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(54) **FITTING FOR A PET KEG**

(57) The invention relates to closure structures for polyethylene terephthalate containers, which can be mounted on the necks of PET kegs for dispensing, storing and transporting beverages kept under pressure inside a PET keg. A fitting comprises a cap with a central aperture, a hollow rod, a valve element, a spring, and a ring nut. The rod is configured to have a first open end and a second closed end with an annular flange, the surface of revolution of the rod is provided with a port, and the rod has a valve element mounted thereon having an inner annular shoulder, which interacts with the annular flange of the rod, and an outer annular shoulder. The spring is mounted between the valve element and the ring nut, and the cap is configured in the shape of a mushroom and is connected to the ring nut by a threaded joint. Apertures are provided in the bottom part of the ring nut, and a washer ring is disposed between the ledge and the cylindrical surface of the cap. The valve element comprises a blind passageway which is open at the bottom end and is closed at the top end by a thin seal. The technical result is a reliable, manufacturable and operationally safe fitting for a PET keg.

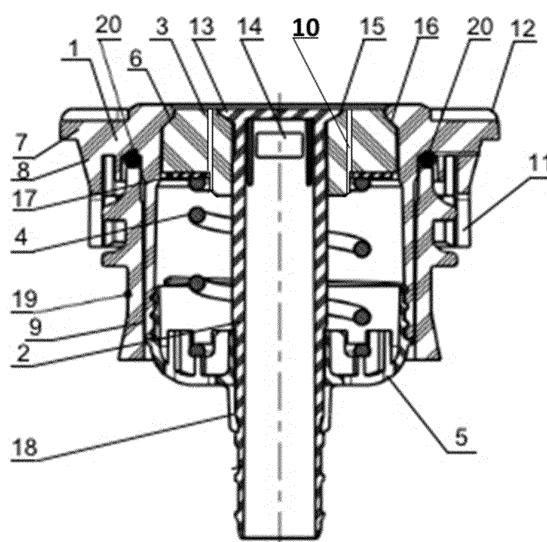


FIG. 1

Description

Field of Invention.

[0001] The present invention relates to closing mechanisms for vessels made of polyethyleneterephthalate (hereinafter referred to as PET kegs) fitted on the filler necks of PET kegs for dispensing, storing and transporting beverages contained in pressurized PET kegs.

Background of the invention.

[0002] PET kegs fitted with closure fittings are used for storing and dispensing drinks such as beer. Such closure fittings have several channels that provide liquid and gas passage. During filling process, when a PET keg is usually upside down, a beverage is injected via the first channel of the fitting while displaced gas exits the keg via the second channel. During bottling, gas (nitrogen or carbon dioxide) is supplied to the PET keg through the first channel and displaces the beverage from the PET keg through the second channel. The bottling is done using a filling head coupled to the valve assembly which presses against spring-loaded fitting elements with subsequent opening of the channels, one of which is designed to supply inert gas under excess pressure, while the second channel is used for dispensing beverages forced out of the keg by gas. The seal element of the fitting is used to keep the built up excess pressure within the PET keg when removing (uncoupling) the filling head. For dispensing and storing beer, the excess pressure is normally about 2.5 to 3.0 bar. This pressure is the operating pressure of a PET keg. However, a PET keg can withstand the pressure of 7 to 8 bar.

[0003] The violation of technical conditions of production, storage and usage of PET kegs filled with a beverage can lead to increase in the excess pressure inside a PET keg above the permissible limit, which ultimately can cause rupture of the PET keg. This problem presents a serious threat to people in the close vicinity of the PET keg.

[0004] The prior art provides a plastic vessel such as a PET keg for beverages with a closing mechanism fitted with a seal element (Russian Federation invention patent No. 2466085, convention priority date: 29.10.2008, IPC B67D 1/08), wherein the closing mechanism and/or seal element and, consequently, a keg head are constructively designed so that after the opening operation, the subsequent automatic closing operation is carried out practically incompletely, because a non-closable through opening remains during the said subsequent automatic closing operation. This through opening provides the release of the pressure inside the keg. This ensures that it is no longer possible to build up an overpressure inside the vessel, thus eliminating the potential danger of vessel rupture. Thereby, the closing mechanism includes a stopper with a predetermined rupture point for the spring-loaded seal element. The seal element has a predeter-

mined rupture point or is made with the possibility of deformation during a closing operation to create a through opening.

[0005] This type of valve prevents a PET keg from rupture not during the entire period of use but only after the previously conducted opening operation with the subsequent automatic closing operation, which makes further use of the PET keg impossible after opening, i.e. the filling head can be attached only once. After removing the filling head, a PET keg loses its seal and becomes unsuitable for further use, thus making all remaining product useless. It should be noted, that the filling head often needs to be uncoupled when using a PET keg before it is fully emptied, for example, in case of a failure of the filling head or the overall filling system, or if regular sanitary treatment of the filling system needs to be conducted. It should also be noted that the prior art solution does not prevent a PET keg with the product from destruction during storage and transportation.

[0006] The prior art provides a valve for a vessel (Russian Federation utility model patent No. 117417, priority date: 07.02.2012, IPC B67D1/12) comprising a body made in the form of a cup with a hollow rod mounted therein, a ring seal, a spring and a cover with the means of connection to connect with the vessel neck, wherein the first end of the rod is made open and attached to the bottom of the body, protruding from it, and the second end of the rod is made closed and fitted with a flange, in addition, the rod forming surface has at least one opening, wherein the ring seal which can move along the rod is installed on the rod between the bottom of the body and the flange of the rod, the central opening of the ring seal has a collar recess configured to engage with the flange of the rod, and a spring is installed between the ring seal and the bottom of the body, in addition, the body forming surface has at least one opening, wherein the cover is made in the form of a bushing with the means of connection on its inner surface, the channel of which has a collar step configured to engage with the ring seal.

[0007] According to the prior art, the device is assembled on the neck of the vessel in a staged manner, including placement of the body on the neck of the vessel using a shoulder on the body and a recess on the neck of the vessel, and subsequent installation of the rest of the components completed by installation of the cover secured with the external surface of the neck using a threaded fastener or a locking connection. The known design of the valve does not solve the problem of increased excess pressure occurring due to violation of technical conditions of production, storage and handling of PET kegs filled with a beverage.

[0008] The prior art provides a valve assembly according to patent No. 2640988, published on 12.01.2018.

[0009] The prior art valve assembly comprises a cover with a central opening with the means of connection to connect with the keg neck, a hollow rod, valve element, spring, ring nut, wherein the first end of the rod is made open and the second end of the rod is made closed and

fitted with a collar step; the rod forming surface has at least one opening, wherein the valve element which can move along the rod is installed on the rod, the central opening of the valve element has a collar recess configured to engage with the collar step of the rod and the collar step on the external surface configured to engage with the valve element, and a spring is installed between the valve element and the ring nut, the cover, however, is made in the form of a mushroom and connected to the ring nut using a threaded fastener for direct installation of the valve assembly on the keg neck, openings for gas passage are provided at the bottom of the ring nut, a ring gasket is placed between the shoulder and cylindrical surface of the mushroom leg of the cover to seal the connection between the cover and the keg neck, while the valve element made of polymeric material with a Shore hardness of 40-60 is configured to function both as a safety relief valve and as an operation indicator (taken as a prototype).

[0010] The technical solution according to the prototype provides high reliability, pressure integrity and is configured to function as a safety relief valve in case excess pressure inside a PET keg exceeds the maximum permissible limit. The safety relief valve actuates in 30-180 minutes for the pressure range of 5.5 to 6 bar. In some cases, a rapid increase in pressure (1 bar within 5 minutes) can cause valve actuation at 7 to 7.5 bar which entails the risk of rupture of the keg. In addition, beverage manufacturers often use protective covers fixed to the fitting in order to prevent unauthorized use of the keg, or put shrink wrap film on fittings for the same purpose. In this case, such cover or film can prevent the pressing out of the seal, which again entails the risk of rupture of the keg. In order to achieve a more efficient and reliable valve actuation at a given maximum permissible pressure, including when the fitting is equipped with a protective cover, it is required to reduce the valve actuation time to 5 minutes or less.

Disclosure of the Invention.

[0011] The technical problem of the claimed invention is to design a multifunctional, technologically simple closure fitting for a PET keg which provides high reliability and pressure integrity and is configured to function as a safety relief valve in case excess pressure inside PET kegs exceeds the maximum permissible limit.

[0012] Since the burst pressure of a PET keg is more than 7 bar while the working pressure is up to 3.5 bar, the pressure inside a PET keg at which valve actuation occurs must be less than 7 bar, and the actuation time should not be more than 5 minutes.

[0013] The technical result of the claimed invention consists in producing a reliable, technologically simple and safe closure fitting for a PET keg.

[0014] The technical result is achieved by the fact that the closure fitting for a PET keg comprises a cover with a central opening with the means of connection to con-

nect with the keg neck, a hollow rod, valve element, spring, ring nut, wherein the first end of the rod is made open and the second end of the rod is made closed and fitted with a collar step, the rod forming surface has at least one opening, wherein the valve element which can move along the rod is installed on the rod, the central opening of the valve element has an inner collar recess which is configured to engage with the collar step of the rod and the external collar recess which is configured to engage with the collar step of the cover, and a spring is installed between the valve element and the ring nut, the cover is made in the form of a mushroom and connected to the ring nut using a threaded fastener for direct installation of the fitting on the keg neck, openings for gas passage are provided at the bottom of the ring nut, a ring gasket is placed between the shoulder and cylindrical surface of the mushroom leg of the cover to seal the connection between the cover and the PET keg neck, while the valve element made of polymeric material with a Shore hardness of 40-60 is configured to function both as a safety relief valve and as an operation indicator and comprises at least one non-through channel with the diameter of 3 to 5 mm open on the bottom side and bounded by a thin strap with the thickness of 0.2 to 1.5 mm on the top side.

[0015] The claimed invention is illustrated by the following drawings:

Fig. 1 - Sectional view of the closure fitting with a locking connection;

Fig. 2 - Sectional view of the closure fitting with a threaded fastener;

Fig. 3 - Overall view of the valve element of the closure fitting.

[0016] The closure fitting comprises a cover 1 made in the form of a mushroom with a central opening, a hollow rod 2 mounted therein along the longitudinal axis, a valve element 3, a spring 4 and a ring nut 5 to provide its preload (see Fig. 1, 2).

[0017] The cover 1 comprises a bottom 7 which can be made both in the form of a circle and in the form of a truncated equal triangle, vertices of which are bounded by a circle, fitted with a shoulder 8 and a cylindrical leg 9. The closure fitting can be attached to a PET keg neck using both a locking connection (see Fig. 1) and a threaded fastener (see Fig. 2). The petals 11 on the shoulder 8 are used to ensure latch coupling with a PET keg neck. The female thread 21 on the shoulder 8 is used for a threaded connection with a PET keg neck. The surface of the cover is fitted with shoulders 12, thus ensuring workability of securing the device to threaded keg necks. The cover 1 is fitted with a central opening with the collar step 6 which engages with the collar recess 16 of the valve element 3. The ring gasket 20 with circular cross section is placed between the shoulder 8 and the cylin-

dricul mushroom leg 9 of the cover 1 to seal the connection between the fitting and the PET keg neck.

[0018] The rod 2 is made in the form of a hollow tube. The first end of the rod is made open and goes through the hole of the ring nut 5, protruding from it. The second end of the rod 2 is made closed and fitted with a step 13. The upper part of the hollow rod 2 has at least one opening 14.

[0019] The valve element 3 which can move along the rod 2 is installed on the rod. The central opening of the valve element has a collar recess 15 which is configured to engage with the step 13 of the hollow rod 2. The valve element comprises at least one non-through channel 10 open on the bottom side and bounded by a thin strap 22 on the top side. The thin strap is 0.2 to 1.5 mm thick. The strap can be made of uneven thickness (within the specified range).

[0020] The diameter of the channel is 3 to 5 mm (see Fig. 3). The channel is mostly made in the cylindrical form, however in some cases it can have an oval, triangle or rectangular form of section.

[0021] The specific values of the strap thickness and channel diameter are defined in accordance with the specified actuation pressure.

[0022] The spring 4 placed between the ring nut 5 and the valve element 3 presses the valve element 3 against the collar step 6 of the cover 1. The support ring 17 placed between the valve element 3 and the spring 4 prevents the squeezing of the material surface of the valve element. The location of the channel 10 is chosen so that part of the channel is not covered by the support ring 17 (see Fig. 3).

[0023] The ring nut 5 is fastened to the cover 1 by a threaded fastener. The ring nut 5 comprises the centering petals 18 and liquid and gas passage holes.

Embodiment of the Invention

[0024] The closure fitting is made of polymeric materials, in particular the cover, rod and ring nut are made of polyacetal, while the valve element 3 is made of polymeric materials with a Shore hardness of 40-60, such as thermoelastoplast (TEP), or ethylene-propylene-diene monomer based rubber (EPDM), or silicone depending on the required actuation pressure.

[0025] The claimed closure fitting is to be installed on the PET keg neck 19. Wherein the fitting may be attached by a threaded connection with the female thread 21 or a locking connection formed by petals 11.

[0026] When using the locking connection, the petals 11 engage with a slot between the collar steps on the external surface of the PET keg neck.

[0027] When using the threaded connection, the fitting is fastened by using the female thread 21 on the shoulder 8.

[0028] The beverages are injected into the PET keg and dispensed from it by means of the closure fitting attached to the PET keg neck. A beverage dispensing tube

is coupled to the open end of the hollow rod 2 in order to dispense beverages.

[0029] The PET keg is filled as follows:

The filling head of the filling line (not illustrated) has one or more collar steps which press against the surface of the spring-loaded valve element 3 open on the side of the cover 1. Thereby, opening of the first ring-shaped channel between the valve element 3 and the mushroom of the cover 9 as well as the second channel, formed by the inner channel of the hollow rod with the open opening 14 on its forming surface is initiated. The beverage is injected into the PET keg through the second channel, while the gas is forced out of the PET keg through the first channel. After the pressure is relieved on the side of the filling head, the valve element 3 returns to its initial position, shutting both channels. The filled PET kegs are stored and transported with the valve element 3 closed.

[0030] Beverages are dispensed from the PET keg in the reverse manner: The collar steps of the filling head (not illustrated) press against the surface of the spring-loaded valve element 3 open on the side of the cover 1. Thereby, opening of the first ring-shaped channel between the valve element 3 and the mushroom of the cover 9 as well as the second channel, formed by at least one opening 14 on the forming surface of the hollow rod 2 is initiated. The inert gas is supplied to the keg through the first ring-shaped channel under the excess pressure from an outer vessel, the gas displaces the liquid in the keg through the tube, hollow rod 2 connected to it, and opening 14 on the forming surface of the hollow rod 2.

[0031] An increase in excess pressure inside the PET keg above the maximum permitted limit during transportation, storage or usage causes pressure build-up in the channel area 10 of the valve element, which leads to pressing out of the straps 22 and their subsequent destruction when pressure increases. The time period from the beginning of pressing out of the strap to the moment of its destruction is less than 5 minutes. The resulting through channel allows excess pressure to release from the keg, thus preventing the destruction (rupture) of the PET keg.

[0032] Visually observed blistering of the material of the valve element in places where openings are located warns the consumer of pressure build-up in the keg and possible valve actuation. When using protective covers, valve actuation occurs as well, as such covers do not fit tightly to the fitting surface.

[0033] The following tests of the device of the claimed invention were carried out:

Example 1.

The valve element was made of TEP with a Shore hardness of 60 ± 2 . Channels with the diameter of 3 mm and 0.5 mm thick straps were made in the valve element. The device withstood the operating pressure of up to 3.5 bar. Upon reaching the pressure of $P = 6$ bar, the valve actuated in 3 minutes at the ambient temperature of 25-26 °C.

Example 2

The valve element was made of TEP with a Shore hardness of 47 ± 2 . Channels with the diameter of 3 mm and 0.5 mm thick straps were made in the valve element. The device withstood the operating pressure of up to 2.5 bar. Upon reaching the pressure of $P = 5$ bar, the valve actuated in 30 seconds at the ambient temperature of 25-26 °C.

Example 3

The valve element was made of TEP with a Shore hardness of 57 ± 2 . Channels with the diameter of 4 mm and 0.7 mm thick straps were made in the valve element. The device withstood the operating pressure of up to 3.0 bar. Upon reaching the pressure of $P = 6$ bar, the valve actuated in 1 minute at the ambient temperature of 25-26 °C.

Example 4

The valve element was made of TEP with a Shore hardness of 42 ± 2 . Channels with the diameter of 3 mm and 1.5 mm thick straps were made in the valve element. The closure fitting was equipped with a protective plastic cover. The device withstood the operating pressure of up to 2.0 bar. Upon reaching the pressure of $P = 5$ bar, the valve actuated in 1 minute at the ambient temperature of 25-26 °C.

Example 5

The valve element was made of TEP with a Shore hardness of 42 ± 2 . Channels with the diameter of 5 mm and 1.6 mm thick straps were made in the valve element. The closure fitting was equipped with a protective plastic cover. The device withstood the operating pressure of up to 3.5 bar. Upon reaching the pressure of $P = 6$ bar, the valve actuated in more than 5 minutes at the ambient temperature of 25-26 °C.

[0034] The thickness of the strap of more than 1.5 mm is not effective, as the actuation time becomes more than 5 minutes.

[0035] An opening with the diameter of more than 5 mm is not practical because it does not match the dimensions of the seal. The opening diameter of less than 3 mm makes the actuation time longer than 5 minutes. When using a less than 0.2 mm thick strap, the working pressure becomes less than 1 bar which is unsuitable for many beverages, such as beer.

[0036] The claimed invention has the following advantages:

- ensuring safe storage and usage of PET kegs due to the possibility of functioning as a safety relief valve when excess pressure inside a PET keg is above the specified value and preventing the PET keg from destruction (rupture);
- indication of valve actuation due to visually observed

pressing out of the straps of the valve element and formation of through holes in the seal when the pressure inside a PET keg is above the specified value;

- design flexibility due to possible usage of protective covers on the fitting;
- workability of the device due to possible separate assembly of the fitting elements, installation of the assembled fitting on the PET keg neck, and subsequent filling of the PET keg on an automated filling line;
- flexibility due to possible usage of the fitting for different types of vessel necks and filling heads by changing only one element - the fitting cover;
- ensuring reliability and pressure integrity of the device due to the threaded connection between the cover and the ring nut, as well as due to the seal element placed along the edge of the PET keg neck when installing the fitting.

Claims

1. A fitting for a PET keg comprising a cover with a central opening with the means of connection to connect with the keg neck, a hollow rod, valve element, spring, ring nut, wherein the first end of the rod is made open and the second end of the rod is made closed and fitted with a collar step, the rod forming surface has at least one opening, wherein the valve element which can move along the rod is installed on the rod, the central opening of the valve element has an inner collar recess which is configured to engage with the collar step of the rod and the external collar recess which is configured to engage with the collar step of the cover, and a spring is installed between the valve element and the ring nut, the cover is made in the form of a mushroom and connected to the ring nut using a threaded fastener for direct installation of the fitting on the keg neck, openings for gas passage are provided at the bottom of the ring nut, a ring gasket is placed between the shoulder and cylindrical surface of the mushroom leg of the cover to seal the connection between the cover and the keg neck, while the valve element made of polymeric material with a Shore hardness of 40-60 is configured to function both as a safety relief valve and as an operation indicator, **characterized in that** the valve element comprises at least one non-through channel with the diameter of 3 to 5 mm open on the bottom side and bounded by a thin strap with the thickness of 0.2 to 1.5 mm on the top side.
2. A fitting according to Claim 1 **characterized in that** the valve element is made of thermoelastoplast, or ethylene-propylene-diene monomer based rubber, or silicone.
3. A fitting according to Claim 1 **characterized in that**

the external surface of the cover is made in the form of a circle or a truncated equal triangle, vertices of which are bounded by a circle.

4. A fitting according to Claim 1 **characterized in that** 5
the means of connection of the cover with the keg
neck is made threaded.
5. A fitting according to Claim 1 **characterized in that**
the means of connection of the cover with the keg 10
neck is made in the form of a locking connection.

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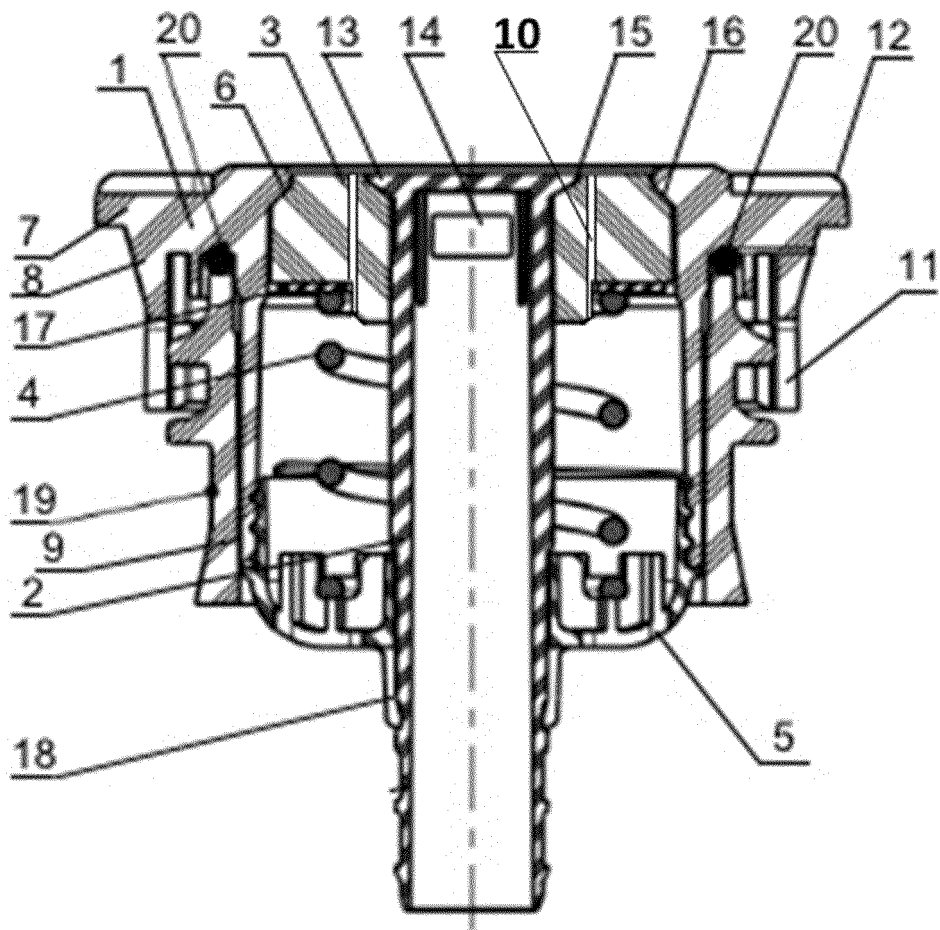


FIG. 1

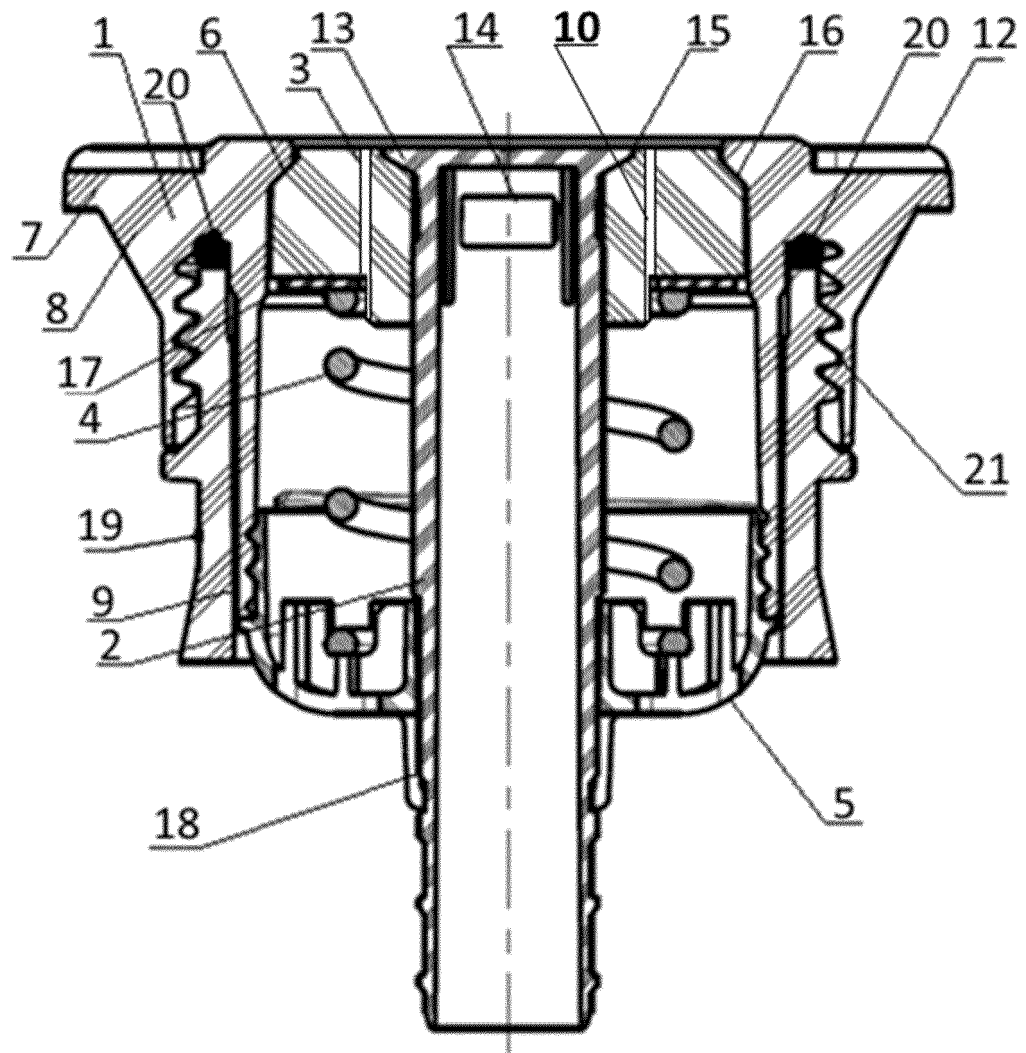


FIG. 2

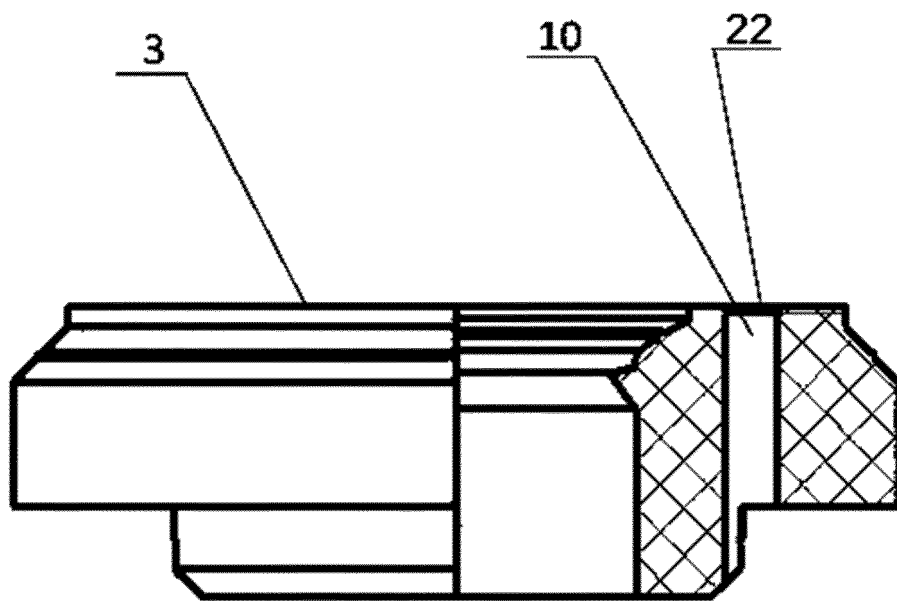


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2019/000567

A. CLASSIFICATION OF SUBJECT MATTER

B67D 1/08 (2006.01); B65D 47/00 (2006.01); B67D H12 (2006.01); B65D 47/32 (2006.01); B67C3/22 (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 1/00-1/14, B67C 3/00-3/22, B65D 47/00, 47/32

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)

PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A, D	RU 2640988 C1 (OBSHESTVO S OGRANICHENNOI OTVETSTVENNOSTJU "KAZANSKY ZAVOD "EVROPLAST") 12.01.2018	1-5
A	US 2007/284371 A1 (INBEV S.A.) 13.12.2007	1-5
A	WO 2019/048868 A1 (POLYKEG SRL et al) 14.03.2019	1-5
A	WO 2018/142148 A1 (PETAINER LARGE CONTAINER IP LIMITED) 09.08.2018	1-5

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

04 December 2019 (04.12.2019)

Date of mailing of the international search report

05 December 2019 (05.12.2019)

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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]
- WO 2640988 A [0008]