United States Patent [19]

Nishiguchi et al.

[11] **3,788,550**

[45] **Jan. 29, 1974**

[54] **AUTOMATIC INTERMITTENT SPRAY VALVE FOR PRESSURIZED PACKAGING**

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[73] Assignee: **Tokusyu Aerosol Company, Ltd.**, Tokyo, Japan

[22] Filed: **Oct. 6, 1972**

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[52] **U.S. Cl.** **239/337**

[51] **Int. Cl.** **B65d 83/14**

[58] **Field of Search** 239/350, 337, 573, 579; 222/402.2, 389

[56] **References Cited**

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Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Andres Kashnikow
Attorney, Agent, or Firm—Ladas, Parry, Von Gehr, Goldsmith & Deschamps

[57] **ABSTRACT**

An automatic intermittent spray valve for pressurized packaging or aerosols comprising a piston cylinder which is composed of a greater diameter section and a smaller diameter section, both sections being communicated with the discharge valve of a pressurized package container. A channel connecting said discharge valve and the greater diameter section is choked by a flow regulating means, a needle valve for instance. As the contents of the pressurized package container (liquefied gas composition) enters the greater diameter section of the piston cylinder at a controlled rate, the free piston moves toward the smaller diameter section and effects spraying when the piston has moved to some extent. After the spraying is effected, the free piston returns to the initial position and thus intermittent spraying is repeated. This valve can be used for the conventional pressurized packaging and intermittent spraying is effected at constant intervals regardless of change in the ambient temperature.

5 Claims, 4 Drawing Figures

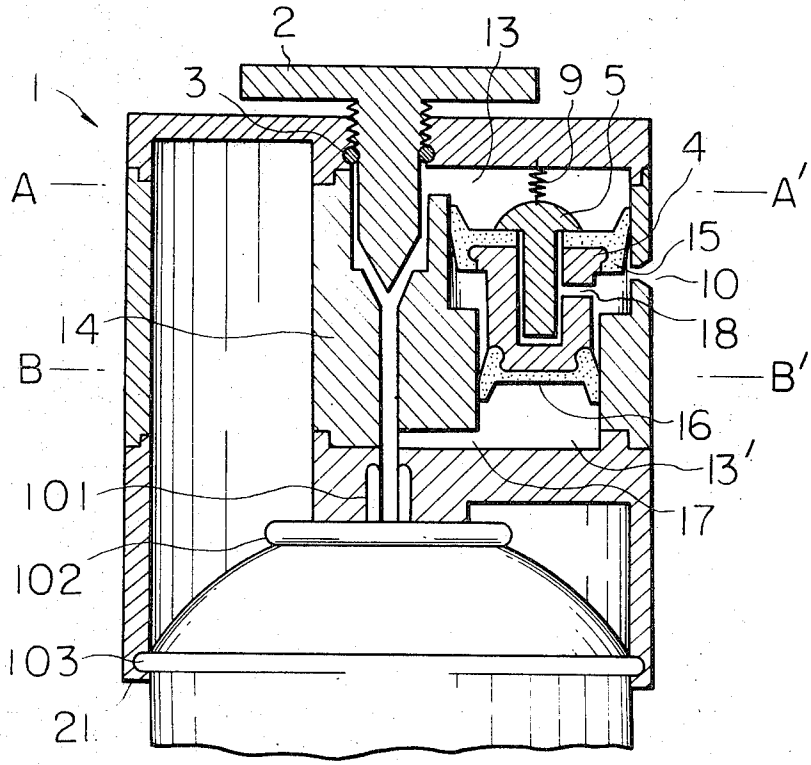


Fig. 1

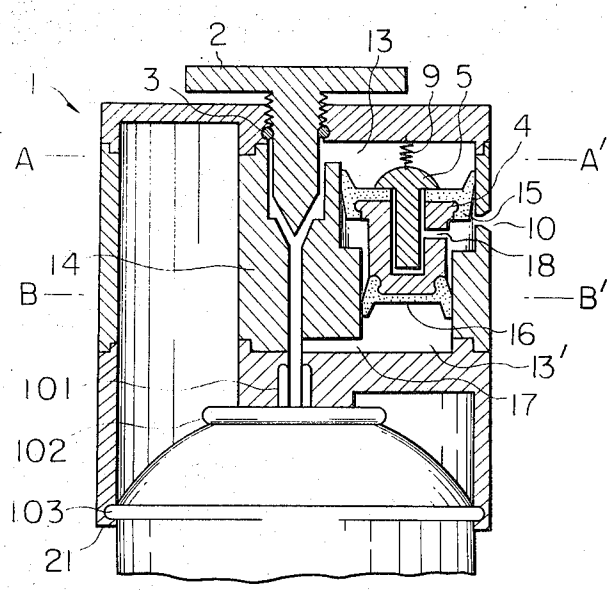


Fig. 2A

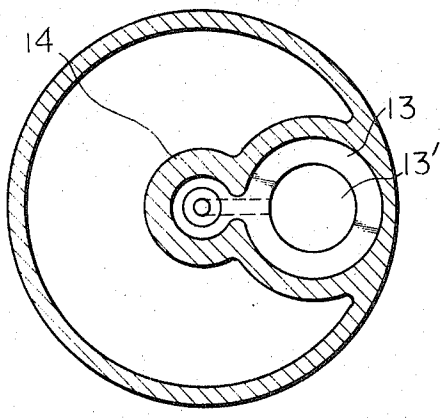


Fig. 2B

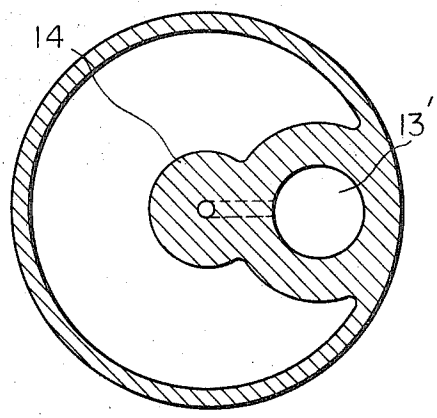


Fig. 3A

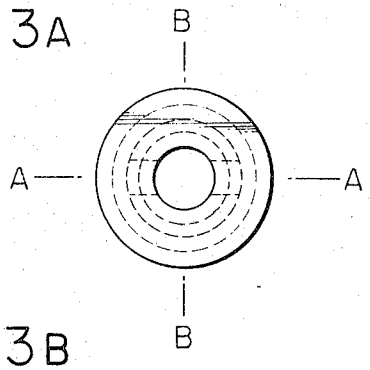


Fig. 3C

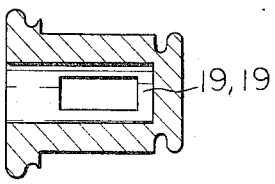


Fig. 3B

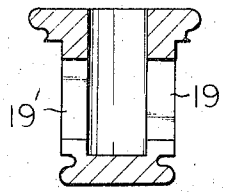


Fig. 3D

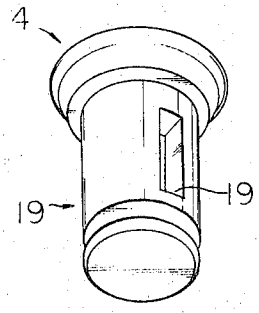


Fig. 3E

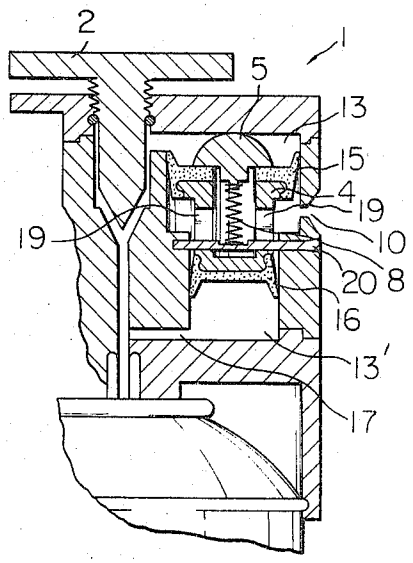


Fig. 4 E

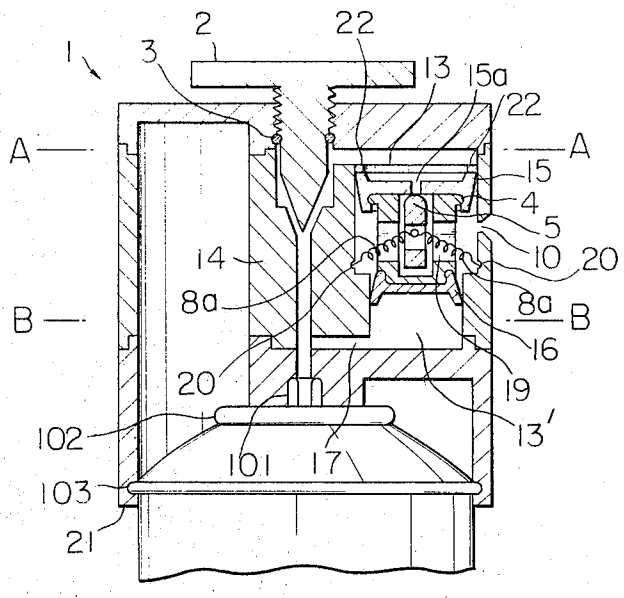
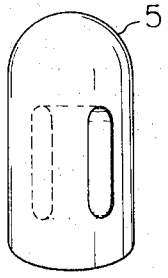

1
2
3
22
13
15a
22
A
A
15
4
5
10
20
14
8a
B
8a
B
16
19
20
13'
102
101
17
103
21

Fig. 4 F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AUTOMATIC INTERMITTENT SPRAY VALVE FOR PRESSURIZED PACKAGING

BACKGROUND OF THE INVENTION

This invention relates to an automatic intermittent spray valve for pressurized spray packaging or so-called aerosols.

With aerosol type deodorants, insecticides, space sanitizers, medicines (for instance, a remedy for hay fever called "vaporizer"), etc., it is often desirable to have the perfume or medicinal substance contained therein discharged intermittently so as to maintain a constant predetermined level of the substance in a space.

Several apparatuses intended to be used for the above-mentioned purpose are known. One is a simple apparatus which actuates the spray valve of a pressurized product every time a door is opened or closed; another is a more complicated apparatus in which an electromagnetic valve is used in combination with a timer.

However, the simple apparatus does not always operate the spray valve precisely and the use thereof is quite limited, and the more complicated apparatus is expensive and requires an electric source and therefore it is not suited for universal use. The other known apparatuses are the same as these in that they are not suitable for practical use.

Of course it has been considered to construct an automatic apparatus to intermittently spray a pressurized package product by utilizing the internal pressure of the pressurized package product per se and a resilient member which counteracts or is balanced with the former. The principle of such an apparatus or mechanism is as follows: Contents of a pressurized packaging product (a liquefied gas composition) is let, at a controlled flow rate, into a piston cylinder which is closed by a piston pressed by a resilient means (spring or other means). When the vapor pressure of the liquefied gas composition which gradually fills the piston cylinder space becomes enough to overcome the force of the resilient member, the piston is driven, a spray discharge orifice is opened and the liquefied gas composition which has been confined in the piston cylinder space is discharged. As soon as the discharge is effected, the pressure in the piston cylinder becomes nil and the force exerted by the resilient member returns the piston to the original position, closing the spray discharge orifice, and again letting the product flow into the piston cylinder.

In this mechanism, however, close contact of the piston and the piston cylinder wall is maintained by means of an O-ring or the like, and therefore such mechanism does not work smoothly. So there was no practically successful device of this mechanism. In contrast to said prior art, there is an automatic intermittent spray valve for pressurized package products invented by us, the inventors of the present invention, which is smoothly operated by virtue of the internal pressure of the product by combination of a smoothly moving stem valve with a piston which slides inside a piston cylinder keeping tight contact therewith. (Japanese Pat. application Nos. 046286/71 and No. 070843/71).

In these automatic intermittent spray valves, the force which holds the piston resisting the vapor pressure of the contents of the pressurized package product is provided by a spring. However, the resilient force or strength of a spring is substantially constant all the time independent of temperature while vapor pressure of the liquefied gas composition is sensitive to and is influenced by temperature. Therefore the interval of actuation of the valve varies according to the change in the ambient temperature. In an extreme case, actuation of the valve, that is, spraying will not take place unless the resiliency or the strength of the spring is modified.

The purpose of this invention is to provide an automatic intermittent spray valve for use with a pressurized package product which is free from the above-explained defects and is actuated smoothly and intermittently at relatively equal intervals regardless of change in the ambient temperature.

SUMMARY OF THE INVENTION

In the most generic aspect, the automatic intermittent spray valve of this invention comprises: (1) a valve body which comprises a channel for a liquefied gas composition (contents of a pressurized package product) which can be connected to the valve stem of a conventional pressurized package container; a means for regulating the flow rate of the liquefied gas composition flowing through the channel from the pressurized package container; and a piston cylinder which is composed of a greater diameter section communicating with said channel at the lower stream side of said flow regulating means and a section of smaller diameter communicating with said channel at the upper stream side of said flow regulating means, and is provided with a spray orifice in the middle section thereof; (2) a free piston placed in said piston cylinder, said piston being integrally composed of a greater diameter part which keeps a gas-tight contact with the inside wall of said greater diameter section of the cylinder and has a through-hole and a smaller diameter part which keeps gas-tight contact with said smaller diameter section of the cylinder; and (3) a stopper piece which is supported by a resilient means and closes the through-hole of the greater diameter part of the piston when the piston is positioned at the greater diameter section side, and opens said through-hole when the piston has moved toward the smaller diameter section side to some extent.

In a preferred embodiment, the free piston is provided with a bucket type gasket respectively at the greater diameter part and the smaller diameter part, which slides smoothly along the inside wall of the piston cylinder keeping a gas-tight seal.

The stopper piece can be of varied structures. A few suitable structures thereof are explained in the Detailed Description of the Invention.

The automatic intermittent spray valve of this invention is mounted on the top of the conventional pressurized package container so that the inlet of the valve is tightly connected to the valve stem of the container keeping the container valve open. Then the pressurized product is sprayed intermittently at regular intervals regardless of change in the ambient temperature.

The automatic intermittent spray valve of this invention can be easily manufactured by those skilled in the field of aerosol spray valves using known materials guided by the drawings disclosed herein.

BRIEF EXPLANATION OF THE DRAWINGS

"FIG. 1 is a sectional view in elevation of an embodi-

ment of the automatic intermittent spray valve of this invention. FIG. 2(A) is sectional view along lines A – A′ in FIG. 1. FIG. 2(B) is sectional view along lines B – B′ in FIG. 1. FIG. 3(E) is a sectional view in elevation of another embodiment of the invention. FIG. 3(A) is a plan view of the piston used in the embodiment of FIG. 3(E). FIG. 3(B) is a cross-sectional view along line A – A′ of the same piston. FIG. 3(C) is a cross-sectional view along line B – B′ of the same piston. FIG. 3(D) is a tilted external view of the piston. FIG. 4(E) is a sectional view in elevation of still another embodiment of the invention. FIG. 4(F) is a side view of the stopper used in FIG. 4(E).

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, the valve body is shown at 1. One part of the valve body constitutes a piston cylinder which is composed of a greater diameter section 13 and a smaller diameter section 13′. The shape of the piston cylinder will be well understood by referring to FIG. 2 A and B as well as FIG. 1. The other part thereof constitutes a channel 14. The channel 14 connects the discharge valve 101 of the pressurized package container and the piston cylinder sections 13, 13′. The channel 14 is choked by a flow regulating means 2, which is a needle valve in this case. The whole valve body is removably secured to the spray container so as to hold the container discharge valve in the open state, for instance, by a locking means 21, which engages with the upper seam of the spray container.

The flow regulating means or needle valve 2 is a gas-tightly held by means of an O-ring 3 and regulates the opening of the flow channel by screw adjustment.

The greater diameter section 13 of the piston cylinder communicates with the flow regulating channel and the smaller diameter section 13′ communicates with the inlet side of the flow channel 14 through a passage 17. The cylinder has a spray orifice 10 in the middle section thereof, said orifice opening to the atmosphere.

The cylinder (13 & 13′) contains a free piston of a special structure 4. This piston, for instance, comprises a cylindrical body with a bottom and a through hole 18 in the side wall as shown at 4 in FIG. 1. At the opening and the bottom, bucket type gaskets 15 and 16 made of an elastomer are respectively secured. The buckets contact the inside wall of the piston cylinder sections 13, 13′ gas-tightly but slide very smoothly. The larger bucket 15 has a through hole, the diameter of which is approximately the same as the inside diameter of the cylindrical piston 4.

A stopper piece, a rivet-like piece 5 in this case, is inserted in the bottomed cylindrical piston 4 with its head out, said head being supported by a spring 9 fixed to the valve body 1. The peripheral underside surface of the rivet-head keeps gas-tight contact with the surface of the bucket 15.

When the flow regulating means is closed, that is, the needle valve 2 is closed, the liquefied gas composition, that is, the content of the pressurized product, enters the smaller diameter section 13′ of the piston cylinder through the passage 17, driving the piston 4 upward. Thus the piston 4 stands still approximately at the position where the vapor pressure of the liquefied gas composition and the resilient force of the spring 9 are balanced, if the pressure of the air initially confined in the greater diameter section 13 of the cylinder is neglected.

If the flow regulating means is slightly opened, the liquefied gas composition slowly enters the greater diameter section 13 of the cylinder, and the piston gradually moves downwards, because the surface area of the bucket and hemispherical surface of the rivet-like stopper which receives the vapor pressure of the liquefied gas composition is greater than that of the bucket 16.

However, after the piston is displaced to some extent, the tensile force of the spring 9 now operates and the rivet-like stopper is left behind the movement of the piston and thus the gas tight contact of the rivet-like stopper 5 and the bucket 15 is broken and the liquefied gas composition confined in the space 13 is sprayed through the through-hole 18 and the spray orifice 10. At this moment, the vapor pressure (gauge pressure) inside the space 13 becomes nearly zero because the inflow of the liquefied gas composition into the space 13 is restricted by the flow regulating means 2. Therefore the piston is driven upward by the vapor pressure operating on the surface of the bucket 16 until it reaches its initial position. But soon the liquefied gas composition enters the space 13 again and the cycle is repeated.

The inflow of the liquefied gas composition into the greater diameter section 13 takes some time because it is restricted by the flow regulating means. Also the greater diameter section 13 is cooled somewhat by the vaporization and expansion of the liquefied gas composition, so it takes some time before this section regains its initial temperature.

Therefore, it takes some time for the vapor pressure inside the section 13 to return to the value comparable with the vapor pressure inside the section 13′. According to this delay, intermittent spraying is effected.

In another embodiment of this invention, the piston 4 is constructed as shown in FIG. 3A to 3E. As seen in FIG. 3D, the piston 4 has a pair of slots or windows in the side wall at the diametrically opposite positions as shown at 19. In FIG. 3E, the buckets 15 and 16 are the same as in the previous embodiment. A crosspiece or bar 20 is fixed diametrically in the cylinder penetrating the windows 19 of the piston 4. A rivet-like stopper 5 is placed on the upper bucket surface with the end thereof inserted in the cylindrical piston. A spring is connected to the end of the rivet-like stopper 5 in one end thereof and to the center of the crosspiece 20 at the other end thereof. In this case the strength of the spring 8 is selected so that the initial resilient (compressive) force of the spring 8 is weaker than the pressure applied to the hemispherical surface of the rivet head.

When the liquefied gas composition enters the section 13 at a controlled rate, its vapor pressure is applied to both the surface of the bucket 15 and the hemispherical head of the rivet-like stopper. The total pressure applied to these surfaces is greater than that applied to the surface of the smaller bucket 16. Therefore, the piston 4 gradually moves downward. However, when the piston moves downward to some extent, the resilient (compressive) force of the spring 8 becomes greater than the vapor pressure applied to the hemispherical surface of the rivet-like stopper. Then the contact of the bucket 15 and the rivet-like stopper 5 is broken and the liquefied gas composition is sprayed through the windows 19 and the spray orifice 10. At this moment, the vapor pressure inside the space 13 becomes substantially nil, and the piston returns upward driven by the pressure applied to the smaller bucket 16. The next

cycle starts with the flow of the liquefied gas composition into the section **13**. Thus the intermittent spraying at regular intervals is effected.

Still another embodiment of this invention is shown in FIG. 4(E), which is an elevational cross section illustrating the construction thereof. The construction is the same as that of the previous embodiment shown in FIG. 3(E) except that the diameter of the hole **15***a* of the larger bucket **15** is smaller than the diameter of the cylindrical hollow of the piston **4**, and the stopper piece **5** placed in the cylindrical hollow of the piston is not rivet-like but is bullet-like. FIG. 4 (F) is a side view of this stopper piece. The stopper piece has a slot diametrically extending there through. The combination of a crosspiece **8** and a spring **20** in FIG. 3 is replaced with a resilient means **8***a*. In FIG. 4(E) the resilient means is a spring, which penetrates the slot of the stopper piece and is fixed to the piston cylinder wall at both ends. The spring is bent so that its resilient force pushes the stopper piece either upward or downward. If desired, the center of the spring may be secured to the stopper piece at a suitable position in the slot thereof. In the greater diameter section, a stopper **22** is provided.

When the piston is positioned at the greater diameter section side and the spring **8***a* is bent upward, the stopper piece is pressed onto the hole of the larger bucket **15** so as to close the hole. But as the liquefied gas composition enters the piston cylinder section **13**, the piston gradually moves downward as explained in the above. And when the piston **4** moves past the point where the center of the spring **8***a* which has been upwardly bent turns downward, the stopper piece which has been pressed onto the hole of the larger bucket **15** is then pressed downward and thus the opening at **15***a* is opened. Therefore, the liquefied gas confined in the space **13** is sprayed. As soon as spraying effected, the piston returns to its initial position. Thus intermittent discharge of the liquified gas composition at regular intervals is effected.

The invention has been explained with reference to a few preferred embodiments thereof, but it should be understood that the various modifications in design can be made by those skilled in the art within the scope of the inventive idea of this application.

What we claim is:

1. An automatic intermittent spray valve for pressurized package products comprising: (1) a valve body which comprises a channel for a liquefied gas composition (contents of a presurrized package product) which can be connected to the valve stem of a conventional pressurized package container; a means for regulating the flow rate of the liquefied gas composition flowing through the channel from the pressurized package container; and a piston cylinder which is composed of a greater diameter section communicating with said channel at the lower stream side of said flow regulating means and a smaller diameter section communicating with said channel at the upper stream side of said flow regulating means, and is provided with a spray orifice in the middle section thereof; (2) a free piston placed in said piston cylinder, said piston being composed of a greater diameter part which keeps a gas-tight contact with the inside wall of said greater diameter section of the cylinder and has a through-hole and a smaller diameter part which keeps a gas-tight contact with said smaller diameter section of the cylinder and the both parts being rigidly connected in a fashion that said greater diameter section communicates with the spray orifice when said through-hole is opened; and (3) a stopper piece which is suported by a resilient means secured to the piston cylinder and closes the through-hole of the greater diameter part when the piston is positioned at the greater diameter section side, and opens the through-hole when the piston has moved toward the smaller diameter section side to some extent.

2. The automatic intermittent spray valve for pressurized package products as described in claim **1**, wherein the free piston is provided with a bucket type gasket which slides along the piston cylinder wall keeping gas tightness at each end thereof.

3. The automatic intermittent spray valve for pressurized package products as described in claim **2**, wherein the free piston comprises a bottomed cylinder having a through-hole in the side wall thereof, and the stopper piece is a rivet-shaped piece which is inserted in the hollow of the piston with the head thereof out of the hollow and is supported by the valve body by means of a spring.

4. The automatic intermittent spray valve for pressurized package products as described in claim **2**, wherein the free piston comprises a bottom cylinder having two slots or windows provided in the cylinder wall at the diametrically opposite positions, and the stopper piece is a rivet-shaped piece which is inserted in the hollow of the piston with the head thereof out of the hollow and is supported by a spring one end of which is connected to the tail end of the stopper piece and the other thereof is secured to a crosspiece which penetrates the two slots of the piston and is secured to the piston cylinder wall at both ends.

5. The automatic intermittent spray valve for pressurized package products as described in claim **2**, wherein the free piston comprises a bottomed cylinder having two slots or windows provided in the cylinder wall at the diametrically opposite positions, and the stopper piece is bullet shaped and has a slot extending diametrically therethrough and is located within the piston and supported by resilient means which extends through the slots of the piston and the slot of the stopper piece and is secured to the piston wall at both ends.

* * * * *