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(54) **Pumping unit for feeding oil under pressure to a user**

Pumpeinheit für die Zuführung von Drucköl zu einem Benutzer

Unité de pompage pour alimentation d'huile sous pression vers un utilisateur

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Description

[0001] The present invention relates to a pumping unit for feeding oil under pressure to a user.

[0002] Document US 3 496 879 is considered to represent the closest prior art.

[0003] In particular, the present invention relates to a pumping unit of the type comprising a volumetric pump, preferably a gear pump, having at least one inlet to draw the oil into the pump and at least one outlet to deliver the oil to the user; and a gas accumulator comprising a cylinder and a piston, which is slidingly engaged in the cylinder, and within the cylinder itself, defines a first chamber containing a gas under pressure and a second chamber hydraulically connected to the delivery outlet of the pump by means of a hydraulic duct.

[0004] Feeding the oil under pressure into the second chamber implies the displacement of the piston and the compression of the gas contained in the first chamber, and allows the gas accumulator to accumulate potential energy which will then be returned in the phases of maximum absorption of the user.

[0005] The pump generally comprises a pump body; a pair of closing lids mounted at the ends of the pump body orthogonally to a longitudinal axis thereof; and a plurality of locking screws distributed around the axis to lock the two lids against the pump body.

[0006] The known pumping units of the above-described type have several drawbacks, mainly deriving from that these pumping units are relatively cumbersome and expensive due to the presence of the locking screws and of two distinct devices, that is the gas accumulator and the pump, and for each locking screw, entail a hole through each of the two lids and a further hole through the pump body to be made.

[0007] It is an object of the present invention to provide a pumping unit for feeding oil under pressure to a user which is free from the above-described drawbacks, and simple and cost-effective to be implemented.

[0008] According to the present invention, there is provided a pumping unit for feeding oil under pressure to a user as claimed in the appended claims.

[0009] The present invention will now be described with reference to the accompanying drawings, which illustrate a non-limiting embodiment thereof by way of example, in which:

figure 1 is an exploded perspective view of a preferred embodiment of the pumping unit according to the present invention;
figure 2 is a longitudinal section of the pumping unit in figure 1; and
figure 3 schematically illustrates a hydraulic circuit provided with the pumping unit in figures 1 and 2.

[0010] With reference to figures 1, 2 and 3, numeral 1 indicates as a whole a pumping unit for feeding oil under pressure from a containment tank 2 at atmospheric pressure to a user 3 comprising, in this case, a cylinder 4 and a piston 5, which is movable within cylinder 4, and defines two chambers 6, 7 within cylinder 4.

[0011] Pumping unit 1, tank 2, and user 3 define part of a hydraulic circuit 8 further comprising an over-pressure valve 9, which is mounted between pumping unit 1 and user 3, and is shaped to open when the pressure value of the oil fed to user 3 is substantially equal to a predetermined threshold value, and a solenoid valve 10 movable between a closed position of circuit 8 (figure 3), a first operative position (not shown), in which solenoid valve 10 is arranged so as to allow the pumping unit 1 to feed oil under pressure into chamber 6, and chamber 7 to discharge oil under pressure into tank 2, and a second operative position (not shown), in which solenoid valve 10 is arranged so as to allow the pumping unit 1 to feed oil under pressure into chamber 7, and chamber 6 to discharge oil under pressure into tank 2.

[0012] Pumping unit 1 is provided with a gas accumulator 11 comprising a cylinder 12, which has a longitudinal axis 13, and comprises in turn a bell-shaped housing 14, which is coaxial to axis 13, is closed at a first end thereof by a bottom wall 15 substantially perpendicular to axis 13, and is closed at a second end thereof by a substantially cylindrical plate 16 arranged perpendicularly to axis 13.

[0013] Accumulator 11 further comprises a piston 17, which is mounted within cylinder 12 coaxially to axis 13, is cup shaped with the concavity facing plate 16, is slidingly coupled to housing 14, and is further fluid-tightly coupled with cylinder 12, by interposing an annular gasket 18 mounted to piston 17 coaxially to axis 13.

[0014] Within cylinder 12, piston 17 defines a first chamber 19 which is axially closed by wall 15 and contains a gas under pressure therein, e.g. nitrogen, and a second chamber 20 which is axially closed by plate 16 and hydraulically communicates with user 3 through a delivery hole 21 obtained in plate 16.

[0015] Plate 16 is fluid-tightly coupled with housing 14 by interposing an annular gasket 22 mounted to plate 16 coaxially to axis 13, is slidingly coupled to housing 14, and is held within cylinder 12 by a stop ring 23 mounted within housing 14 coaxially to axis 13 and on the opposite side of piston 17 with respect to plate 16.

[0016] Pumping unit 1 further comprises a volumetric pump 24, in this case a gear pump, which is housed within chamber 20, and comprises in turn a pump body 25, which is axially closed on one side by plate 16 and on the other side by a substantially cylindrical lid 26 arranged perpendicularly to axis 13, and is mounted to plate 16 by means of two centring pins (not shown) engaged in respective holes 27 obtained in the plate 16 itself, parallel to axis 13.

[0017] Pump body 25 hydraulically communicates with tank 2 through a suction hole 28 obtained through plate 16, and hydraulically communicates with chamber 20 through a delivery hole 29 which is obtained, in this case, through lid 26, and cooperates with a check valve 30

(figure 3) adapted to prevent the oil under pressure from returning into the pump body 25.

[0018] Pump 24 further comprises an inlet shaft 31, which has a longitudinal axis 32 parallel to axis 13, and extends through plate 16; and a waved spring 33, which is substantially U-shaped, extends about lid 26, and is secured to the lid 26 itself.

[0019] When pump 24 is off, piston 17 is displaced, and normally held, by the gas under pressure contained in chamber 19 in a locking position (figure 2), in which piston 17 is arranged in contact with a stop ring 34 mounted between plate 16 and piston 17, coaxially to axis 13, and is further arranged in contact with lid 26 by interposing spring 33 to lock pump body 25 and lid 26 against plate 16.

[0020] Upon activating pump 24 and closing solenoid valve 10, chamber 20 is filled with the oil under pressure fed through the delivery hole 29. When the pressure of the oil contained in chamber 20 is higher than the pressure of the gas contained in chamber 19, piston 17 is displaced towards wall 15 from its locking position, so as to reduce the volume of chamber 19, compress the gas contained in chamber 19, and allow accumulator 11 to accumulate potential energy which will then be returned to the hydraulic circuit 8 in the maximum absorption phases of user 3.

[0021] Since the cross-section available to the oil within pump body 25 is smaller than the surface of lid 26, the force exerted on lid 26 by the oil contained in chamber 20 is greater than the force exerted on lid 26 by the oil contained in pump body 25, and therefore it ensures pump body 25 and lid 26 to be locked against plate 16.

[0022] From the above description, pump 24 is hydraulically connected in series with chamber 20 and user 3, and assembling pump 24 within chamber 20 allows:

- a pumping unit 1 which is relatively simple, compact and cost-effective to be implemented;
- pump body 25 and lid 26 to be simply locked against plate 16 by means of piston 17 when pump 24 is off and by means of the oil under pressure fed into chamber 20 when pump 24 is on; and
- using locking screws and making corresponding holes through plate 16, pump body 25, and lid 26 to be avoided, with the consequent reduction of friction inside pump 24 and the performance increase of pump 24.

[0023] Furthermore, the combination of oil under pressure within chamber 20 and gas under pressure within chamber 19 increases the capacity of pumping unit 1 to reduce both the pressure pulsations along the hydraulic circuit 8 and the irregularities in the flow of oil under pressure fed to user 3.

Claims

1. A pumping unit for feeding oil under pressure to a user (3), the pumping unit comprising a pump (24) having at least one suction inlet (28) for the oil into the pump (24) and at least one delivery outlet (29) for the oil to the user (3); and a gas accumulator (11) comprising a cylinder (12) and a piston (17), which is slidingly engaged in the cylinder (12), and defines within the cylinder (12) a first chamber (19) containing a gas under pressure and a second chamber (20) hydraulically connected with the delivery outlet (29) of the pump (24); and being **characterised in that** the pump (24) is housed within the second chamber (20); the pump (24), the second chamber (20), and the user (3) being hydraulically connected in series to one another.

2. Pumping unit according to claim 1, wherein the cylinder (12) comprises a closing header (16) of the second chamber (20); the pump (24) comprising a pump body (25) arranged between the header (16) and a closing lid (26) of the pump body (25).

3. Pumping unit according to claim 2, wherein the cylinder (12) further comprises stop means (34) adapted to stop the piston (17) in a locking position of the lid (26) and of the body pump (25) against the header (16).

4. Pumping unit according to claim 3, wherein the pump (24) further comprises a waved spring (33) mounted on the lid (26); the piston (17) being arranged in contact with the lid (26) with the interposition of the waved spring (33) upon its displacement in said locking position.

5. Pumping unit according to any of claims 2 to 4, wherein each suction inlet (28) is obtained through the header (16).

6. Pumping unit according to any of claims 2 to 5, wherein the gas accumulator (11) comprises a further delivery outlet (21), which is hydraulically connected with the user (3), and is provided through the cylinder (12) at the second chamber (20).

7. Pumping unit according to any of claims 2 to 6, wherein the pump (24) has an inlet shaft (31) extending through said header (16).

8. Pumping unit according to any of the preceding claims and further comprising a check valve (30) arranged at said delivery outlet (29).

Patentansprüche

1. Pumpeinheit zum Zuführen von Drucköl zu einem Benutzer (3), mit einer Pumpe (24), die wenigstens einen Saugeinlass (28) für das Öl zur Pumpe (24) und wenigstens einen Abgabeauslass (29) für das Öl zum Benutzer (3); einen Gassammler (11), der einen Zylinder (12) und einen Koben (17) umfasst, der im Zylinder (12) gleitbar ist und innerhalb des Zylinders (12) eine erste Kammer (19) bildet, enthaltend unter Druck stehendes Gas, sowie eine zweite Kammer (20), die hydraulisch an den Abgabeauslass (29) der Pumpe (24) angeschlossen ist, **dadurch gekennzeichnet, dass** die Pumpe (24) innerhalb der zweiten Kammer (20) angeordnet ist, und dass Pumpe (24), zweite Kammer (20) und Benutzer (3) hydraulisch in Reihe geschaltet sind.

2. Pumpeinheit nach Anspruch 1, wobei Zylinder (12) einen Schließkopf (16) der zweiten Kammer (20) umfasst, und dass die Pumpe (24) einen Pumpenkörper (25) umfasst, angeordnet zwischen dem Schließkopf (16) und einem Verschlussdeckel (26) des Pumpenkörpers (25).

3. Pumpeinheit nach Anspruch 2, wobei der Zylinder (12) ferner einen Anschlag (34) umfasst, an dem der Kolben (16) in einer Verriegelungsposition des Verschlussdeckels (26) des Pumpenkörpers (25) am Schließkopf (16) anschlägt.

4. Pumpeinheit nach Anspruch 3, wobei die Pumpe (24) weiterhin eine Wellenfeder (33) umfasst, und wobei der Kolben (17) unter Zwischenschaltung der Wellenfeder (33) mit dem Verschlussdeckel (26) bei dessen Verschiebung in die Verriegelungsposition in Kontakt gelangt.

5. Pumpeinheit nach einem der Ansprüche 2 bis 4, wobei jeder Saugeinlass (28) aus dem den Schließkopf (16) gebildet ist.

6. Pumpeinheit nach einem der Ansprüche 2 bis 5, wobei der Gassammler (11) einen weiteren Abgabeauslass (21) aufweist, der hydraulisch an den Benutzer (3) angeschlossen und durch den Zylinder (12) an der zweiten Kammer (20) vorgesehen ist.

7. Pumpeinheit nach einem der Ansprüche 2 bis 6, wobei die Pumpe (24) einen Einlassstutzen (31) aufweist, der sich durch den Schließkopf (16) hindurch erstreckt.

8. Pumpeinheit nach einem der vorausgegangenen Ansprüche, weiterhin umfassend ein Rückschlagventil (30) am Abgabeauslass (29).

Revendications

1. Unité de pompage permettant de fournir de l'huile sous pression à un utilisateur (3), l'unité de pompage comprenant une pompe (24) ayant au moins un orifice d'admission d'aspiration (28) pour l'huile dans la pompe (24) et au moins un orifice de refoulement de distribution (29) pour l'huile à l'utilisateur (3) ; et un accumulateur de gaz (11) comprenant un cylindre (12) et un piston (17), qui est enclenché en coulissement dans le cylindre (12), et définit au sein du cylindre (12) une première chambre (19) contenant un gaz sous pression et une seconde chambre (20) reliée hydrauliquement à l'orifice de refoulement de distribution (29) de la pompe (24) ; et **caractérisée en ce que** la pompe (24) est logée au sein de la seconde chambre (20) ; la pompe (24), la seconde chambre (20), et l'utilisateur (3) étant reliés hydrauliquement en série les uns aux autres.

2. Unité de pompage selon la revendication 1, dans laquelle le cylindre (12) comprend un collecteur de fermeture (16) de la seconde chambre (20) ; la pompe (24) comprenant un corps de pompe (25) agencé entre le collecteur (16) et un couvercle de fermeture (26) du corps de pompe (25).

3. Unité de pompage selon la revendication 2, dans laquelle le cylindre (12) comprend en outre un moyen d'arrêt (34) adapté pour arrêter le piston (17) en une position de blocage du couvercle (26) et du corps de pompe (25) contre le collecteur (16).

4. Unité de pompage selon la revendication 3, dans laquelle la pompe (24) comprend en outre un ressort ondulé (33) monté sur le couvercle (26) ; le piston (17) étant agencé en contact avec le couvercle (26) avec l'interposition du ressort ondulé (33) lors de son déplacement dans ladite position de blocage.

5. Unité de pompage selon l'une quelconque des revendications 2 à 4, dans laquelle chaque orifice d'admission d'aspiration (28) est obtenu à travers le collecteur (16).

6. Unité de pompage selon l'une quelconque des revendications 2 à 5, dans laquelle l'accumulateur de gaz (11) comprend un orifice de refoulement de distribution supplémentaire (21), qui est relié hydrauliquement à l'utilisateur (3), et est disposé à travers le cylindre (12) au niveau de la seconde chambre (20).

7. Unité de pompage selon l'une quelconque des revendications 2 à 6, dans laquelle la pompe (24) comporte un arbre d'admission (31) s'étendant à travers ledit collecteur (16).

8. Unité de pompage selon l'une quelconque des revendications précédentes, et comprenant en outre un clapet de non-retour (30) agencé au niveau dudit orifice de refoulement de distribution (29).

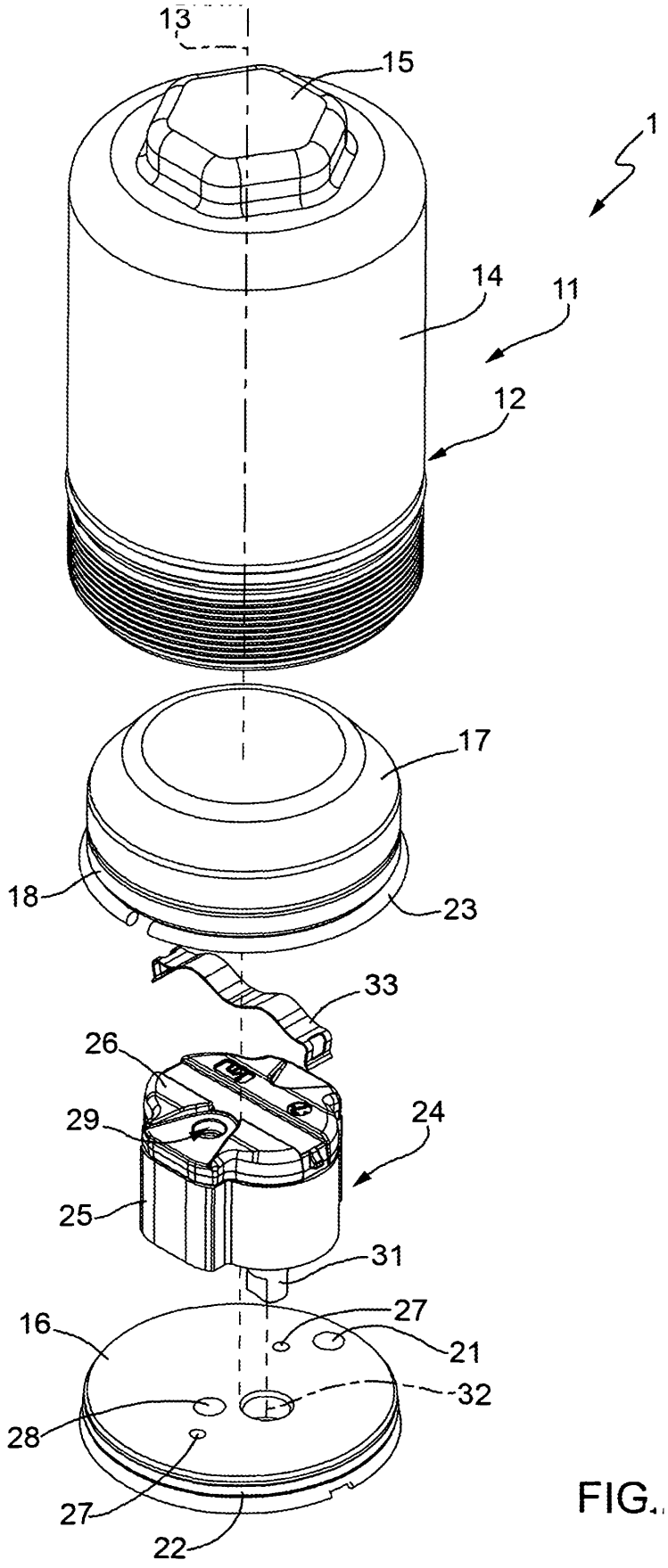


FIG. 1

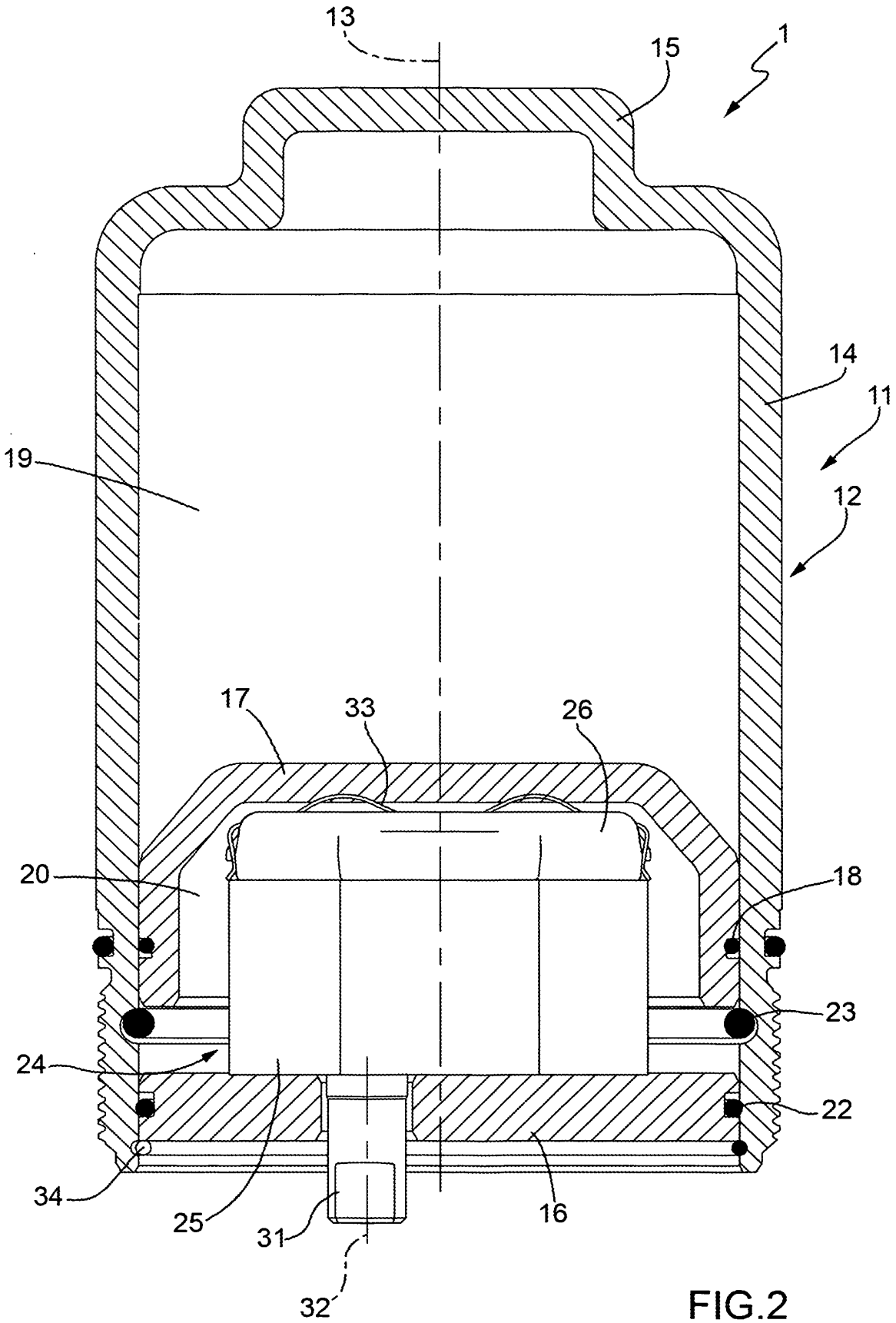


FIG.2

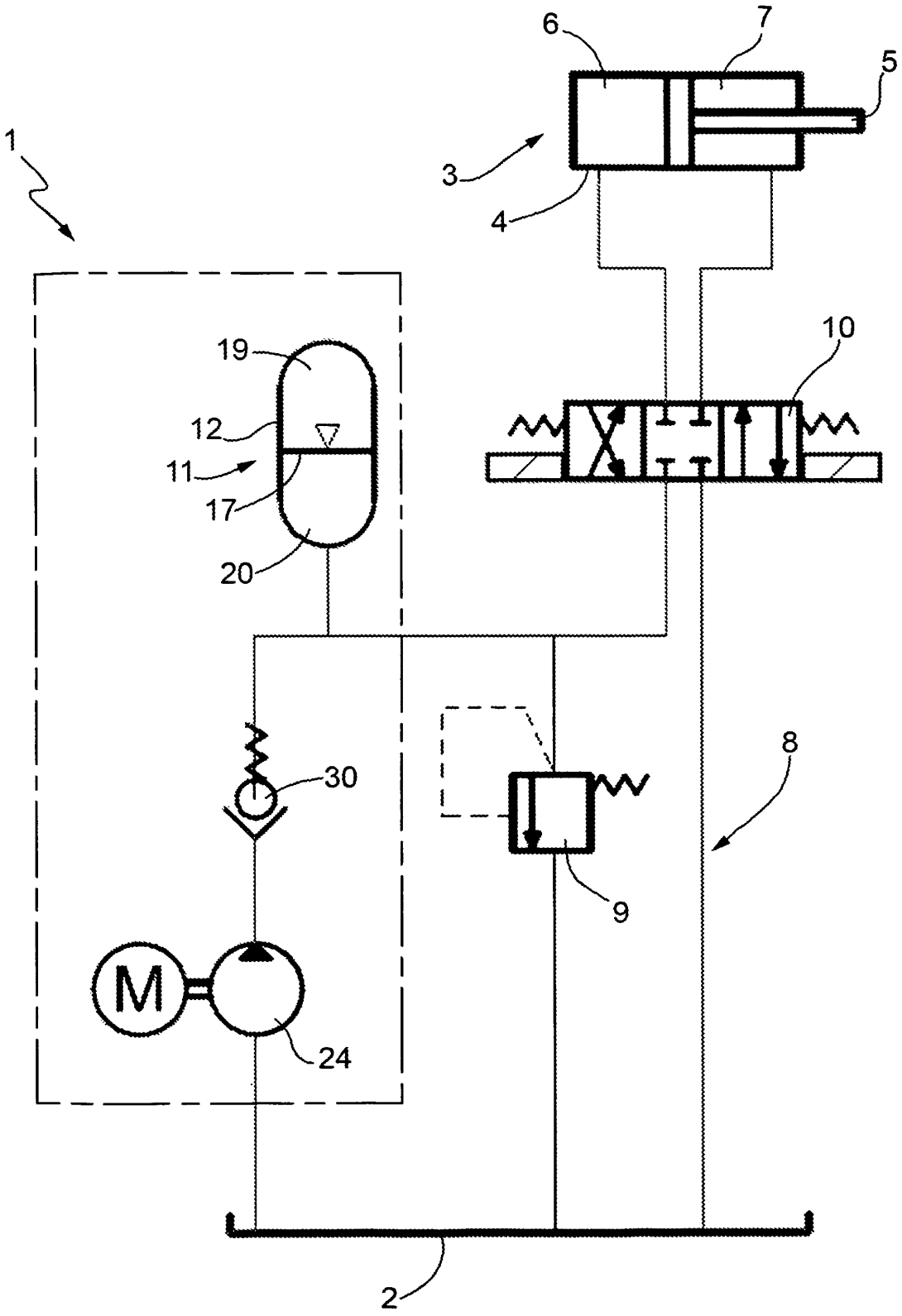


FIG.3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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