terms used herein have the same meaning as commonly understood by one in the art. The technical terms used herein in the description is for the purpose of describing particular embodiments only and is not intended to limit the protection scope. The words "or/and" as used herein includes any and all combinations of one or more of the associated listed items.

[0020] Referring to FIG. 1 to FIG. 5, an embodiment provides a diaphragm pump including a pump core base 10, a diaphragm 20, a pump core 30, a magnetic isolation tube 40, an excitation coil 50, a spring 60 and a pump body 70. The pump core 30 can be located opposite to the pump core base 10. The diaphragm 20 can be fixed to the pump core 30 and configured for cooperating with the pump core base 10. The excitation coil 50 can be sleeved on the magnetic isolation tube 40. The spring 60 can be configured for providing a reset force for the pump core 30. The pump core 30 can perform a reciprocating motion relative to the pump core base 10 under a function of a magnetic field formed by the excitation coil 50 when the excitation coil 50 is energized and under the resetting force of the spring 60. Therefore, the diaphragm pump can control a flow rate of a fluid.

[0021] The pump core base 10 can include a water inlet passage 11 and a water outlet passage 12. The pump core base 10 can further include an inlet check valve 101 at an end of the water inlet passage 11 and an outlet check valve 102 at a first end of the water outlet passage 12, so that the water inlet passage 11 and the water outlet passage 12 in the pump core base 10 can be one-directional (i.e., unidirectional) communicated.

[0022] In one embodiment, the pump body 70 and the magnetic isolation tube 30 can be connected and fixed in a snap-connected manner, in order to limit the inlet check valve 101 and the outlet check valve 102 on the pump core base 10. In this way, the inlet check valve 101 and the outlet check valve 102 can be assembled on the pump core base 10.

[0023] The pump core base 10 can include a groove 13 at a second end of the water outlet passage 12 opposite to the first end. The diaphragm 20 can include a convex portion 21, and the convex portion 21 can cooperate with the groove 13 to push the fluid in the groove 13 outward from the water outlet passage 12. That is, the diaphragm pump can include a water chamber 100 between the pump core base 10 and the diaphragm 20 and the groove 13 in the pump core base 10. When the diaphragm pump works, the diaphragm 20 will move toward the pump core base 10 and the diaphragm 20 will firstly push the fluid in the water chamber 100. Then, the convex portion 21 on the diaphragm 20 will further push the fluid in the groove 13 so as to improve the pressure of water.

[0024] Referring to FIG. 2, the convex portion 21 can extend into the groove 13. In this embodiment, a portion of the diaphragm 20 that is connected to the pump core 30 is away from the convex portion 21. When the pump core 30 drives the diaphragm 20 to move toward the pump core base 10, the convex portion 21 will enter into the groove 13 of the pump core base 10 to achieve a lager pressure. That is, when the diaphragm pump is in operation, the movement of the diaphragm 20 toward the pump core base 10 can be divided into two stages: the first stage is water in the water cavity 100 can be pushed by the diaphragm 20; and the second stage is water in the groove 13 can be further pushed by the convex portion 21.

[0025] The convex portion 21 can be a plunger formed by the diaphragm 20 and partially protruding toward the pump core base 10. The diaphragm 20 can drive the plunger to insert into the groove 13 and the fluid in the groove 13 will be pushed outward. Of course, it should be noted that the convex portions 21 are not limited to the shape shown in the figure. One in the art can design the convex portions 21 in a frustum or cylindrical shape if required.

[0026] Furthermore, the convex portion 21 can be in clearance fit with an inner wall of the groove 13 when the convex portion 21 is inserted into the groove 13. In this way, the fluid in the groove 13 can be pushed outward, thereby further increasing the flow rate of the fluid during the operation of the diaphragm pump.

[0027] In this embodiment, the pump core base 10 can include a first sealing portion 14, and the diaphragm 20 can include a second sealing portion 22. The first sealing portion 14 can cooperate with the second sealing portion 22 to make a sealing effect between the convex portion 21 and the groove 13. That is, when the convex portion 21 is pushed into the groove 13, the fluid in the groove 13 can be completely discharged from the water outlet passage 12, thereby avoiding reverse flows of water if the inlet check valve 101 is not completely closed. As a result, it ensures the stability and the pressure of the water outlet when the diaphragm pump is in operation.

[0028] In one embodiment, the first sealing portion 14 can be a sealing ring on an outer periphery of the groove 13, and the second sealing portion 22 can be a sealing block at an outer periphery of the convex portion 21. When the diaphragm 20 moves towards the pump core base 10, the second sealing portion 22 can abut against the first sealing portion 14 of the pump core base 10, so as to realize the sealing fit between the first sealing portion 14 and the second sealing portion 22. It should be noted that when the second sealing portion 22 of the

diaphragm 20 abuts on the first sealing portion 14 of the pump core base 10, the fluid in the water chamber 100 and the groove 13 has been discharged outward through the water outlet passage 12. Of course, the first sealing portion 14 and the second sealing portion 22 are not limited to the shape shown in the figure. The one in the art can design the shapes of the first sealing portion 14 and the second sealing portion 22 as required, for example, the first sealing portion 14 and the second sealing portion 22 can be exchanged.

[0029] The first sealing portion 14 can be protruded toward the diaphragm 20, so that the second sealing portion 22 of the diaphragm 20 can cooperate with the first sealing portion 14, realizing the sealing effect between the pump core base 10 and the diaphragm 20.

[0030] In this embodiment, the water outlet passage 12 can be in inclined shape. The second end of the water outlet passage 12 is not completely covered by the convex portion 21 even when the convex portion 21 enters into the groove 13, so that the water outlet passage 12 can communicate with the groove 13. When the diaphragm pump works, the fluid can flow from the groove 13 to the water outlet passage 12.

[0031] In another embodiment, the diaphragm 20 can further include a bending portion 23 away from the pump core base 10, and a cavity can be formed by the bending portion 23 and communicates with the water chamber 100, so that water storage capacity of the water chamber 100 can be expanded. When the pump core 30 drives the diaphragm 20 to move away from the pump core base 10, a vacuum degree of the water cavity 100 may be better, thus improving the self-priming force of the diaphragm pump during operation. The bending portion 23 of the diaphragm 20 will facilitate the driving of the diaphragm 20 by the pump core 30. In detail, it can reduce the force when the pump core 30 drives the diaphragm 20, thereby reducing the power consumption of the diaphragm pump during operation and extending the service life.

[0032] Compared with the diaphragm pump in the prior art, the diaphragm pump of the present disclosure tested under the same conditions can have a higher drainage pressure improved by at least 40%, a higher vacuum of the pump improved by at least 45%, and an enhanced stability of the diaphragm pump improved by at least 10%.

[0033] The diaphragm pump has the following advantages. The diaphragm includes the convex portion 21 cooperated with the groove 13 at the second end of the water outlet passage 12, which is configured to push fluid in the groove 13 outward from the water outlet passage 12. That is, through the structural of the convex portion 21, the diaphragm pump can work to achieve a second pushing of the fluid. Thereby, the pressure of outlet water can be increased, self-priming force of the diaphragm pump can be enhanced at the same time, and the stability of the pressure difference can be improved during the operation of the diaphragm pump.

[0034] The technical features of the embodiments described above can be arbitrarily combined. In order to simplify the description, all possible combinations of the technical features in the above embodiments have not been described. However, as long as there is no contradiction in the combination of these technical features, it should be considered as the scope described in this specification.

[0035] The above-mentioned embodiment only expresses several implementation manners of the present disclosure, and the description thereof is more specific and detailed, but it cannot be understood as a limitation on the scope of the invention patent. It should be noted that, for one in the art, without departing from the concept of the present disclosure, several modifications and improvements can be made, which all belong to the protection scope of the present disclosure. Therefore, the protection scope of the invention patent shall be subject to the appended claims.

Claims

1. A diaphragm pump comprising a pump core base (10), a pump core (30) opposite to the pump core base (10), and a diaphragm (20) fixed to the pump core (30) and configured for cooperating with the pump core base (10),
   wherein the pump core base (10) comprises a water inlet passage (11) and a water outlet passage (12), wherein the pump core base (10) further comprises an inlet check valve (101) at an end of the water inlet passage (11) and an outlet check valve (102) at a first end of the water outlet passage (12),
   characterized in that:

   the pump core base (10) further comprises a groove (13) at a second end of the water outlet passage (12) opposite to the first end, and
   the diaphragm (20) comprises a convex portion (21) cooperated with the groove (13) which is configured to push fluid in the groove (13) outward from the water outlet passage (12).

2. The diaphragm pump of claim 1, wherein the convex portion (21) extends into the groove (13).

3. The diaphragm pump of claim 2, wherein the convex portion (21) is a plunger toward the pump core base (10).

4. The diaphragm pump of claim 2, wherein the diaphragm (20) is configured to drive the convex portion (21) to insert into the groove (13) until the convex portion (21) is in clearance fit with the groove (13).

5. The diaphragm pump of claim 2, wherein the pump core base (10) comprises a first sealing portion (14), the diaphragm (20) comprises a second sealing por-

tion (22), the first sealing portion (14) cooperates with the second sealing portion (22) to make a sealing effect between the convex portion (21) and the groove (13).

6. The diaphragm pump of claim 5, wherein the first sealing portion (14) is a sealing ring on an outer periphery of the groove (13), and the second sealing portion (22) is a sealing block at an outer periphery of the convex portion (21).

7. The diaphragm pump of claim 6, wherein the sealing ring is convexly arranged outward to the diaphragm (20).

8. The diaphragm pump of claim 2, wherein the water outlet passage (12) is inclined, and the second end of the water outlet passage (12) is not completely covered by the convex portion (21), and the water outlet passage (12) communicates with the groove (13).

9. The diaphragm pump of claim 1, wherein the diaphragm (20) cooperates with the pump core base (10) to form a water chamber (100), the diaphragm (20) comprises a bending portion (23) away from the pump core base (10), and a cavity is formed by the bending portion (23) and communicates with the water chamber (100).

10. The diaphragm pump of claim 1, wherein the diaphragm pump further comprises:

a magnetic isolation tube (40);
an excitation coil (50) sleeved on the magnetic isolation tube (40);
a spring (60) disposed in the magnetic isolation tube (40) and abutting against the pump core (30); and
a pump body (70),
wherein the pump body (70) and the magnetic isolation tube (40) are connected with each other, and both are configured to limit the inlet check valve (101) and the outlet check valve (102) on the pump core base (10).

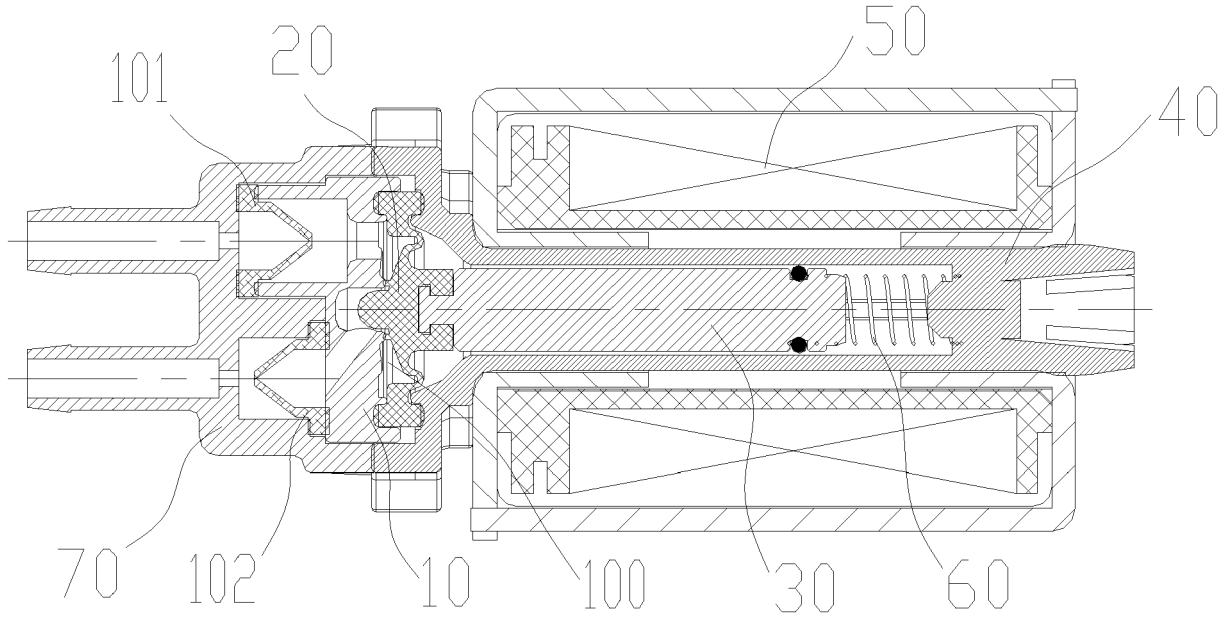

Fig. 1

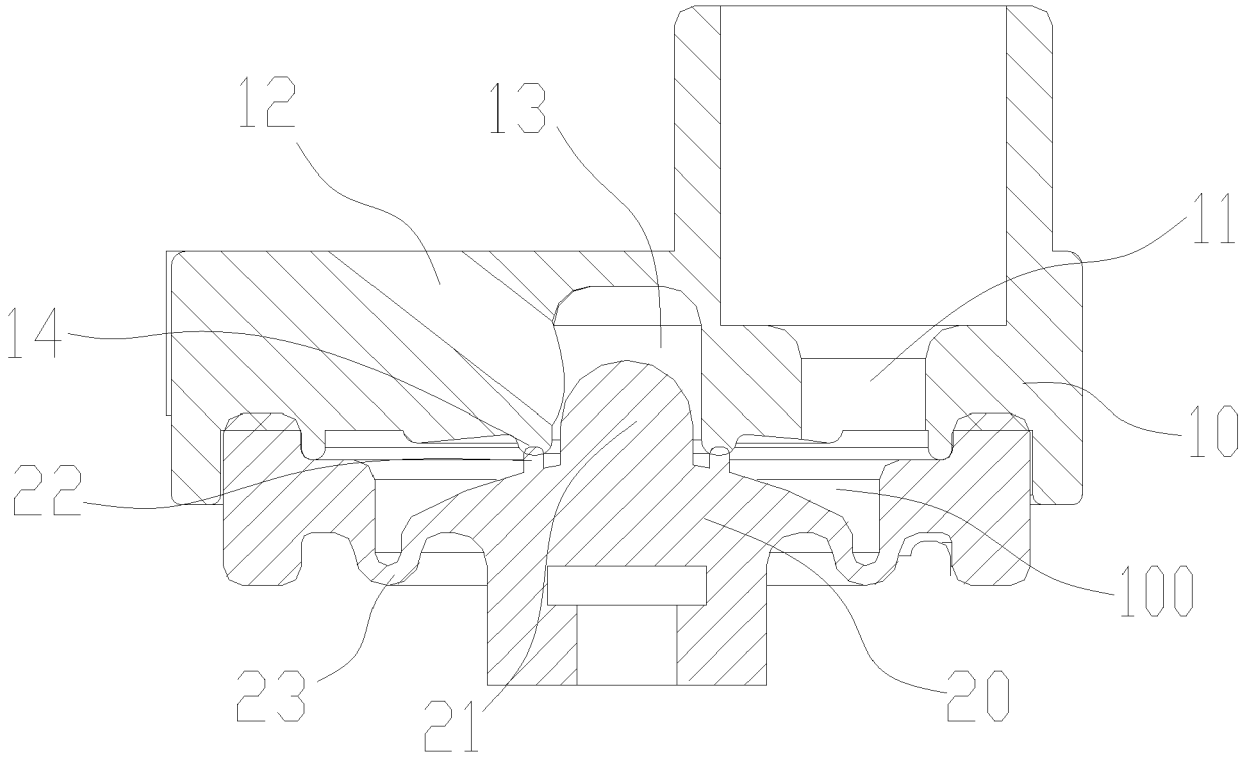

Fig. 2

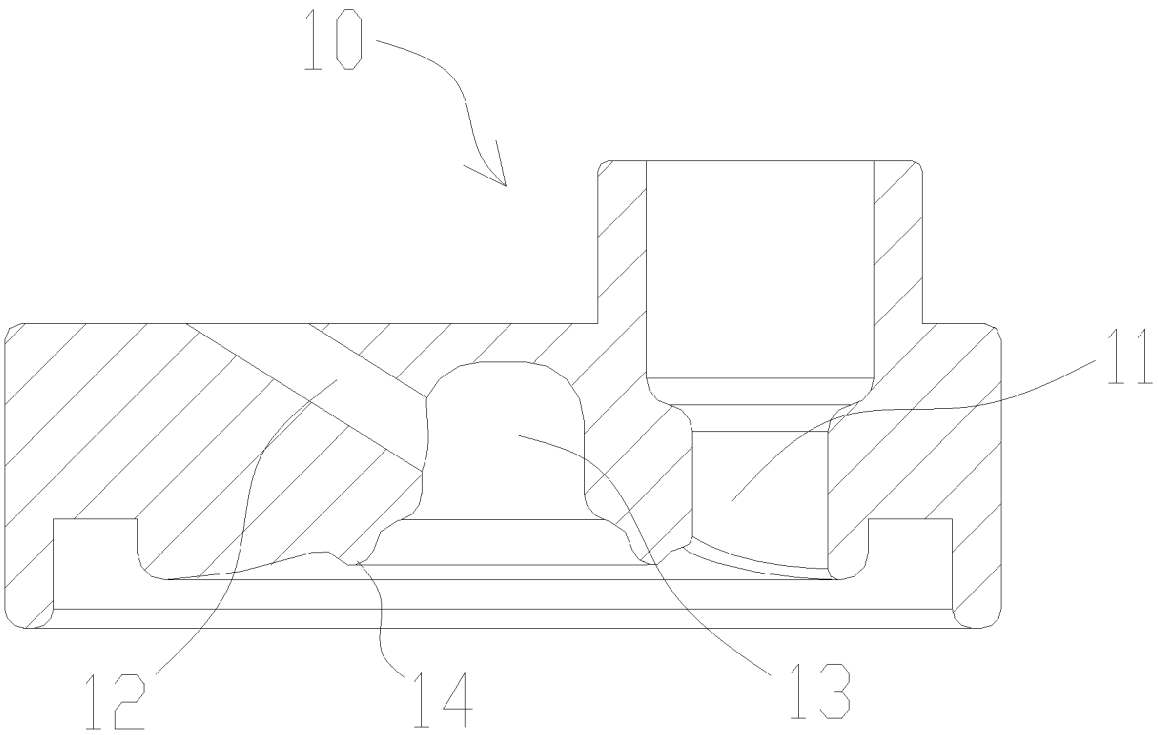

Fig. 3

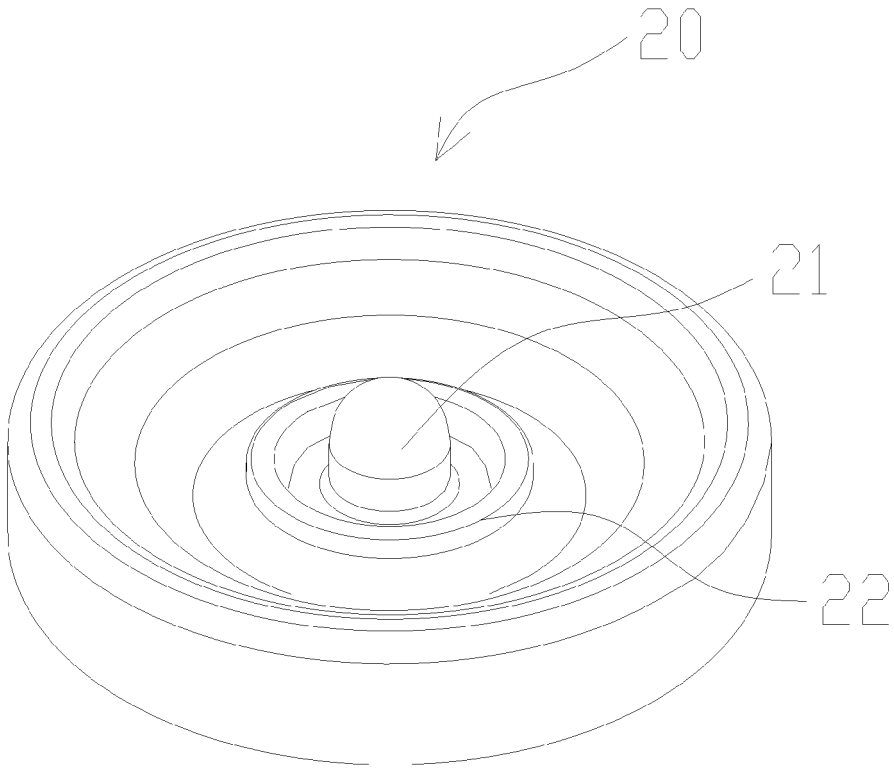

Fig. 4

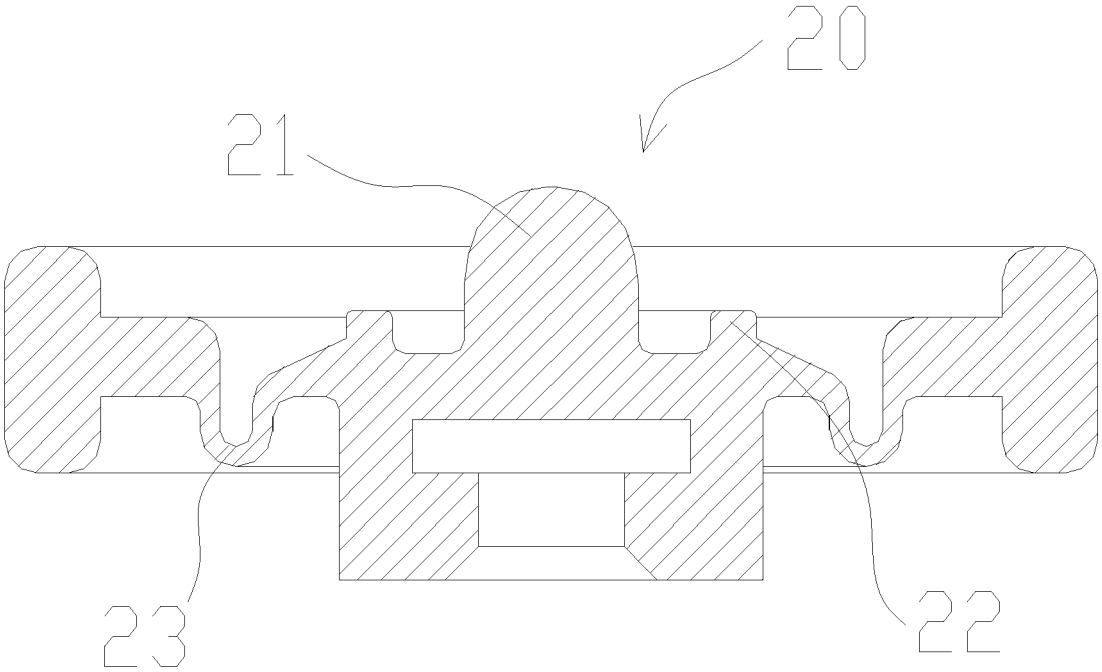

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 20 02 0025

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 208 749 519 U (NINGBO JIAYIN ELECTRICAL AND MECHANICAL TECH CO LTD) 16 April 2019 (2019-04-16) * figures 1-6 * -----	1-10	INV. F04B39/12 F04B43/02 F04B43/04 F04B53/16
A	CN 205 542 579 U (WENLING HUANLI ELECTRICAL APPLIANCE CO LTD) 31 August 2016 (2016-08-31) * figure 1 * -----	1-10	
A	CN 206 723 031 U (NINGBO JIAYIN ELECTRICAL AND MECHANICAL TECH CO LTD) 8 December 2017 (2017-12-08) * figures 1-2 * -----	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 April 2020	Fistas, Nikolaos

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 02 0025

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14-04-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 208749519 U	16-04-2019	NONE	
CN 205542579 U	31-08-2016	NONE	
CN 206723031 U	08-12-2017	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82