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(54) **VALVE STRUCTURE FOR A PET KEG**

(57) The invention relates to corking constructions intended for polyethylene terephthalate tanks for dispensing, storage and transportation of beverages under pressure (s PET keg). A valve construction for a PET keg comprises a cover with a central opening and means of connection with a keg neck, a hollow stem, valve element, spring, annular nut; with the first end of the tube made open, and the second end made closed with an annular shoulder; with at least one window in the stem generatrix; where the valve element is installed on the stem and able to slide along thereof, having a central opening with an annular recess designed such that it can engage with the annular shoulder of the stem and the annular shoulder on the exterior surface made such that it can engage with the valve element; and the spring is installed between the valve element and the annular nut; and the cover is made in the form of a mushroom and connected to the annular nut using a threaded connection intended for direct installation of the valve construction on a keg neck; openings for gas flow are provided at the bottom of the annular nut; an annular gasket is provided between the flange and cylindrical surface of the mushroom leg of the cover to seal off the connection of the cover with the neck of a PET keg; the valve element is made such that it can function both as a relief valve and as an actuation indicator made of polymeric material with 40-60 Shore hardness. The invention ensures high reliability and leak-proofness of the valve construction functioning at the same time as a relief valve if overpressure in a PET keg

is above the maximum permissible value.

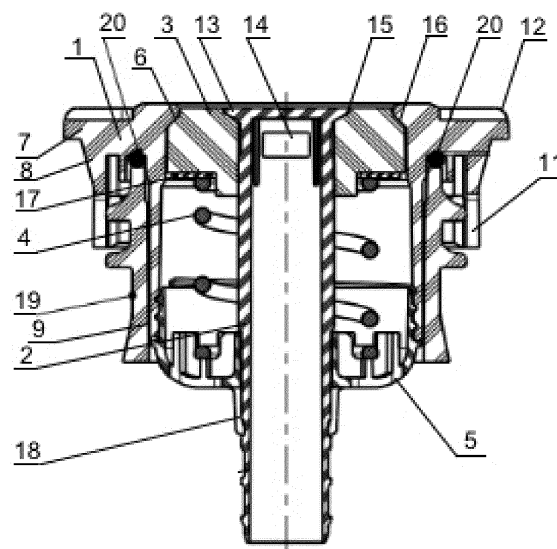


FIG.1

Description

Field of the Invention

[0001] The invention relates to corking constructions intended for polyethylene terephthalate tanks (hereinafter referred to as a "PET keg") and installed on PET keg necks for dispensing, storage and transportation of beverages in a PET keg under pressure.

Description of the Prior Art

[0002] PET kegs equipped with valve constructions are used for storage and dispensing of beverages, for example, such as beer. These valve constructions have several channels ensuring flow of liquid and gas. When filling a PET keg, which is usually filled upside down, a beverage is filled through the first channel of the valve construction, while the gas, which is forced out from the keg, comes out through the second channel. During dispensing, the gas, i. e. nitrogen or carbon dioxide, is injected into a PET keg through the first channel to force out the beverage content from a PET keg through the second channel. The beverage content is dispensed using a dispensing head attached to the valve construction on spring-loaded elements of the valve construction with subsequent opening of channels, one of which is used to supply inert gas under overpressure, and the other is used to dispense the beverage content which is forced out by the gas. The sealing element of the valve construction is intended to maintain the created ynop pressure in the PET keg during removal (dismantling) of the dispensing head. As a rule, in the case of dispensing and storage of beer, the overpressure makes about 2.5-3.0 bars. Said pressure is the operating pressure of a PET keg. A PET keg, however, withstands the pressure of about 7-8 bars.

[0003] In the case of violation of specifications of production, storage and use of a PET keg filled with beverage content, overpressure above the maximum permissible value may occur in a PET keg leading to rupture thereof. This problem poses serious threat to people located in close proximity to the PET keg.

[0004] A container made of plastics material is known, for example, a PET keg for beverages with a connecting fitting with a seal (patent of the Russian Federation for an invention No. 2466085, convention priority date 29.10.2008, international patent classification B67D 1/08), wherein the connecting fitting and/or the seal and, consequently, a keg head are structurally designed such that after a certain opening operation, the subsequent automatic closing operation in practice is not carried out completely or is not completed for a non-closable opening remains during the said subsequent automatic closing operation. Said opening ensures that the pressure is reduced in the interior. This means that it is no longer possible for an overpressure to build up in the interior and the potential danger of container rupture conse-

quently no longer applies. The connecting fitting, however, includes a stopper with a predetermined breaking point for the spring-loaded seal. The seal has a predetermined breaking point or is designed with the possibility of deformation during a closing operation to form an opening.

[0005] Said type of valve prevents a PET keg from destruction not for the entire period of use but only after the previous opening operation with the subsequent automatic closing operation making the further use of a PET keg impossible after opening thereof, i.e. the dispensing head can be put on only once. With the dispensing head removed, the sealing of a PET keg is reduced and it can not be further used, thus making the rest of the product worthless. It should be noted, that it is often necessary to remove the dispensing head when using the PET keg in order to fully empty it, for example, if a failure of the dispensing head or the overall dispensing system has been detected, or if routine sanitation treatment of the dispensing system is being conducted. It should also be noted that the prior art solution does not ensure that the valve prevents a PET keg and product therein from destruction during storage and transportation.

[0006] A valve for a container according to patent of the Russian Federation for a utility model No. 117417 (priority date 07.02.2012, international patent classification B67D1/12) is known with a body made in the form of a sleeve, having a hollow stem mounted therein, an annular gate, spring and cover with the means of connection to connect with the container neck; where the first end of the stem is made open and connected to the bottom of the body, protruding from it, and the second end of the stem is made closed and equipped with a flange; in addition, the stem forming has at least one window; an annular gate which can slide along the tube is installed on the stem between the bottom of the body and the flange of the stem, the central opening of which has an annular shoulder designed such that it can engage with the flange of the stem, and the spring is installed between the annular gate and the bottom of the body; in addition, the body forming has at least one window; the cover, however, is made in the form of a bushing with the means of connection on the interior surface thereof and with an annular shoulder in the channel thereof designed such that the annular shoulder can engage with the annular gate. (it has been taken as a prototype)

[0007] According to the prototype, the construction is assembled on the neck of the container by stages. The assembly procedure consists of the placement of the body on the neck of the container using a shoulder provided on the body and a recess provided on the neck of the container, and subsequent installation of other elements, which is completed by the installation of the cover secured with the exterior surface of the neck using a threaded connection or latch assembly. The known construction of the valve does not solve the problem of exceeding overpressure occurring in the case of violating the specifications of production, storage and use of PET

kegs filled with beverage content.

Summary of the Invention

[0008] The technical object of the claimed invention is to create a flexible easily producible valve construction for a PET keg providing high reliability, sealing and the possibility of functioning as a relief valve if overpressure inside a PET keg exceeds the maximum permissible value.

[0009] The technical result consists in obtaining a reliable, easily producible and safely operated valve for a PET keg.

[0010] The technical result is achieved by the fact that the valve construction for a PET keg comprising a cover with a central opening and the means of connection with the keg neck, a hollow stem, valve element, spring, annular nut; with the first end of the stem made open, and the second end made closed having an annular shoulder; with at least one window in the stem forming, and the valve element installed on the stem and able to slide along thereof, having a central opening with an annular recess designed such that it can engage with the annular shoulder of the stem and the annular shoulder on the exterior surface made such that it can engage with the valve element; and the spring is installed between the valve element and the annular nut; and the cover, however, is made in the form of a mushroom and connected to the annular nut using a threaded connection intended for direct installation of the valve on a keg neck; openings for gas flow are provided at the bottom of the annular nut; an annular gasket is provided between the flange and cylindrical surface of the mushroom leg of the cover to seal off the connection of the cover with a PET keg neck; the valve element is made such that it can function both as a relief valve and as an actuation indicator made of polymeric material with 40-60 Shore hardness.

[0011] The distinction of the claimed invention from the prototype is the fact that the claimed invention can ensure the functioning of the valve element as a valve when dispensing beverages in the normal mode of operation, as a relief valve when overpressure in a PET keg is above the maximum permissible value, and as an actuation indicator of the relief valve.

[0012] The claimed invention is illustrated by the following drawings:

Fig.1 - valve construction (with a latch assembly) in section;

Fig.2 - valve construction with a threaded connection in section;

Fig.3. - detail drawing of the elements of valve construction with a latch assembly;

Fig.4 - detail drawing of the elements of valve construction with a threaded connection.

Fig.5 - cross-sectional view of the cover base.

[0013] The valve construction comprises the cover (1)

made in the form of a mushroom with a central opening, the hollow stem (2) installed therein along the longitudinal axis, the valve element (3), the spring (4) and the annular nut (5) providing upward pressure thereto (Fig. 1, 2).

[0014] The cover (1) comprises the base (7) which may be made both in the form of a circle and in the form of a truncated equilateral triangle having vertices constrained by a circle (see Fig. 5), the flange (8), and the cylindrical leg (9). Reinforcement ribs (10) are provided at the joint of the base (7) and the external annular surface of the flange (8). Both the latch assembly (Fig.3) and threaded joint (Fig.4) may be used to connect the valve construction with a PET keg neck. The vanes (11) on the flange (8) are intended to ensure latch engagement with a PET keg neck. The female thread (21) on the flange (8) is intended to ensure a threaded connection with a PET keg neck. The surface of the cover has the shoulders (12) to ensure producibility when installing the valve construction on threaded keg necks. The cover (1) has a central opening with the annular shoulder (6) engaging with the annular recess (16) of the valve element (3). The annular gasket (20) with a circular cross section is provided in the area between the cylindrical mushroom leg (9) and the flange (8) of the cover (1) to ensure the sealing of connection of the valve construction with a PET keg neck.

[0015] The stem (2) is made hollow and has the form of a tube. The first end of the stem is made open and passes through the opening of the annular nut (5), protruding from it. The second end of the stem (2) is made closed and has the shoulder (13). At least one window (14) is provided in the upper part of the hollow stem (2).

[0016] The valve element (3) having the central opening with the annular recess (15) designed such that it can engage with the shoulder (13) of the hollow stem (2) is installed on the stem (2) and can slide along thereof.

[0017] The spring (4) installed between the annular nut (5) and the valve element (3) ensures upward pressure of the valve element (3) to the annular shoulder (6) of the cover (1). The sealing ring (17) is installed between the valve element (3) and the spring (4) to prevent from pressing-through of material surface of the former.

[0018] The ring nut (5) is fastened to the cover (1) using a threaded connection. The ring nut (5) has the centering vanes (18) and openings for the flow of liquid or gas.

Detailed Description of the Embodiments

[0019] The valve parts are manufactured using polymeric materials, in particular the cover, tube and annular nut of the valve construction are made of polyacetal, and the valve element (3) is made of polymeric materials with 40-60 Shore hardness depending on the required actuation pressure, such as: thermoelastoplast (TEP), or rubber based on ethylene propylene diene monomer (EPDM) rubber, or silicone.

[0020] The claimed valve construction is installed on the neck (19) of the PET keg. Fastening, however, may

be implemented using a threaded connection with the female thread (21) or using a latch assembly formed by the vanes (11).

[0021] When using the latch assembly, the vanes (11) enter the groove between the annular shoulders on the exterior surface of a PET keg neck.

[0022] When using a threaded joint, fastening is made by means of the female thread (21) on the flange (8).

[0023] Filling of liquid into the PET keg as well as dispensing of liquid therefrom is ensured by the valve construction installed on a PET keg neck. A dispensing tube is connected to the open end of the hollow stem (2) ensuring dispensing of beverage content.

[0024] The PET keg is filled as follows:

The dispensing head of the dispensing line (not shown) has one or several shoulders which apply pressure onto the open surface of the spring-loaded valve element (3) on the side of the cover (1). This initiates opening of the first annular channel between the valve element (3) and the mushroom of the cover (9) as well as the second channel formed by the internal channel of the hollow stem with the open window (14) on the forming thereof. A PET keg is filled with beverage content by means of the second channel, while the gas in the PET keg is forced out through the first channel. After relief of pressure applied to the valve element (3) from the side of the dispensing head, the valve element returns to the initial position, thus blocking the channels. A PET keg filled with beverage content is stored and transported with the valve element (3) closed.

[0025] The dispensing of liquid from a PET keg is made in the reverse order: the shoulders of the dispensing head (not shown) apply pressure onto the open surface of the spring-loaded valve element (3) from the side of the cover (1). This initiates opening of the first annular channel between the valve element (3) and the mushroom of the cover (9), as well as the second channel formed by at least one window (14) on the forming of the hollow stem (2). The keg is supplied with inert gas under overpressure through the first annular channel from an external container, which forces out the liquid in the keg through the tube, hollow stem (2) attached thereto, and window (14) on the forming of the hollow stem (2).

[0026] If the overpressure in the PET keg is above the maximum permissible value under transportation, storage and operation conditions, the valve element (3) is irretrievably pressed out of the valve construction such that it is above the end surface of the cover (1) to relieve overpressure, thus preventing the destruction (rupture) of the PET keg.

[0027] The pressed-out valve element observed visually warns the consumer of valve actuation and unfit of the beverage content for consumption. In addition, the pressed-out valve element does not allow to attach the dispensing head to the valve construction, thus preventing possible use of a PET keg with beverage content unsuitable for consumption.

[0028] Considering that the PET keg rupture pressure

makes 7-8 bars, and the working pressure makes 2.5-3.0 bars, the maximum permissible value pressure in the PET keg shall be maintained within 4-6 bars.

[0029] Tests of the construction of the claimed invention were carried out:

Example 1.

[0030] The valve element was made of TEP with 54 ± 2 Shore hardness. The construction withstood the operating pressure of up to 4.5 bars. Upon reaching the pressure of $P=6$ bars, the valve actuated in 60-120 minutes at the ambient temperature of 25-26°C.

Example 2

[0031] The valve element was made of TEP with Shore hardness of 47 ± 2 pieces. The construction withstood the operating pressure of up to 4.0 bars. Upon reaching the pressure of $P=5.5$ bars, the valve actuated in 30-60 minutes at the temperature of 25-26°C.

Example 3

[0032] The valve element was made of EPDR with 47 ± 2 Shore hardness. The construction withstood the operating pressure of up to 4.0 bars. Upon reaching the pressure of $P=5.5$ bars, the valve actuated in 50-180 minutes at the temperature of 25-26°C.

Example 4

[0033] The valve element was made of silicone with 50 ± 2 Shore hardness. The construction withstood the operating pressure of up to 4.5 bars. Upon reaching the pressure of $P=6$ bars, the valve actuated in 60-120 minutes at the temperature of 25-26°C.

Example 5

[0034] The valve element was made of silicone with 41 ± 2 Shore hardness. The construction withstood the operating pressure of up to 3.5 bars. Upon reaching the pressure of $P=5.5$ bars, the valve actuated in 5-15 minutes at the temperature of 25-26°C.

[0035] The claimed invention offers the following advantages:

- ensuring safe storage and usage of PET kegs due to functioning as a relief valve when overpressure in a PET keg is above the maximum permissible value and preventing from the destruction (rupture) of the PET keg;
- indicating valve actuation due to irretrievable pressing-out of the valve element when the pressure in a PET keg is above the maximum permissible value;
- preventing from consumption of an unsuitable beverage due to the fact the dispensing head can not

- be connected to the valve construction with a pressed-out valve;
- producibility of the construction due to separate assembly of the elements of the valve construction, installation thereof in an assembled conditions, and consequent filling of the PET keg on an automated production line;
 - flexibility due to possible usage of the valve construction for various types of necks and dispensing heads changing only the cover of the valve construction;
 - ensuring reliability and sealing due to the threaded connection of the cover and annular nut as well as sealing of a PET keg neck along the edge thereof when connecting with the valve construction.

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Claims

1. A valve construction for a PET keg comprising a cover with a central opening and means of connection with a keg neck, a hollow stem, valve element, spring, annular nut; with the first end of the tube made open, and the second end made closed with an annular shoulder; with at least one window in the stem forming; where the valve element is installed on the stem and able to slide along thereof, having a central opening with an annular recess designed such that it can engage with the annular shoulder of the stem and the annular shoulder on the exterior surface made such that it can engage with the valve element; and the spring is installed between the valve element and the annular nut; **characterized in that** the cover is made in the form of a mushroom and connected to the annular nut using a threaded connection intended for direct installation of the valve construction on a keg neck; openings for gas flow are provided at the bottom of the annular nut; an annular gasket is provided between the flange and cylindrical surface of the mushroom leg of the cover to seal off the connection of the cover with the neck of a PET keg; the valve element is made such that it can function both as a relief valve and as an actuation indicator made of polymeric material with 40-60 Shore hardness.
2. A valve construction for a PET keg of claim 1 **characterized in that** the valve element is made of thermoplast, or rubber based on ethylene propylene diene monomer (EPDM) rubber, or silicone.
3. A valve construction for a PET keg of claim 1 **characterized in that** the external surface of the cover is made in the form a circle or a truncated equilateral triangle having vertices constrained by a circle.
4. A valve construction for a PET keg of claim 1 **characterized in that** the means of connection of the cover with the keg neck is made threaded.

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5. A valve construction for a PET keg of claim 1 **characterized in that** the external surface of the cover is made with shoulders to increase the producibility of installation thereof on a threaded neck.
6. A valve construction for a PET keg of claim 1 **characterized in that** the means of connection of the cover with the keg neck is represented by a latch assembly.

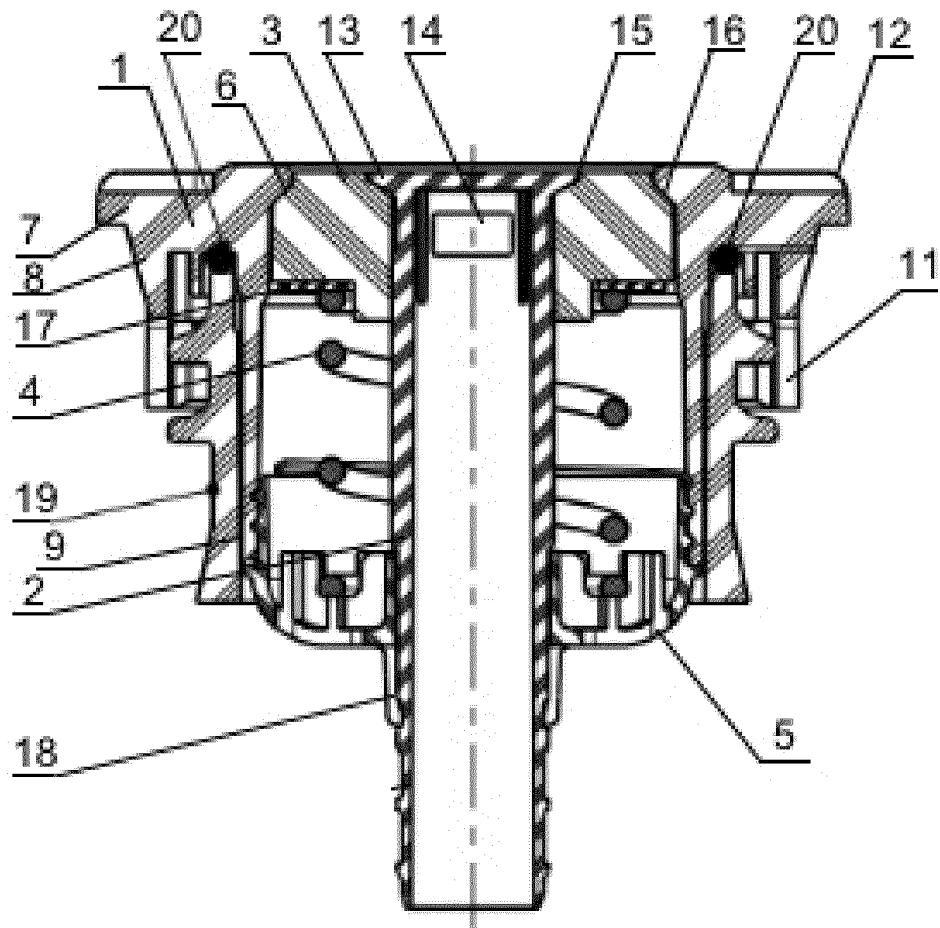


FIG.1

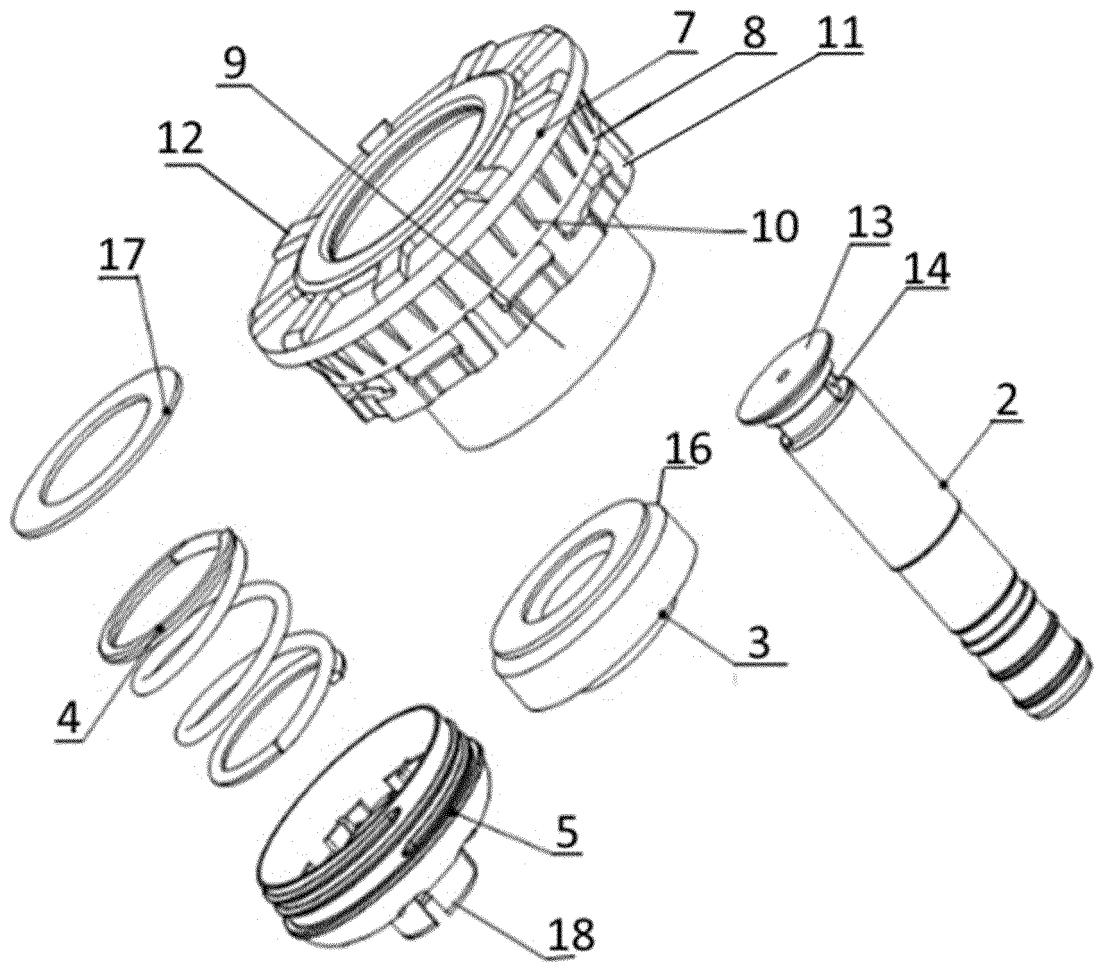


FIG.2

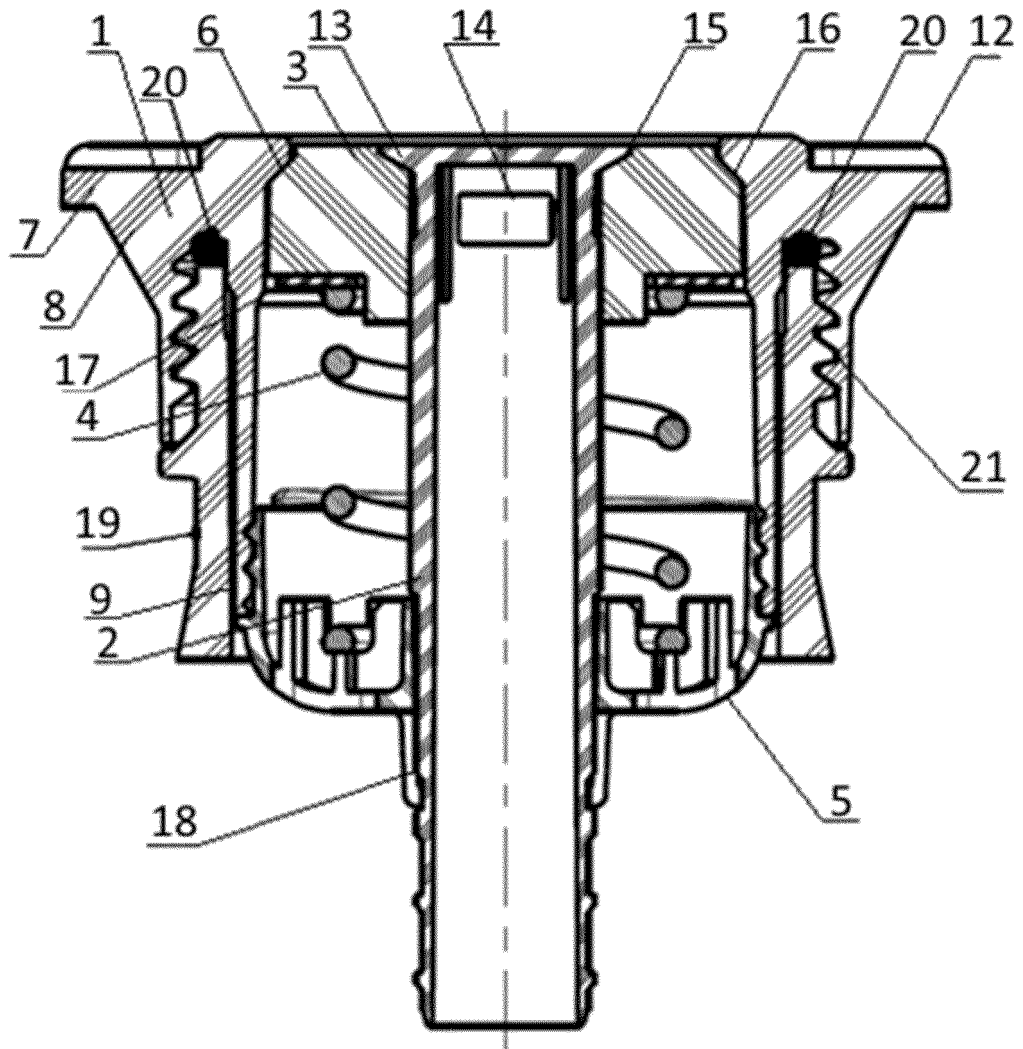


FIG.3

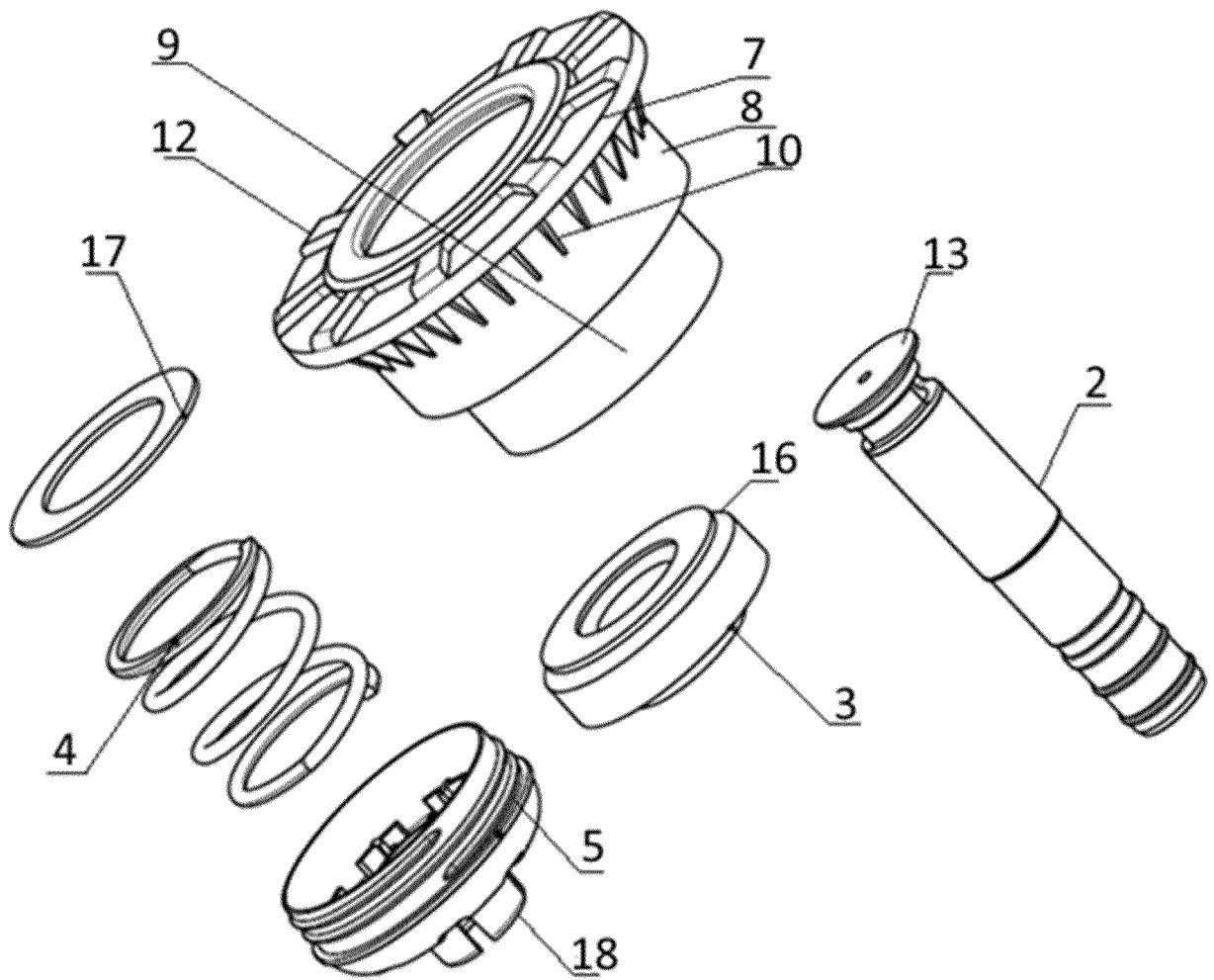


FIG.4

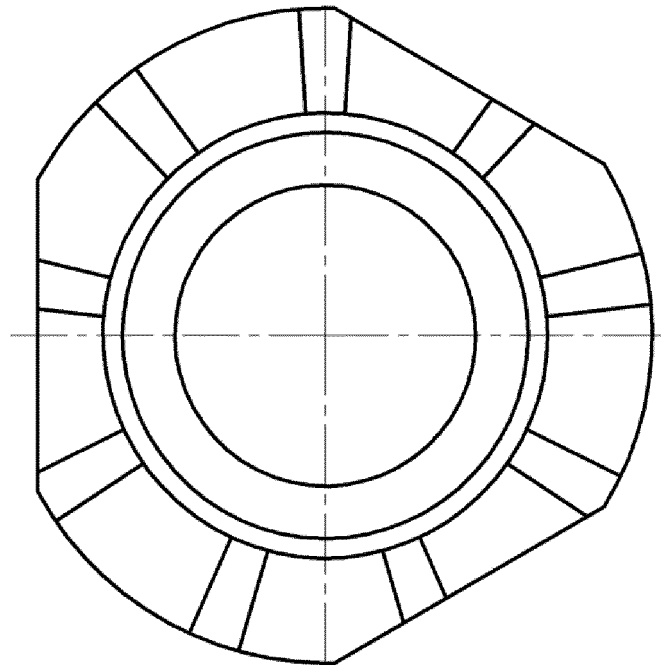


FIG.5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2017/000726

A. CLASSIFICATION OF SUBJECT MATTER		
B67D 1/08 (2006.01); B67D 1/12 (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)		
B67D 1/08, 1/12		
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, USPTO, PatSearch (RUPTO Internal), CIPO		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
D, A	RU 117417 U1 (MAKSIMOV SERGEI ALEKSANDROVICH et al.) 27.06.2012	1-6
D, A	RU 2466085 C1 (KKHS GMBH) 10.11.2012	1-6
A	GB 2508303 A (PETAINER LARGE CONTAINER IP LIMITED) 28.05.2014, the abstract, fig. 1	1-6
A	WO 2005/113416 A1 (INBEV S.A. et al) 01.12.2005, the abstract, fig. 4	1-6
A	EP 2505546 A1 (SCHAEFER WERKE GMBH) 03.10.2012, the abstract, fig. 1-4	1-6
☐ 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 application or patent 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
11 January 2018 (11.01.2018)		31 January 2018 (31.01.2018)
Name and mailing address of the ISA/ RU		Authorized officer
Facsimile No.		Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2466085 [0004]
- RU 117417 [0006]