(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
13 August 2020 (13.08.2020)

WIPO | PCT

(10) International Publication Number
WO 2020/162787 A1

(51) International Patent Classification:
E03B 11/00 (2006.01) *F15B 1/02* (2006.01)

(21) International Application Number:
PCT/RU2019/000957

(22) International Filing Date:
17 December 2019 (17.12.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2019103564 08 February 2019 (08.02.2019) RU

(72) Inventor; and

(71) Applicant: **YAZYKOV, Andrey Yurievich** [RU/RU]; Chobotovskay 5-ya alley, 24, Moscow, 119619 (RU).

(74) Agent: **PROZOROVSKIY, Alexander Yurjevich** et al.; ul. Nizhnaya Krasnoselskaya, 13, a/ya 265, Moscow, 107078 (RU).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, Cl, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

WO 2020/162787 A1

(54) Title: WELL-WATER SUPPLY DEVICE

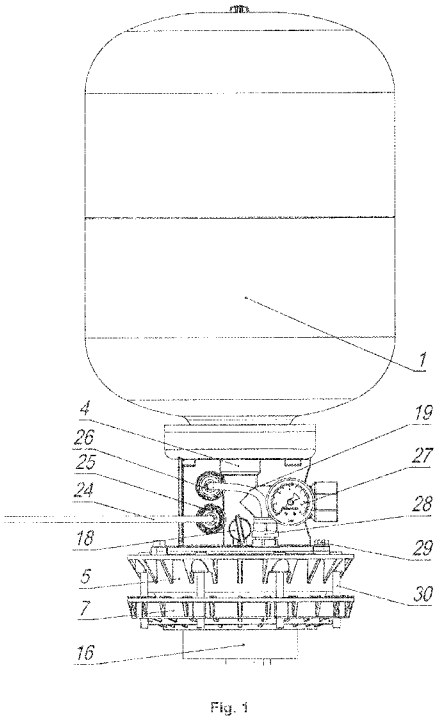

Fig. 1

(57) Abstract: The well-water supply device contains a base (5), an elastic sealing ring (6) of elastic material and a clamping flange (7), tightened by connecting elements (30), for the installation on the casing pipe (16) of the well, a hydraulic accumulator (1) with a housing and a working chamber, with a connecting fitting on the inlet (48), and a manifold (4), made with two oppositely located connecting parts with an end-to-end internal channel (40) and an outlet internal channel (41), moreover, the latter is made with the possibility of connection to the major pipeline of the water supply consumer on the one side, and is connected to the said end-to-end internal channel (40), connected through the connecting fitting (48) with the working chamber of the hydraulic accumulator (1) on the other side. The manifold (4) is supplied with a plug (18) to drain the water from the device, one connecting part (3) of the manifold (4) is used to rigidly fix it to the housing of the hydraulic accumulator (1), while the other connecting part (32) is used to rigidly fix it to the base (5). It has a compression fitting (9, 10, 11, 12) for connection of the end-to-end internal channel (40) to the pressure pipe (17) of the submersible pump of the well. The clamping flange (7) is designed to be installed around the casing pipe (16,) while the base (5) - at the end of the casing pipe (16) of the well. The manifold (4) is fixed by a connecting part made in the form of an annular belt (32) in a cylindrical bore made on the base (5), while by another connecting part made in the form of an annular recess to the flange on the hydraulic accumulator (1) housing. The technical result is to reduce the size and weight by reducing the length of major pipelines (there is no special major pipeline between the well and the hydraulic accumulator).

Well-water supply device

Field of the invention

The invention relates to the field of hydraulic automation and water supply systems, it can be used to store water for automatic potable and technical water supply of one private house or a group of private houses, mainly from an individual well.

Prior art

There is a water supply device comprising a vertically oriented hydraulic accumulator, inlet and outlet fittings and a filter connected to the hydraulic accumulator with a replaceable cartridge placed in the housing, while the hydraulic accumulator is suspended and provided with a flanged manifold fixed in its lower part for attachment to the hydraulic accumulator. The specified manifold is designed with channels connected to the inlet and outlet fittings, as well as holes for attaching control and adjustment equipment, while the filter housing is mounted on the thread of the manifold. The hydraulic accumulator is made of metal, in the form of cylinder with rounded edges and is equipped with a bracket for hanging to the support and a worm drive clamp for adjusting the position of the bracket on the hydraulic accumulator. The control and adjustment equipment of the manifold is made in the form of a pressure gauge and a pressure relay connected to the channels of the manifold with the possibility of rearrangement and connection to any of the fittings. The manifold is provided with a check valve installed in front of the inlet fitting and a tap installed in front of the outlet fitting (RU 152938).

There is also a supply device containing a hydraulic accumulator, a base with a distribution manifold designed with longitudinal and transverse channels, input and output pipes and a filter with a replaceable cartridge connected to the base and placed in a flask, while the hydraulic accumulator is equipped with a threaded connecting fitting made with a hole to connect the hydraulic accumulator through a connecting channel of the base with the filter and through a longitudinal channel of the manifold with the output pipe. The base is designed with a support plane and is provided with a threaded element for installing a hydraulic accumulator fitting, wherein longitudinal channels of the distribution manifold are connected at opposite

ends to the inlet and outlet pipes, while the filter flask is mounted on the base by means of a threaded connection. The hydraulic accumulator is designed to be disassembled from the base by the thread of the fitting. The device is equipped with a pointer to replace the filter cartridge fixed on the base. The manifold is equipped with control and adjustment equipment, made in the form of a pressure relay and a pressure gauge connected to the manifold channels with the possibility of rearrangement and connection to any of the pipes. The manifold is equipped with a check valve installed in front of the inlet pipe and a ball valve installed in front of the outlet pipe (RU 184169, prototype).

Disadvantages of the specified devices include the inability to be mounted directly on the well, necessity for the availability and use of support building structures for mounting the accumulator, risk of vibrations in the section of the main pipeline between the well and the device, which can cause vibrations in the hydraulic accumulator, possibility of flooding of the surrounding area in emergency situations because there is no water drain from the accumulator and pipeline directly into the well, as well as large size and complexity of the network of main pipelines between the well and consumers.

Summary of the Inventions

The technical issue, which is solved by the claimed technical solution, is the creation of an effective well-water supply device and expansion of the arsenal of water supply devices suitable for the installation directly on the casing pipe of the well.

The technical result ensuring the settlement of this issue includes the reduction in the size and weight by reducing the length of major pipelines (there is no special major pipeline between the well and hydraulic accumulator). Due to the design to be based directly on the massive casing pipe the possibility of vibration of the device decreases, which positively affects stability of the hydraulic accumulator, as well as durability and reliability of the whole device. By optimizing the composition of structural components and their connections for the installation directly on the well simultaneously with the installation of a submersible pump in the well and sealing the casing pipe, the need for the presence and use of support structures for the installation of the hydraulic accumulator is eliminated, providing the possibility of

draining water directly from the water supply device into the well, if necessary. In this case, the device has all necessary functions to control the automatic operation of the pump, accumulate water volume, control pressure, drain water from the hydraulic accumulator and major pipeline into the well, arrange caissons and pits.

Short description of drawings

The drawing in Fig.l shows the water supply device, front view, in Fig.2 - a cross-section of Fig. 2 through the pressure relay, in Fig.3 - a cross-section of Fig. 2 through the connection channel to the consumer major pipeline, in Fig.4 - a general view with the pressure relay cover removed, in Fig.5 - three kinds of sequential assembly of the water supply device, in Fig.6 - base manifold of the water supply device.

Detailed Description of the Invention

. The well-water supply device comprises a base 5, a rubber sealing ring 6 of elastic material and a clamping flange 7, tightened by connecting elements (screws) 30 for the installation on a casing pipe 16 of the well, a hydraulic accumulator 1 with a housing and a working chamber, with a connecting fitting 48 at the inlet of the working chamber.

The device also comprises a basic distribution manifold 4, made with two oppositely arranged connecting parts, with an end-to-end internal channel 40 and an outlet internal channel 41.

The channel 4 1 is made with the possibility of connection to the major pipeline of the water supply consumer on the one side, and is connected to the said end-to-end internal channel 40, connected through the connecting fitting 48 with the working chamber of the hydraulic accumulator 1, on the other side.

The manifold 4 is provided with water drain means 18, one connecting part 3 of the manifold 4 is used to rigidly fix it to the housing of the hydraulic accumulator 1, while the other connecting part 32 is used to rigidly fix it to the base 5. It is also equipped with a compression fitting (9,10,1 1,12) to connect the end-to-end inner channel 40 to the pressure pipe 17 of the submersible pump of the well.

The clamping flange 7 is designed to be installed around the casing pipe 16 of the well, while the base 5 - at the end of the casing pipe 16 of the well.

Water draining means is made in the form of a drain plug 18, installed with the possibility of draining end-to-end internal channels 40, 41 from the working chamber of the hydraulic accumulator 1 and from the major pipeline of the water supply consumer directly into the well.

The manifold 4 is fixed by a connecting part made in the form of an annular belt 32 in a cylindrical bore made on the base 5.

The manifold 4 is fixed by a connecting part made in the form of an annular recess to the flange 3 of the hydraulic accumulator 1.

The manifold 4 is made with a threaded part of the compression fitting including a collet 10, a pressure ring 12, a sealing ring 9 and a nut 11 for screwing onto the threaded part of the fitting and crimping the collet 10 with a pressure ring 12 and a sealing ring 9.

The water supply device is provided with a pressure relay 22 fixed to the manifold 4, connected to the end-to-end internal channel 41 and made with the possibility of generating signals for switching on and off the submersible pump at a given pressure decrease and increase, respectively, in the consumer major pipeline.

The water supply device is equipped with a pressure gauge 27 mounted on the manifold 4 for visual pressure monitoring.

The manifold 4 is made with a pad eye for attaching the safety hook 8 of a cable from the casing pipe 16.

Thus, the base part of the device consists of a base 5 mounted on the end of the casing pipe 16 of the well, a pressure flange 7, a sealing elastic ring 6. The base part is fixed to the casing pipe 16 by screws 30 of the elastic ring 6. The base 5 has a hole with rounded edges for safe lowering of the pump and a cylindrical surface for sealing the manifold 4 with an elastic ring 35.

The manifold 4 is installed on the base 5, fixed from rotation on the base 5 with bolts 29. The manifold 4 contains a compression fitting for connection to the pressure pipe 17 coming from the submersible pump. The fitting consists of a nut 11 screwed onto the threaded part of the manifold 4, a collet 10, a pressure ring 12 and a sealing ring 9. The manifold 4 has an end-to-end channel 40 for water being coaxial with the pressure pipe 17, a channel 42 for supplying water to the pressure relay 22 and an outlet channel 41. The channel 40 ends with a threaded fitting 44 for the

connection by a connecting fitting (48) of the working chamber of the hydraulic accumulator 1.

The channel 41 ends with an output threaded fitting 43 with the possibility of connection to the major pipeline of the water supply consumer. The channel 42 ends with a threaded fitting 45 for connecting the pressure relay 22. The compartment for the pressure relay 22 is sealed with a ring 31, covered with a cover 21, which is fastened with screws 23.

The manifold has a threaded hole 36 for fixing the sealed lead-in 25, a threaded hole 37 for fixing the sealed lead-in 26, a threaded hole 38 for fixing the sealed lead-in 28, a threaded hole 39 for the plug 18 on the manifold 4, an external thread 50 is made for fixing the cap nut 20 of the pressure gauge 27.

The corresponding threaded holes of the manifold 4 have (pressed) sealed lead-ins 25, 26 and 28 for the input of the electric cable 24 from the supply network to the pressure relay 22 and cable 19 going from the pressure relay 22 to the submersible pump. The manifold 4 also has a pad eye for fixing the safety hook 8 of a cable, which serves to hang the submersible pump. During casting, nuts 47 are melted into the manifold 4 to install eye bolts upon the need for using with lifting equipment.

A pressure gauge 27 is installed on the manifold 4, connected to the channel 41 to indicate pressure in the system. The pressure gauge is fixed with a cap nut 20.

The plug 18 is sealed along the step boring in the manifold 4 by elastic rings 33 and 34. When unscrewing the plug 18 from the manifold 4 to the control mark on the plug 18, the channel 40 is connected to the drain channel 46 of the manifold 4 and water is drained from the hydraulic accumulator 1 and major pipelines connected by channels 40, 41 to the manifold 4 into the well (casing pipe 16).

The hydraulic accumulator 1 consists of a housing with a working chamber, a membrane 2, an air valve 15, a counter-flange 14 and a flange 3 with a threaded connection fitting 48.

The installation of the device at the place of operation is carried out in the following sequence.

A flange 7 and an elastic ring 6 are installed around the casing pipe 16 and a base 5 is located at the end of the casing pipe. When screwing the screws 30, the

elastic ring 6 is compressed, decreasing in radial dimensions, thereby fixing details of the base part 5,6,7 of the device on the casing pipe 16 by crimping.

The pressure pipe 17 of the pump is attached to the compression fitting by means of a nut 11, which is screwed onto the threaded part of the manifold 4, compressing the collet 10, a pressure ring 12 and sealing ring 9. The power cable 19 of the submersible pump passes through the cable sealed lead-ins 28, 26 and is connected to the output of the pressure relay 22. The cable 24 goes through the sealed lead-in 25 that provides power to the input of the pressure relay 22. The cable for the suspension of the pump (not shown) is attached to the safety hook 8.

The manifold 4 is inserted in the outer support surface 32 into the cylindrical bore of the base 5, while the joint of the manifold 4 and the base 5 is sealed with an elastic ring and fixed with bolts 29.

The hydraulic accumulator 1 is installed on the manifold 4 fixed to the base 5, with the threaded fitting 48 screwed into the threaded fitting 44 of the manifold 4. In this case, the threaded fitting 48 of the hydraulic accumulator 1 is sealed in the manifold 4 with an elastic ring 13.

The major pipeline of the consumer and elements of the water supply system are mounted to the outlet fitting 43 of the device, depending on the tasks.

The device allows compactly equipping wellheads, caissons and pits, and solving the problem of optimal composition and integration of structural elements connected to each other as a part of this device by assembly operations, providing structural unity and implementation of the device of the general functional purpose (functional unity), necessary for the organization of water supply to the consumer directly from the well, in one industrial product. The supply device is implemented in a constructive union of parts of the device with the manifold 4, characterized by the presence and interrelated functional and relative position, such as:

• The base part 5,6,7 for sealing the casing pipe 16 of the well and coupling with the manifold 4 with simultaneous introduction of the pressure major pipeline 17 into it and its direct connection in the manifold 4 by means of the channel 40 with the volume of the hydraulic accumulator 1 and, by means of the channel 41, with the major pipeline of the consumer;

• The hydraulic accumulator 1 for constant duty as a part of the water supply device to create and maintain the volume of water directly from the well, maintain necessary pressure in the consumer major pipeline, as well as damp water hammers in the pressure pipeline 17 and in the consumer major pipeline;

• The plug (drain valve) 18 for draining water, if necessary, from all ground-based equipment, combined by the manifold 4, directly into the well;

• The pressure relay 22 for continuous monitoring of the water pressure supplied to the major pipeline of the consumer, automation of the submersible pump;

• The pressure gauge 27 for additional visual monitoring of pressure in the channels 40, 41 and pressure pipeline 17 for operational monitoring of the condition and evaluation of the water supply device as a whole.

The well-water supply device works as follows.

The device is operated in conjunction with a submersible pump and a check valve mounted on the pressure pipe 17 (not shown). The included submersible pump delivers water through the pressure pipe 17 to the channels 40, 41 of the manifold 4, providing the filling of the hydraulic accumulator 1 and water supply to the consumer (consumers). In the absence of pressure in the major pipeline, the pressure relay 22 supplies power to the submersible pump, which provides necessary flow-pressure characteristic depending on the configuration of the consumer. When the use of water is stopped (for example, closing the taps by the consumer), a pressure in the system, which corresponds to the pressure of switching off the pressure relay 22, is reached. The volume of water is created in the hydraulic accumulator 1, under the pressure equal in magnitude to the pressure of switching off the relay 22. At the newly arisen water distribution (for example, opening the taps by the consumer) the hydraulic accumulator 1 delivers the saved-up volume to the major pipeline of the consumer, while the pressure falls to a limit of switching on the relay 22, and the power is supplied to the pump, and the cycle repeats.

Due to the use of this device, the dimensions and weight of the equipment are reduced by reducing the length and complexity of major pipelines, while the major pipeline between the well and the hydraulic accumulator is not required (absent). Implementation of the device with basic means of fixing directly to the massive

casing pipe of the well reduces the possibility of vibration of its parts, which positively affects the durability and reliability of its operation for its intended purpose for the water supply. The composition of structural components of the device and their connections for installation directly on the well are optimized, with the possibility of simultaneous installation of a submersible pump in the well and sealing the casing pipe. It is not required to use supporting structures specifically for the installation of the hydraulic accumulator. It is possible to drain water directly from the water supply device into the well, if necessary, without flooding the surrounding area. At the same time, the device has all necessary functions to control the automatic operation of the pump, accumulation of water volume, pressure control, discharge of water from the hydraulic accumulator and major pipeline into the well, arrangement of caissons, and pits. All this significantly increases the reliability of the device as a whole, allows increasing the period of maintenance-free operation.

Industrial application

The present invention is implemented with multipurpose equipment extensively employed by the industry.

Claims

1. The water supply device containing a base, a ring of elastic material and a flange, tightened by connecting elements, for the installation on a casing pipe, a hydraulic accumulator with a housing and a working chamber with a connecting fitting mounted on its inlet, as well as a distribution manifold made with two oppositely located connecting parts, with an end-to-end internal channel and an outlet internal channel, while the latter is made with the possibility of connection to the major pipeline of the consumer on the one side, and is connected on the other side with the aforementioned end-to-end internal channel that is connected via a connecting fitting with the working chamber of the hydraulic accumulator, while the manifold is provided with means for draining water from the device. One connecting part is used to rigidly fix the manifold to the housing of the hydraulic accumulator, while the other connecting part is used to rigidly fix it to the base. The manifold is provided with a compression fitting for connecting the end-to-end internal channel with a pressure pipe of the submersible pump.

2. The water supply device according to p. 1, characterized in that the clamping flange is designed to be installed around the casing pipe, while the base - at the end of the casing pipe.

3. The water supply device according to any of p. 1, 2, characterized in that the water draining means is made in the form of a drain plug installed with the possibility of draining through internal channels from the working chamber of the hydraulic accumulator and from the consumer major pipeline into the well.

4. The water supply device according to any of p. 1, 2, characterized in that the manifold is fixed with one connecting part made in the form of an annular belt in a cylindrical bore made on the base.

4. The water supply device according to any of p. 1, 2, characterized in that the manifold is fixed by another connecting part made in the form of an annular recess to the flange on the hydraulic accumulator housing.

5. The water supply device according to any of p. 1,2, characterized in that the manifold is formed with a threaded part of a compression fitting including a collet, a clamping ring, a sealing ring and a nut to be screwed onto the threaded part of the fitting and compression of the collet with the clamping ring and sealing ring.

6. The water supply device according to p. 1, characterized in that it is provided with a pressure relay fixed to the manifold, connected to the outlet internal channel and made with the ability to generate signals to turn on and off the submersible pump when the pressure in the consumer's major pipeline decreases and increases, **respectively.**

7. The water supply device according to any of p. 1, 2, characterized in that it is equipped with a pressure gauge mounted on the manifold for visual pressure monitoring.

8. The water supply device according to any of p. 1, 2, characterized in that the manifold is made with a pad eye for fastening the safety hook of a cable from the casing pipe.

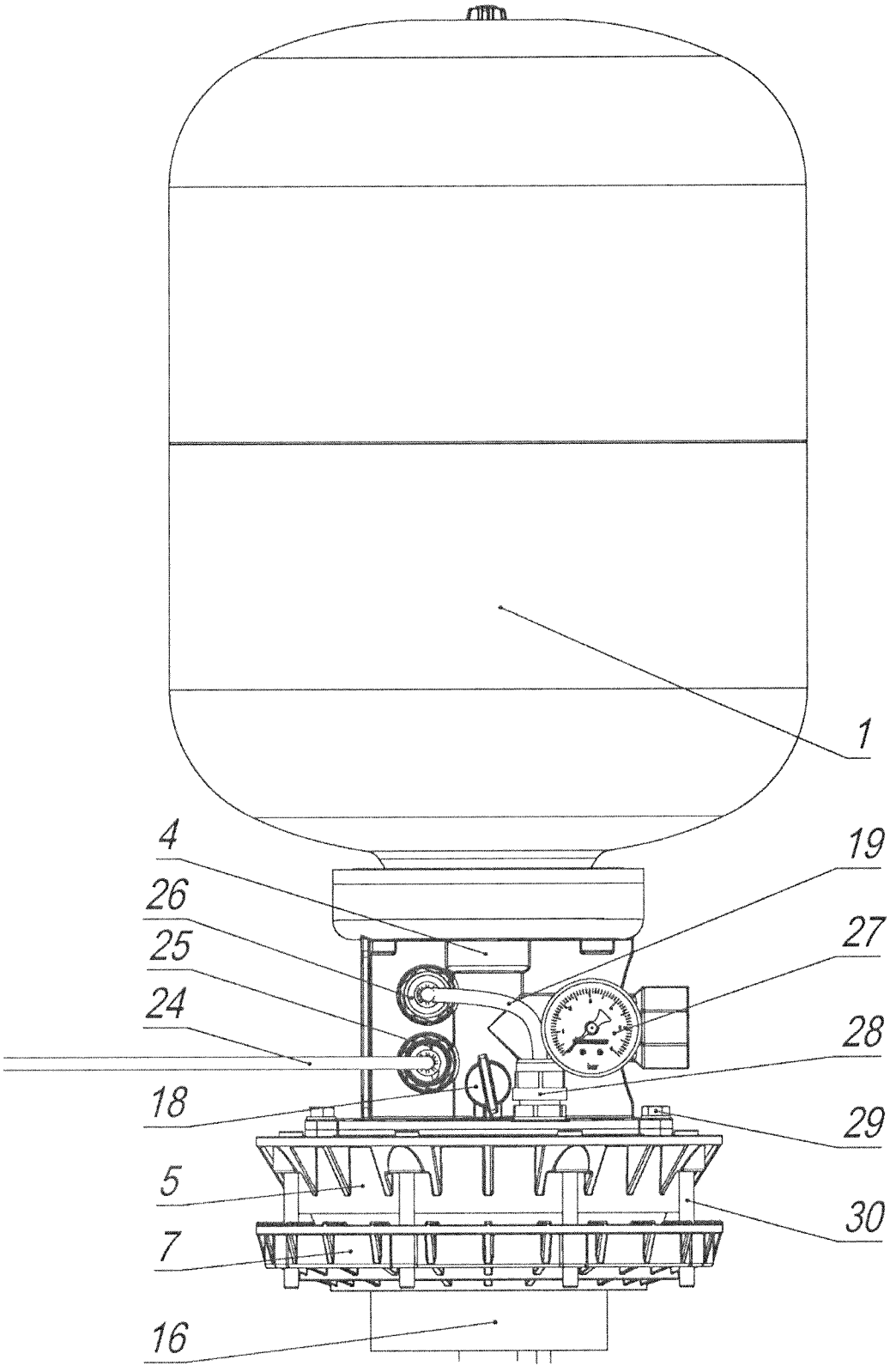

Fig. 1

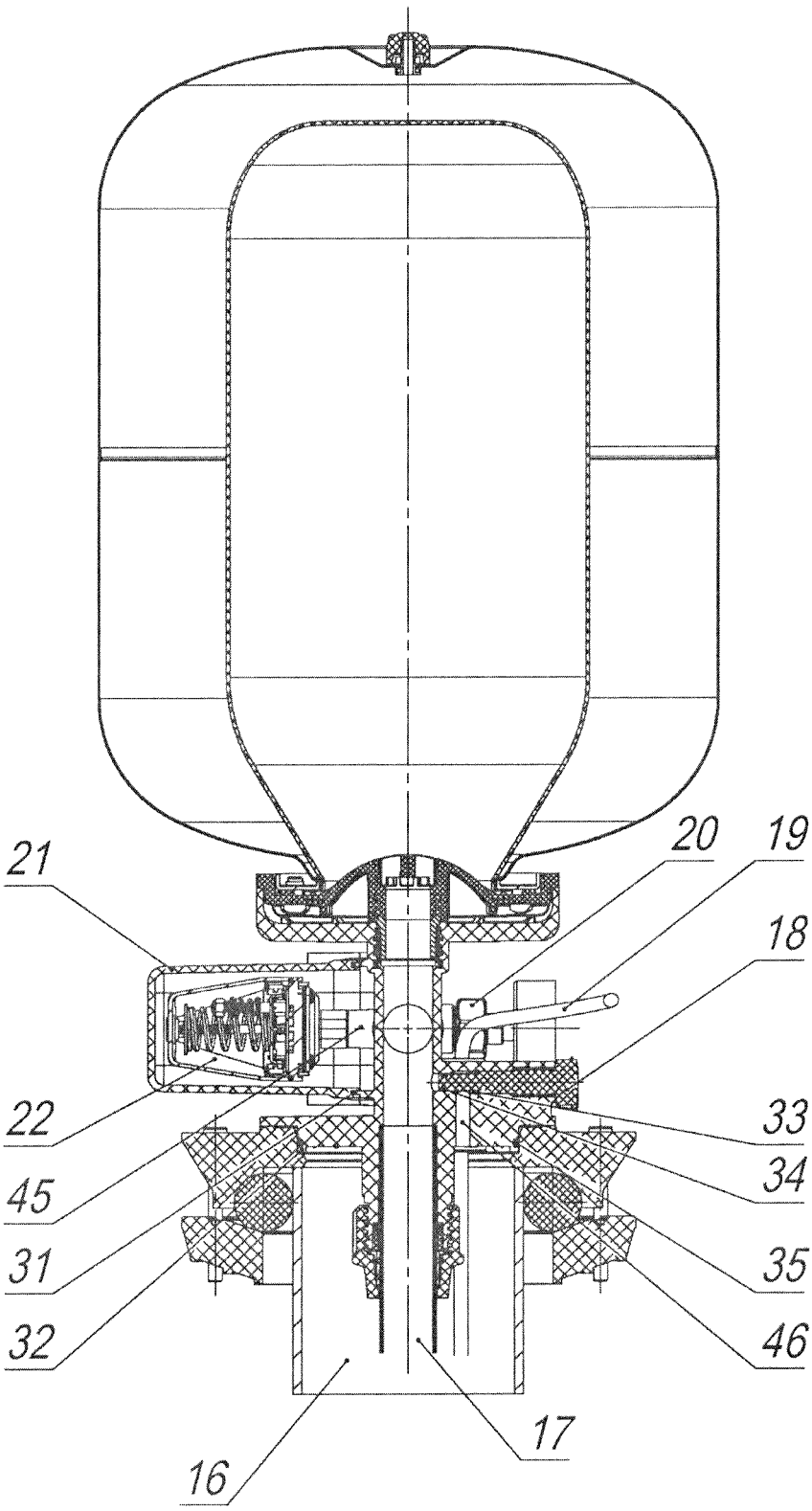

Fig. 2

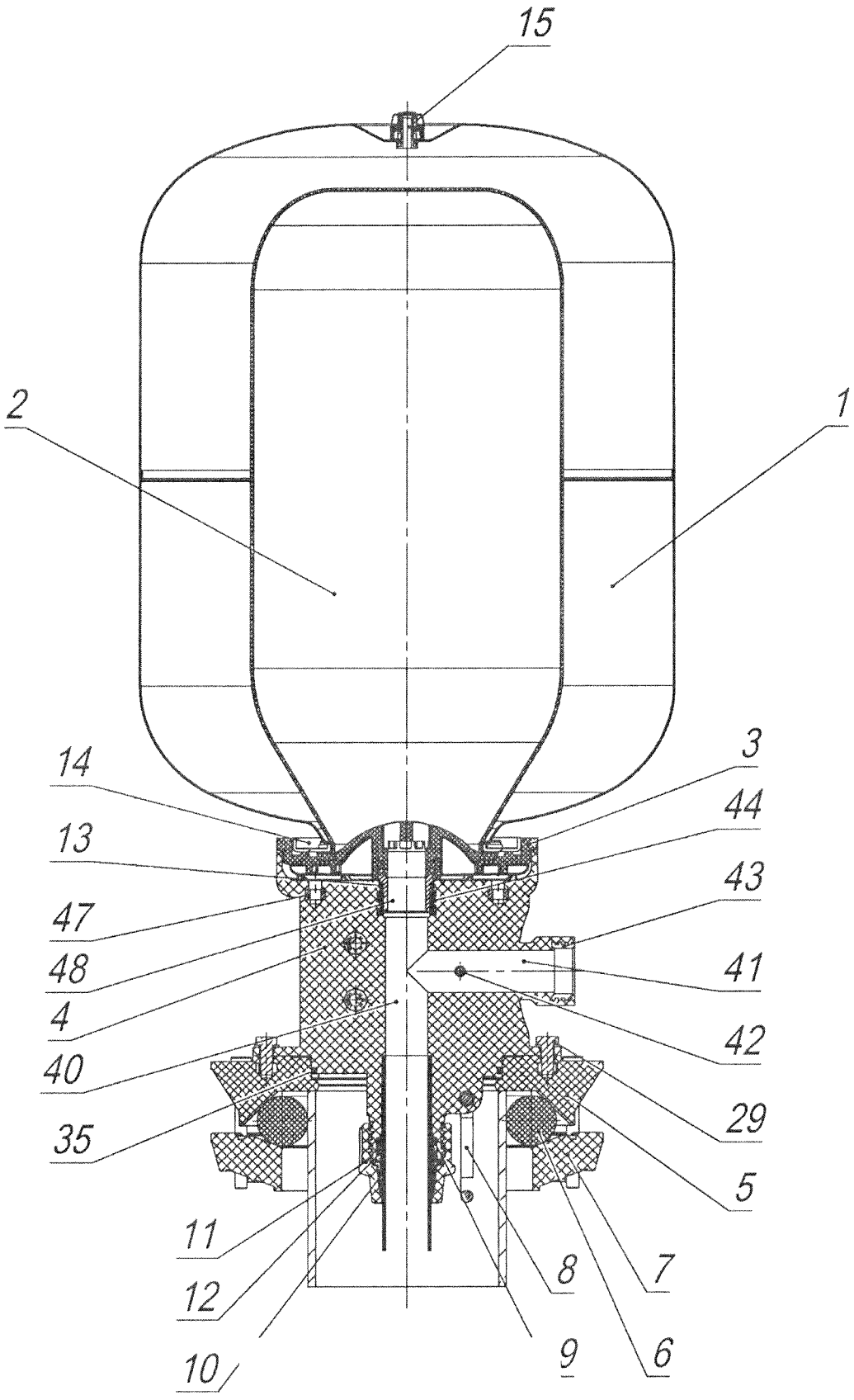

Fig. 3

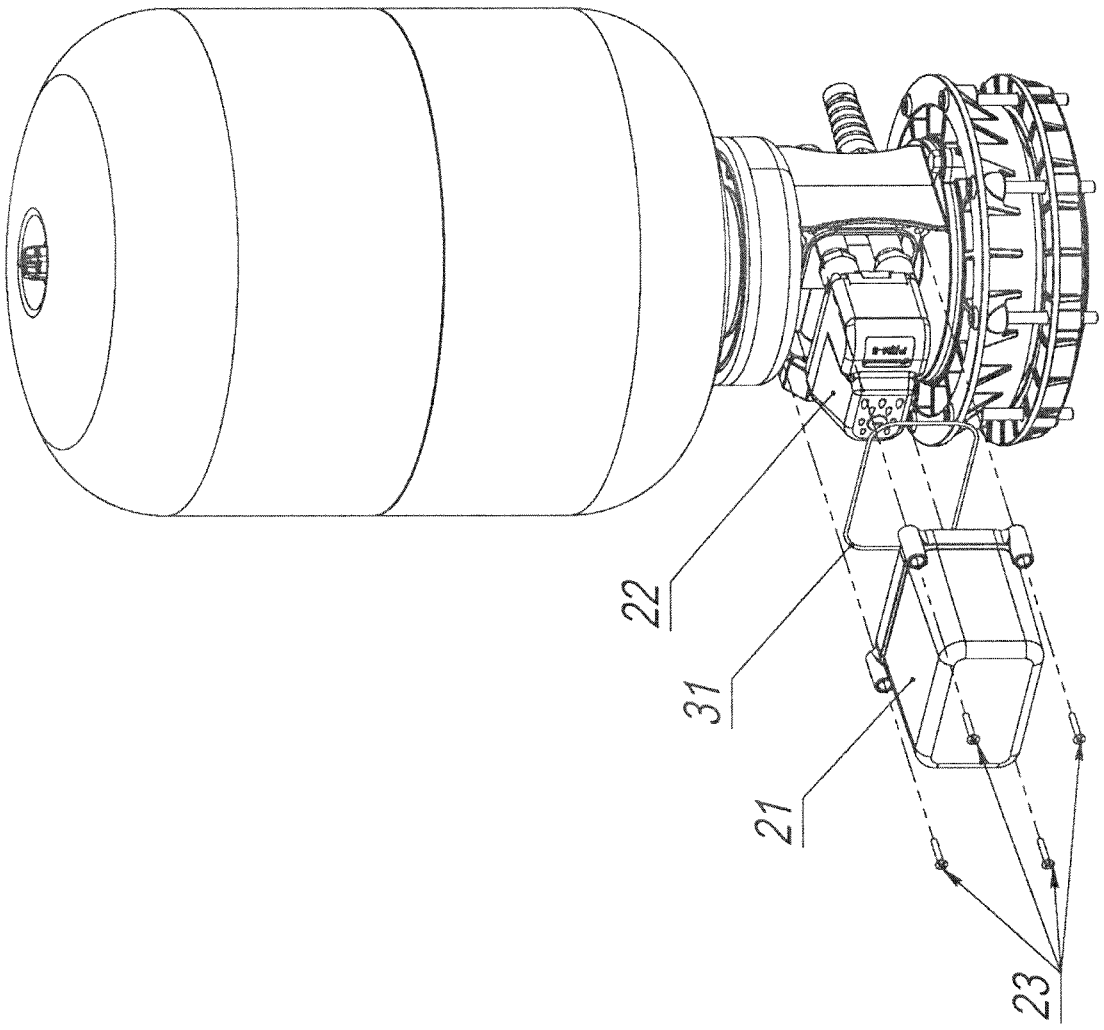

Fig. 4

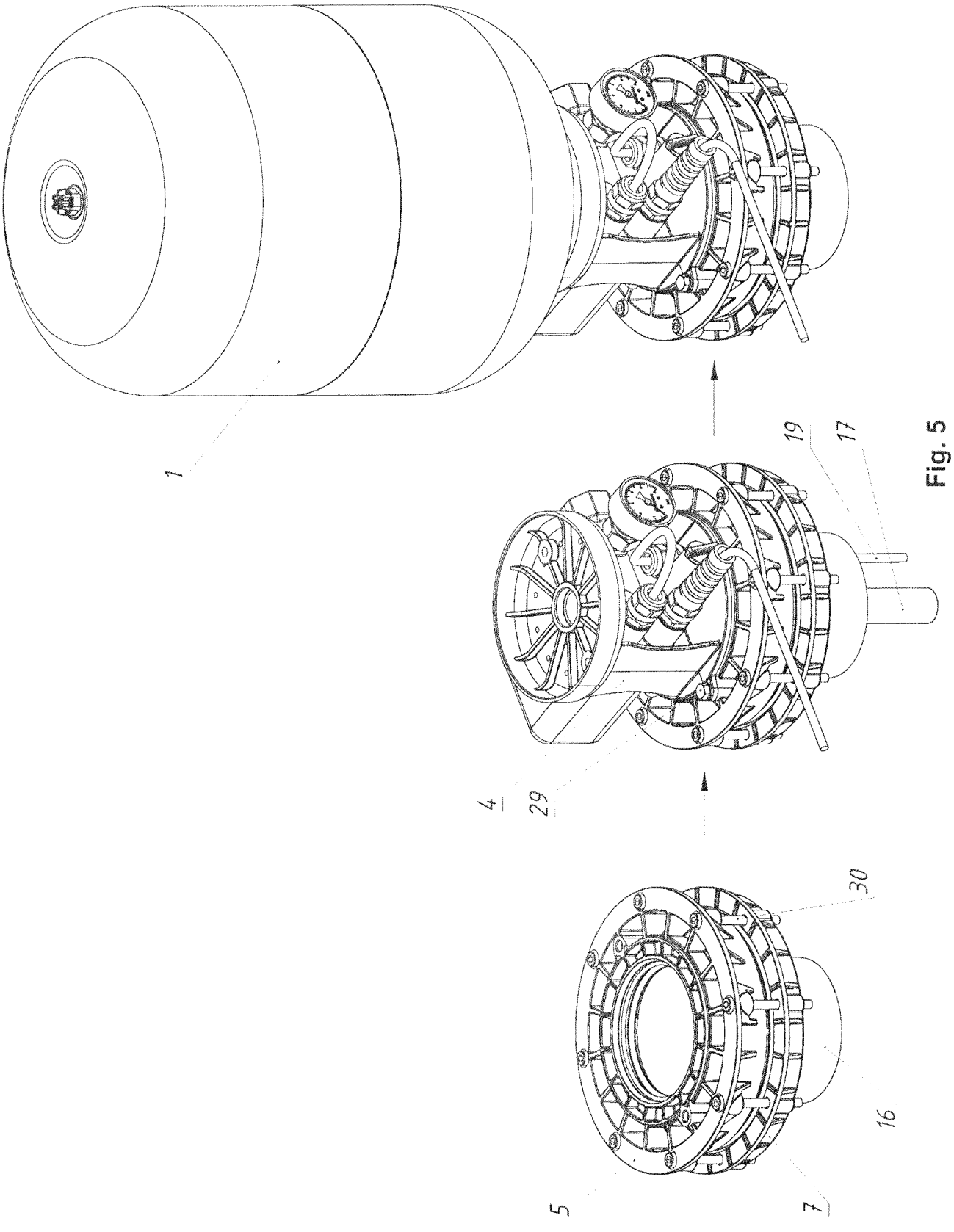

Fig. 5

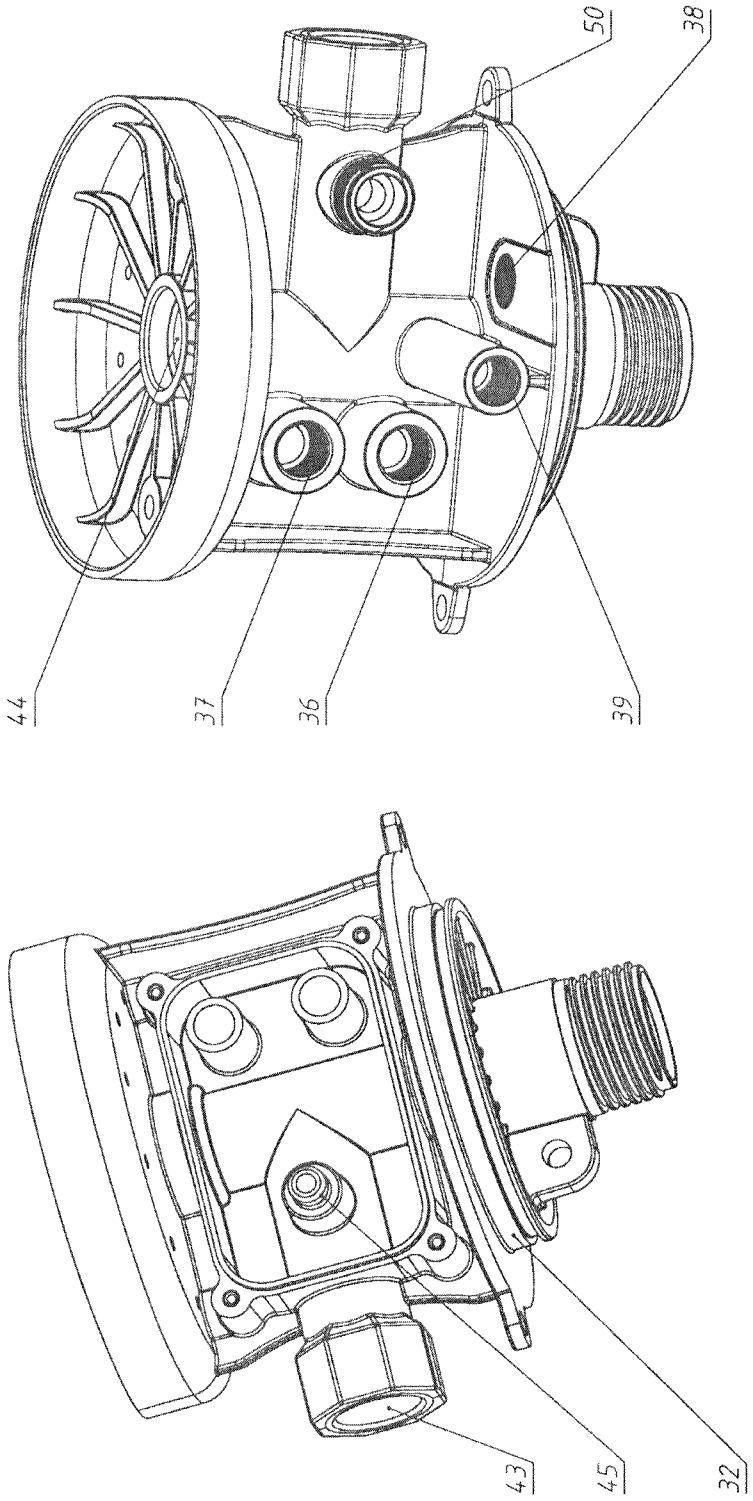

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2019/000957

A. CLASSIFICATION OF SUBJECT MATTER

E03B 11/00 *(2006.01)*
F15B 1/02 *(2006.01)*

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)

C02F 1/00, E03B 7/00, 7/04, 11/00, 11/02, F15B 1/00, 1/02

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)

Espacenet, PatSearch, RUPAT, DWPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	RU 184169 U1 (YAZYKOV ANDREI YURYEVICH) 17.10.2018	1-8
A	RU 153938 U1 (YAZYKOV ANDREI YURYEVICH) 10.08.2015	1-8
A	RU 154456 U1 (ELOVIKOV ALEXANDER GERMANOVICH) 27.08.2015	1-8
A	EP 0004056 A1 (SIEMENS AKTIENGESELLSCHAFT) 19.09.1979	1-8

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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

"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

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 April 2020 (22.04.2020)	30 April 2020 (30.04.2020)

Name and mailing address of the ISA/RU:	Authorized officer
Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37	V. Parfenov Telephone No. 499-240-60-15