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(54) **ELECTROMAGNETIC SHOCK PUMP**

ELEKTROMAGNETISCHE STOSSSPUMPE

POMPE DE CHOC ÉLECTROMAGNÉTIQUE

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Description

Technical field

[0001] The present invention relates to a pump, and more particularly to an electromagnetic shock pump.

Background of the invention

[0002] German patent DE102005035835 relates to a vibrating armature pump with electromagnetic drive, in particular with solar drive, wherein in a cylindrical interior, a ferromagnetic piston is arranged axially displaceable. A coil voltage applied to an outer coil generates drive forces for the piston, a flow path which can be shut off by a check valve in a flow direction being arranged in the piston, and a second check valve being arranged on a delivery-side pump outlet. In a non-magnetic housing tube (1, 21), a hollow piston (6, 23) is arranged, the housing tube (1, 21) is wrapped with at least one coil-shaped wire winding (5) and the hollow piston (6, 23) has axially spaced sealing rings (15, 16) (Fig. 1).

[0003] US Patent US 5518372 A relates to a DC-powered controller for a linear pump or motor is provided. The linear pump or motor is of the type that includes a magnetic permeable member which is attracted to one end of a housing when a power coil is energized, and attracted to the other end of the housing when a reset coil is energized. The controller is connected to and powered by a DC-power source, such as a battery, and includes a voltage regulator, a control signal generator, and a dual coil driver circuit. The voltage regulator converts the battery voltage of the DC-power source to an operating voltage. The control signal generator is powered at the operating voltage and generates a square wave signal. The dual coil driver circuit receives the square wave signal and energizes the power coil during one phase of the square wave, and energizes the reset coil during the other phase of the square wave.

[0004] China patent CN202100449U discloses an electromagnetic shock pump. The electromagnetic shock pump disclosed by the patent comprises a valve body, a first-stage valve rubber head, a second-stage valve rubber head, a gasket, a rubber O-ring, a piston, a sleeve, an iron plate, an iron ring, a plastic packaging coil, a U-shaped iron plate and an iron ring, wherein the first-stage valve rubber head, the second-stage valve rubber head and the piston are sequentially arranged in a space formed by the valve body and the sleeve. The piston comprises a piston head with an inner hole, the piston head is opposite to the head of the second-stage valve rubber head. And the electromagnetic shock pump further comprises a force transmission mechanism used for transmitting a mechanical force.

[0005] In the actual use process of the electromagnetic shock pump, the mechanical force is transmitted among the piston, the second-stage valve rubber head and the the first-stage valve rubber head. However, when the me-

chanical force is transmitted among the piston, the second-stage valve rubber head and the first-stage valve rubber head, the positioning requirement of the first-stage valve rubber head relative to the second-stage valve rubber head is high, and if the position of the first-stage valve rubber head relative to the second-stage valve rubber head is inaccurate, it may easily lead to an electromagnetic shock pump failure.

Summary of the invention

[0006] The technical problem to be solved by the present invention is to overcome the defect that an electromagnetic shock pump provided with a mechanical force transmission mechanism has a failure risk in the prior art.

[0007] To solve the problem, the invention provides an electromagnetic shock pump, comprising: a valve body, provided with a center hole; a pressure relief valve, provided within the center hole; a piston, comprising a piston head provided within the center hole, an end of the free end of the piston head is provided with a sealing member, wherein the sealing member is pressed against a hole wall of the center hole, and the sealing member is able of moving along an axial direction of the center hole in a synchronized manner with the piston head; a water-sucking valve, provided on the piston head, and provided opposite to the pressure relief valve; wherein, the pressure relief valve, the valve body, the piston head, the sealing member and the water-sucking valve form a sealed space; wherein, an annular flange is arranged on the inner wall of the center hole, and the pressure relief valve comprises a first valve spool and a spring, the spring is pressed against the first valve spool so as to make the first valve spool move to a position where the first valve spool seats on the annular flange.

[0008] For the electromagnetic shock pump according to the present invention, a sealing member, which can axially move in the center hole of the valve body in a synchronized manner with the piston head, is sleeved on the piston head. When the piston head drives the sealing member to move synchronously, the volume of the substance of the sealed space may change, so as to change the pressure on the pressure relief valve or the water-sucking valve to open the pressure relief valve or the water-sucking valve. The pressure relief valve and the water-sucking valve are not in direct contact, thereby, the positioning requirements of the pressure relief valve relative to the water-sucking valve are low, and as a result, the electromagnetic shock pump according to the embodiments of the present invention will not undergo failure due to inaccurate positioning of the pressure relief valve relative to the water-sucking valve, thereby ensuring effectiveness of the electromagnetic shock pump, reducing the maintenance ratio of the electromagnetic shock pump, and significantly saving the cost.

[0009] In an embodiment, an annular groove extending in the circumferential direction is formed in the peripheral

surface of the end of the free end of the piston head, and the sealing member is matched with the annular groove. The annular groove can limit the sealing member, when the sealing member moves along with the piston head synchronously in the center hole of the valve body, the annular groove can provide thrust to the sealing member, so as to ensure to avoid the following condition: the sealing member cannot function to compress the sealed space due to its moving in the axial direction of the piston head.

[0010] In another embodiment, the sealing member includes an O-shaped sealing ring. The use of the O-shaped sealing ring can reduce the processing and manufacturing cost. The O-shaped sealing ring can be more easily sleeved in the annular groove of the piston head and tightly fit with the groove surface of the annular groove, so as to ensure the sealing performance between the piston head and the valve body, and keep the sealed space be in a good sealing state.

[0011] In another embodiment, the water-sucking valve comprises a second valve spool arranged on the piston head, and the second valve spool of the water-sucking valve is provided opposite to the first valve spool of the pressure relief valve, and a gap is formed between the second valve spool of the water-sucking valve and the first valve spool of the pressure relief valve. The first valve spool of pressure relief valve and the second valve spool of the water-sucking valve are not in direct contact, thereby, the positioning requirements of the first valve spool of the pressure relief valve relative to the second valve spool of the water-sucking valve are low, and as a result, the electromagnetic shock pump in the embodiments of the present invention will not undergo failure due to inaccurate positioning of the first valve spool of the pressure relief valve relative to the second valve spool of the water-sucking valve, thereby ensuring effectiveness of the electromagnetic shock pump, reducing the maintenance ratio of the electromagnetic shock pump, and significantly saving the cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention will be described in more details below with reference to the embodiments and the accompanying drawings

Fig. 1 is a full-sectional schematic view of an electromagnetic shock pump according to the embodiments of the present invention.

Fig. 2 is a partial enlarged view of the part A in Fig. 1.

[0013] The same reference numerals refer to the same parts in the drawings. The drawings are not drawn necessarily consistent with the actual proportion.

DETAILED DESCRIPTION

[0014] The present invention will be further described

below with reference to the accompanying drawings.

[0015] As shown in Fig. 1, an electromagnetic shock pump 10 according to an embodiment of the present invention comprises a valve body 11, a pressure relief valve, a water-sucking valve, a first spring 12, a piston 13, a second spring 14, a sleeve 15, a first iron ring 16, a rubber ring 17, a second iron ring 18, a plastic packaging coil 19, a fixing frame 20 and a fixing cover 21. A water inlet 151 is provided in one end of the sleeve 15. A water outlet 111 is provided in one end of the valve body 11. The valve body 11 is provided with a center hole. The piston 13 comprises a piston head 131 which is inserted into the center hole.

[0016] A pressing member 22 is arranged between the valve body 11 and the sleeve 15. The pressing member 22 is sleeved on the piston head 131 of the piston 13. A sealing ring is arranged between the end surface of the pressing member 22 and the end surface of the valve body 11. The piston head 131 penetrates through the center hole of the sealing ring and is in interference fit with the sealing ring. The first spring 12 is pressed against the end surface of the pressing member 22 facing the piston 13. Optionally, no sealing ring is arranged between the end surfaces of the pressing member 22 and the valve body 11.

[0017] A circumferential annular groove is formed in the periphery of the end of the free end of the piston head 131. A sealing member 23 is fixedly installed in the annular groove. The annular groove can limit the sealing member 23, when the sealing member 23 moves along with the piston head 131 synchronously in the center hole of the valve body 11, the annular groove can provide thrust to the sealing member 23, so as to ensure to avoid that the sealing member 23 cannot compress the sealed space 99 due to its movement in the axial direction of the piston head 131. The piston head 131 is inserted into the center hole of the valve body 11, and the sealing member 23 is in contact with the hole wall of the center hole of the valve body 11.

[0018] An annular flange 112 is arranged on the inner wall of the center hole of the valve body 11, a first valve spool 24 of the pressure relief valve is seated on the annular flange 112, and the annular flange 112 serves as a valve seat. The top of a first valve spool 24 is positioned in a hole formed by the annular flange 112 and does not extend into the sealed space 99 beyond the hole, so that the first valve spool 24 will always be in contact with a second valve spool 25, thereby avoiding an adhesion phenomenon occurring between the first valve spool 24 and the second valve spool 25. The second valve spool 25 of the water-sucking valve is seated on the top of the piston head 131, and the piston head 131 serves as a valve seat. The second valve spool 25 of the water-sucking valve is separated from the annular flange 112 by a certain distance, so that the first valve spool 24 of the pressure relief valve and the second valve spool 25 of the water-sucking valve are arranged opposite to each other at intervals.

[0019] As shown in Fig. 1 and Fig. 2, the pressure relief valve, the valve body 11, the water-sucking valve, the piston head 131 and the sealing member 23 form the sealed space 99. The sealed space 99 is a part of the center hole of the valve body 11. When the piston 13 is under the action of the magnetic force generated by the plastic packaging coil 19, the sealing member 23 can reciprocate with the piston head 131 synchronously in the center hole of the valve body 11 to change the volume of the sealed space 99. Preferably, the sealing member 23 is an O-shaped sealing ring.

[0020] During long-term transportation, storage and other circulation occasions, an adhesion phenomenon may occur between the first valve spool 24 of the pressure relief valve and the annular flange 112, and between the second valve spool 25 of the water-sucking valve and the piston head 131.

[0021] After the plastic packaging coil 19 is powered, the piston 13 may shock in a reciprocating mode in the sleeve 15. When the piston head 131 moves towards the pressure relief valve, the piston head 131 and the sealing member 23 compress the sealed space 99, and thus, the volume of the sealed space 99 is reduced sharply, the substance (such as air or water) in the sealed space 99 are compressed, and thus, the pressure of the sealed space 99 rises sharply, and then the pressure upon the first valve spool 24 of the pressure relief valve increases. When the pressure on the surface of the first valve spool 24 of the pressure relief valve facing the sealed space 99 is greater than the atmospheric pressure on the first valve spool 24, and the pressure difference upon the first valve spool 24 is greater than the adhesion between the first valve spool 24 and the annular flange, the first valve spool 24 and the annular flange 112 can get rid of the adhesion state therebetween, so that the pressure relief valve is opened. After the first valve spool 24 of the pressure relief valve is opened, the substances of the sealed space 99 is discharged, and the pressure of the sealed space 99 is reduced.

[0022] After the pressure relief valve is opened, the piston head 131 and the sealing member 23 start to move from the position closest to the first valve spool 24 of the pressure relief valve to the direction away from the first valve spool 24 of the pressure relief valve. During the process of the piston head 131 and the sealing member 23 moves away from the pressure relief valve, the first valve spool 24 of the pressure relief valve is reset and seated on the annular flange to form a seal. The sealed space 99 starts to increase sharply, and the substance (such as air or air and water) in the sealed space 99 expand, and the pressure of the sealed space 99 is reduced sharply. The pressure on the first surface of the second valve spool 25 of the water-sucking valve facing the sealed space 99 is smaller than the atmospheric pressure on the second surface opposite to the first surface, and the pressure difference on second valve spool 25 of the water-sucking valve is greater than the adhesion force between the second valve spool 25 and the piston

head 131, the second valve spool 25 of the water-sucking valve and the piston head 131 get rid of the adhesion state therebetween, so that the water-sucking valve is opened.

[0023] After the piston head 131 and the sealing member 23 shock in a reciprocating mode in the center hole of the valve body 11 and both the pressure relief valve and the water-sucking valve are opened, the electromagnetic shock pump 10 enters a normal working state. The piston 13 reciprocates, so that it may suck water from the water inlet 151, and then the water-sucking valve is opened to push the water into the sealed space 99, then the pressure relief valve is opened and the water is pushed out of the sealed space 99 and is discharged from the water outlet 111 of the valve body 11. In this way, the purpose of outputting high-pressure fluid (such as water) is achieved through the reciprocating movement of the piston 13.

[0024] Compared with the prior art, in the electromagnetic shock pump 10 in the embodiments of the present invention, the sealing member 23 is arranged on the piston head 131 and reciprocates with the piston head 131 synchronously in the center hole of the valve body 11, so as to change the volume of the sealed space 99 to a greater extent. When the movement distance of the piston head 131 is shorter, the volume change amount of the sealed space 99 is also relatively large, so that the pressure on the first valve spool 24 of the pressure relief valve and the second valve spool 25 of the water-sucking valve is larger, and it is easier to get rid of the adhesion state, so as to ensure that the electromagnetic shock pump 10 can still enter a normal working state successfully after the long-term transportation, storage and other occasions.

[0025] Compared with the prior art, for the electromagnetic shock pump 10 in the embodiments of the present invention, because the pressure on the the first valve spool 24 of pressure relief valve or the second valve spool 25 of the water-sucking valve are changed by means of the volume change of the substance in the sealed space 99, the first valve spool 24 of pressure relief valve and the second valve spool 25 of the water-sucking valve are not in direct contact, thereby, the positioning requirements of the first valve spool 24 of the pressure relief valve relative to the second valve spool 25 of the water-sucking valve are low, and as a result, the electromagnetic shock pump 10 in the embodiments of the present invention will not undergo failure due to inaccurate positioning of the first valve spool 24 of the pressure relief valve relative to the second valve spool 25 of the water-sucking valve, thereby ensuring effectiveness of the electromagnetic shock pump 10, reducing the maintenance ratio of the electromagnetic shock pump, and significantly saving the cost. A gap is formed between the first valve spool 24 of the pressure relief valve and the second valve spool 25 of the water-sucking valve and the two are not in direct contact all the time, and no friction loss will occur between them, and thus, the service life is prolonged.

[0026] Although the present invention is described with reference to the preferred embodiments, various improvements can be made and equivalent objects can be used for replacing members therein without departing from the scope of the present invention. In particular, the individual technical features mentioned in the individual embodiments can be combined in any manner as long as no structural conflict exists. The present invention is not limited to the specific embodiments disclosed herein, instead, it covers all the technical solutions which fall into the scope defined by the appended claims.

Claims

1. An electromagnetic shock pump, comprising:

a valve body (11), which is provided with a center hole;
 a pressure relief valve, which is provided in the center hole;
 a piston (13), comprising a piston head (131) provided within the center hole, an end of the free end of the piston head (131) is provided with a sealing member (23), wherein the sealing member (23) is pressed against a hole wall of the center hole, and the sealing member (23) is able of moving along an axial direction of the center hole in a synchronized manner with the piston head (131);
 a water-sucking valve, which is provided on the piston head (131), and provided opposite to the pressure relief valve;
 wherein, the pressure relief valve, the valve body (11), the piston head (131), the sealing member (23) and the water-sucking valve form a sealed space;
 wherein, an annular flange (112) is arranged on the inner wall of the center hole, and the pressure relief valve comprises a first valve spool (24) and a spring, the spring is pressed against the first valve spool (24) so as to make the first valve spool (24) move to a position where the first valve spool (24) seats on the annular flange (112).

2. The electromagnetic shock pump of claim 1, wherein, an annular groove extending in the circumferential direction is formed in the peripheral surface of the end of the free end of the piston head (131), and the sealing member (23) is matched with the annular groove.
3. The electromagnetic shock pump of claim 1, wherein, the sealing member (23) comprises an O-shaped sealing ring.
4. The electromagnetic shock pump of claim 1, where-

in, the water-sucking valve comprises a second valve spool (25) arranged on the piston head (131), and the second valve spool (25) of the water-sucking valve is provided opposite to the first valve spool (24) of the pressure relief valve, and a gap is formed between the second valve spool (25) of the water-sucking valve and the first valve spool (24) of the pressure relief valve.

Patentansprüche

1. Elektromagnetische Stoßpumpe, umfassend:

einen Ventilkörper (11), der mit einer Mittenbohrung versehen ist;
 ein Druckbegrenzungsventil, das in der Mittenbohrung vorgesehen ist;
 einen Kolben (13), der einen Kolbenkopf (131) umfasst, der innerhalb der Mittenbohrung vorgesehen ist, ein Ende des freien Endes des Kolbenkopfes (131) mit einem Dichtungselement (23) versehen ist, worin das Dichtungselement (23) gegen eine Bohrungswandung der Mittenbohrung gedrückt wird, und das Dichtungselement (23) sich entlang einer axialen Richtung der Mittenbohrung in einer mit dem Kolbenkopf (131) synchronisierten Weise bewegen kann;
 ein Wassersaugventil, das am Kolbenkopf (131) vorgesehen ist, und das dem Druckbegrenzungsventil gegenüberliegend vorgesehen ist;
 worin das Druckbegrenzungsventil, der Ventilkörper (11), der Kolbenkopf (131), das Dichtungselement (23) und das Wassersaugventil einen abgedichteten Raum bilden;
 worin ein ringförmiger Flansch (112) an der Innenwand der Mittenbohrung angeordnet ist und das Druckbegrenzungsventil einen ersten Ventilschieber (24) und eine Feder umfasst, die Feder gegen den ersten Ventilschieber (24) derart gedrückt ist, dass der erste Ventilschieber (24) zu einer Stellung bewegt wird, wo der erste Ventilschieber (24) auf dem ringförmigen Flansch (112) aufliegt.

2. Elektromagnetische Stoßpumpe nach Anspruch 1, worin eine ringförmige Nut, die sich in der Umfangsrichtung erstreckt, in der Umfangsfläche des Endes des freien Endes des Kolbenkopfes (131) ausgebildet ist und das Dichtungselement (23) zur ringförmigen Nut passt.
3. Elektromagnetische Stoßpumpe nach Anspruch 1, worin das Dichtungselement (23) einen O-förmigen Dichtungsring umfasst.
4. Elektromagnetische Stoßpumpe nach Anspruch 1, worin das Wassersaugventil einen zweiten Ventil-

schieber (25) umfasst, der am Kolbenkopf (131) angeordnet ist, und der zweite Ventilschieber (25) des Wasserausgussventils dem ersten Ventilschieber (24) des Druckbegrenzungsventils gegenüberliegend vorgesehen ist, und ein Spalt zwischen dem zweiten Ventilschieber (25) des Wasserausgussventils und dem ersten Ventilschieber (24) des Druckbegrenzungsventils ausgebildet ist.

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un deuxième tiroir (25) de la soupape disposé sur la tête (131) du piston, et le deuxième tiroir (25) de la soupape de la soupape d'aspiration d'eau est fourni opposé au premier tiroir (24) de la soupape de la soupape de surpression, et un vide est formé entre le deuxième tiroir (25) de la soupape de la soupape d'aspiration d'eau et le premier tiroir (24) de la soupape de la soupape de surpression.

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Revendications

1. Pompe à choc électromagnétique, comprenant :

un corps (11) de la soupape, qui est pourvu d'un trou central ; 15
 une soupape de surpression, qui est fournie dans le trou central ;
 un piston (13), comprenant une tête (131) du piston fournie à l'intérieur du trou central, une extrémité de l'extrémité libre de la tête (131) du piston est pourvue d'un élément d'étanchéité (23), où l'élément d'étanchéité (23) est pressé contre une paroi du trou du trou central, et l'élément d'étanchéité (23) est capable de se déplacer le long d'une direction axiale du trou central d'une manière synchronisée avec la tête (131) du piston ; 20
 une soupape d'aspiration d'eau, qui est fournie sur la tête (131) du piston, et fournie opposée à la soupape de surpression ; 25
 où, la soupape de surpression, le corps (11) de la soupape, la tête (131) du piston, l'élément d'étanchéité (23) et la soupape d'aspiration d'eau forment un espace étanche ; 30
 où, une bride annulaire (112) est disposée sur la paroi intérieure du trou central, et la soupape de surpression comprend un premier tiroir (24) de la soupape et un ressort, le ressort étant pressé contre le premier tiroir (24) de la soupape de manière à déplacer le premier tiroir (24) de la soupape dans une position où le premier tiroir (24) de la soupape repose sur la bride annulaire (112). 35
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2. Pompe à choc électromagnétique selon la revendication 1, où, une rainure annulaire s'étendant dans la direction circonférentielle est formée dans la surface périphérique de l'extrémité de l'extrémité libre de la tête (131) du piston, et l'élément d'étanchéité (23) est adapté avec la rainure annulaire. 50

3. Pompe à choc électromagnétique selon la revendication 1, où, l'élément d'étanchéité (23) comprend une bague d'étanchéité en forme de O. 55

4. Pompe à choc électromagnétique selon la revendication 1, où, la soupape d'aspiration d'eau comprend

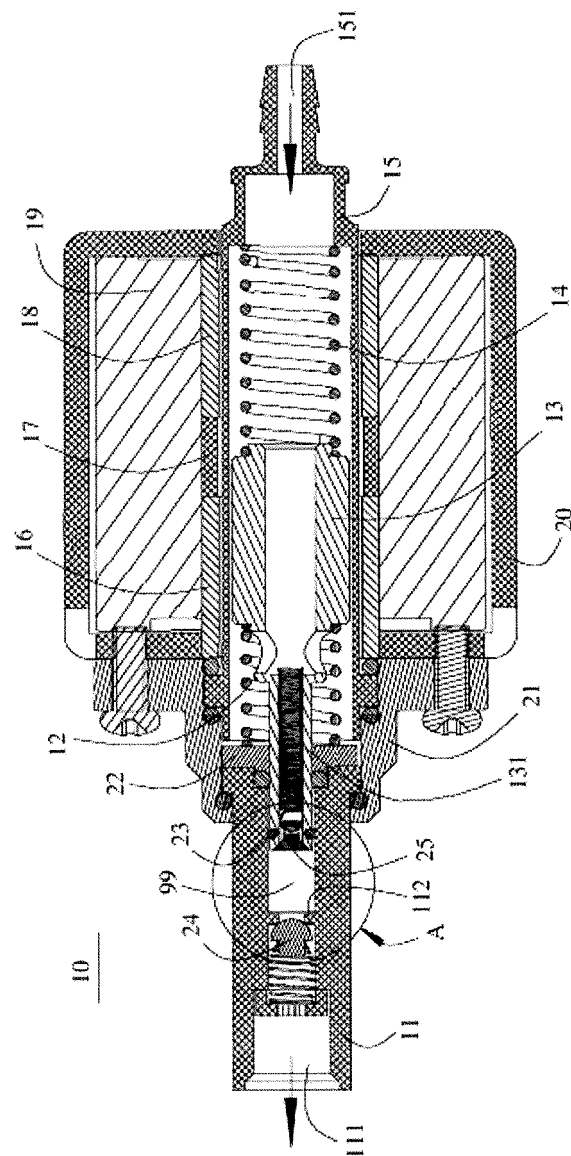


Fig. 1

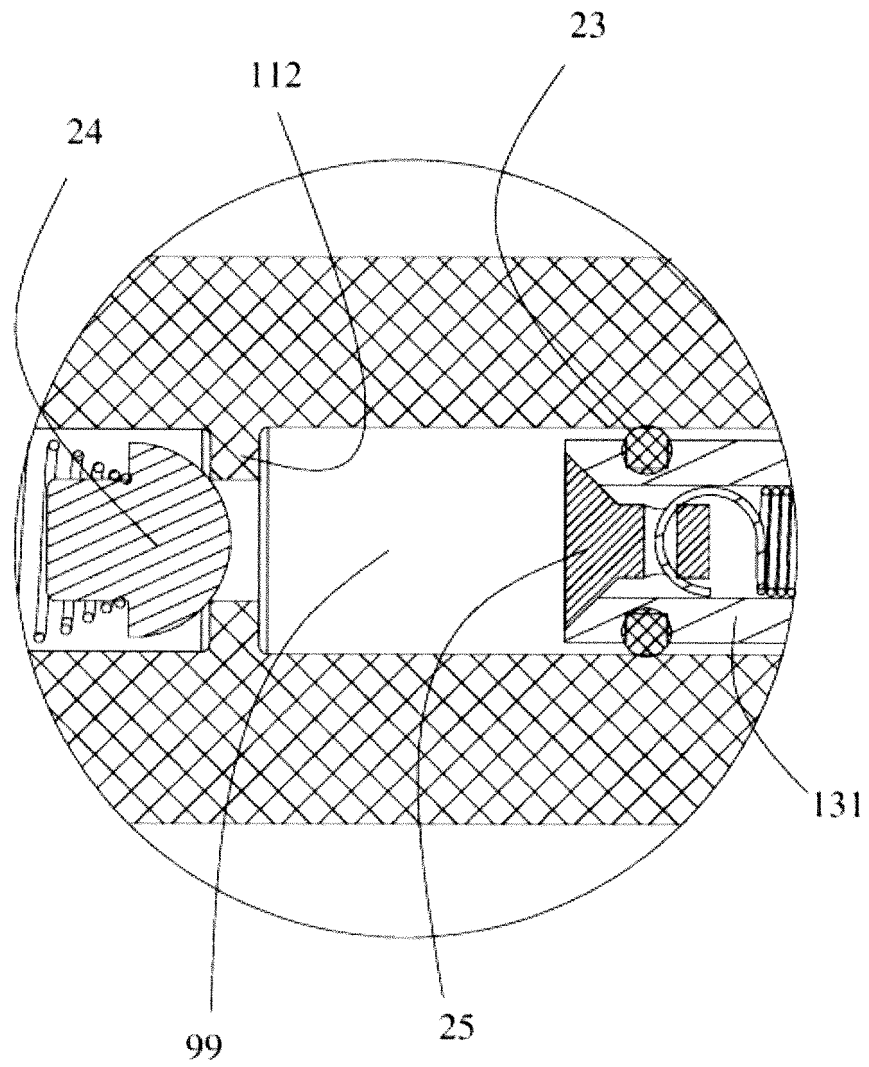


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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