(54) Title: AEROSOL CONTAINER WITH A PISTON

(57) Abstract: An aerosol dispensing container (10) includes a housing having a sidewall (11) and a piston (13) disposed in the housing to sealingly separate the aerosol container into two chambers (17, 18) on opposite sides of the piston. The piston (13) has an upwardly facing annular flexible sealing element (21) in contact with a sidewall of the housing and has a downwardly facing annular flexible sealing element (23) below the upwardly facing sealing element in contact with the sidewall of the housing. The upper and lower seals prevent cocking of the piston and also result in a pressure differential which causes the wall of the piston to be pushed outwardly to force the sealing elements in harder contact with the sidewall of the housing.
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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AEROSOL CONTAINER WITH A PISTON

BACKGROUND OF THE INVENTION

This invention relates to aerosol containers and, more particularly, to aerosol containers using a free-floating piston.

In order to dispense a fluent product from an aerosol container, a barrier is used between the product and propellant. Two types of barriers are commonly used. One is a free-floating piston and the other is a bag. In the case of a bag there is no place for the propellant to bypass the bag since the bag is sealed to the container and functions by collapsing under the propellant pressure when the valve is actuated.

Some bags tend to be expensive and bags generally retain some product.

Free-floating pistons, however, are inexpensive and retain very little product. By the very fact that pistons are free-floating, there is a possibility of propellant migration or bypass past the floating seal and consequent degradation of the product.

There are various pistons discussed in prior patents and known in the industry. The most efficient pistons are those that have a flexible sealing element as part of the piston, such as described in U.S. Patent No. 4,234,108 and U.S. Patent No. 3,381,863.

In U.S. Patent No. 4,234,108, the entire disclosure of which is incorporated by reference herein, the sealing element faces upwardly and is pressed against the wall of the container by its own tension and the force of the compressed product. In the case of U.S. Patent No. 3,381,863 there are a plurality of sealing elements and they all face downwardly. Pressure from the compressed product tends to move the sealing element away from the wall.

As the barrier piston moves upwardly in the aerosol container during expulsion of the fluent product, the piston sometimes cocks and does not always maintain an orientation in which its axis is aligned with the axis of the container. The cocking creates a space between the floating seal and the wall of the container enabling the propellant to bypass the seal and contaminate the product. Accordingly, pistons typically have an anti-cocking means which prevents them from tilting or
cocking to too great an angle, but a certain minimum degree of cocking nevertheless, occurs, resulting in a less than secure seal and contamination of the product.

**SUMMARY OF THE INVENTION**

The present invention overcomes the foregoing disadvantages by providing a free-floating piston which has at least two sealing elements, at least one facing upwardly and at least one facing downwardly.

Preferably, the upwardly and downwardly facing sealing elements are spaced from one another. Accordingly, there is no cocking of the pistons, thereby resulting in a more secure seal without the need for special anti-cocking means.

Additionally, the sealing elements are preferably made flexible. Accordingly, the upwardly facing sealing element at the top is pressed against the wall by the resiliency of the sealing element and product pressure and the downwardly facing sealing element at the bottom is pressed against the wall by its resiliency and the pressure of the propellant which is below it. This action prevents bypass of the propellant into the product chamber and the consequent contamination and deterioration of the product.

More specifically, if a piston is fitted with both an upwardly facing upper sealing element (or elements) and a downwardly facing lower sealing element (or elements) then, once the piston has been moved upward and comes to rest against the fluent product in the container, both of these seals will be energized by the pressure difference between the trapped annular volume (which is approximately at atmospheric pressure) and the fluent product (in the case of the upper seal) or the propellant (in the case of the lower seal) which are at respective pressures considerably higher than atmospheric pressure. This pressure difference and the resulting energizing action cause sealing elements to be forced into harder sealing contact with the walls of the container, which results in better sealing contact and decreases the possibility of fluid or propellant bypass.

In contrast, when a container which is fitted with a free-floating piston with either a single upward pointing sealing element (or elements) or a single downward pointing sealing element (or elements) is pressurized below the piston, the piston is
then moved upward and comes to rest against the fluent product in the container. At this point the pressure is equal on both sides of the piston and the sealing element (or elements). Since the pressure is equal on both sides of the seal, the seal relies solely on its own mechanical fit to the can wall to prevent fluid or pressurizing gas from bypassing the seal. This results in a less secure seal, resulting in a greater possibility of propellant bypass with consequent contamination and deterioration of the fluent product.

Other features and advantages of the present invention will become apparent from the following description of the invention which refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional, elevational, diagrammatic view of an aerosol container having a piston according to the present invention; and

Fig. 2 is a partial cross-sectional, elevational, diagrammatic view of the aerosol container of Fig. 1 showing the effect of differences in pressure in the aerosol container.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring now to Fig. 1, there is shown an aerosol container 10 which includes a housing including a cylindrical sidewall 11, which may be made of a thin sheet metal, such as aluminum, steel or a non-metallic material, and a conventional outlet nozzle and valve assembly 12.

Disposed inside the aerosol can is a barrier piston 13 which may have a domed head 14 and a depending generally cylindrical wall 16. The piston 13 separates the housing into two chambers, an upper chamber 15 and a lower chamber 20, on opposite sides of the piston 13. A fluent product 17 to be dispensed is disposed in the upper chamber 15 and, a propellant gas 18 or a quantity of liquefied propellant is disposed in the lower chamber 20.

The piston 13 further includes an upper annular sealing flange which defines an upwardly facing sealing element 21 and a lower annular flange which defines a
downwardly facing sealing element 23. The piston 13 is made of a flexible material such as various plastics or thin metals so that the sealing elements 21 and 23 are flexible.

Referring to Fig. 2, in operation, the upwardly facing sealing element 21 is pressed against the wall 11 by its resiliency and the pressure $P_2$ of the fluent product 17, and the downwardly facing sealing element 23 is pressed against the wall 11 by its resiliency and the pressure $P_3$ of the propellant gas 18. This action prevents bypass of the propellant gas 18 into the fluent product 17, which thereby prevents a consequent deterioration of the fluent product 17 which would result from mixing the fluent product 17 with the propellant gas 18.

Further, referring to Fig. 2, the upper and lower sealing elements 21 and 23 trap or contain a volume 24 of gas at an atmospheric pressure $P_1$ therebetween. The pressure $P_3$ of the propellant gas 18 is higher (generally considerably higher) than the pressure $P_1$ of the trapped volume 24. This results in a differential pressure acting on the wall 16 of the piston 13 (diagrammatically indicated by the arrows in Fig. 2), causing the piston wall 16 to be flexed. As the piston wall 16 is flexed outward from the position shown in solid lines in Fig. 2 to the position shown in dashed lines, it will force the sealing elements 21 and 23 more tightly against the can wall 11, thus, increasing the sealing force in creating a better seal.

The pressure $P_2$ of the fluent product 17, like the pressure $P_1$ of the propellant gas 18, is also higher (generally considerably higher) than the pressure $P_1$ of the trapped volume 24. Further, the pressure $P_2$ is equal to the pressure $P_3$ when the fluent product 17 is not flowing from the container 10 and only very slightly lower when fluent material is flowing.

The differential in pressure between the fluent product 17 and the trapped volume 24 also forces the upper sealing element 21 into harder sealing contact with the wall 11, while the pressure differential between the propellant gas 16 and the trapped volume 24 also forces the lower sealing element 23 into harder sealing contact with the wall 11.
The embodiment of Fig. 1 employs only one upper sealing element 21 and one lower sealing element 23. However, if desired, to provide even more effective sealing, a plurality of upper and lower sealing elements may be employed.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.
WHAT IS CLAIMED IS:

1. An aerosol dispensing container comprising:
   a housing having a sidewall; and
   a piston disposed in the housing to sealingly separate the aerosol container
   into two chambers on opposite sides of said piston, said piston having an upwardly
   facing annular sealing element in contact with a sidewall of the housing and having
   a downwardly facing annular sealing element below the upwardly facing sealing
   element in contact with the sidewall of the housing.

2. An aerosol dispensing container according to claim 1, wherein each
   of
   the upper and lower sealing elements is flexible.

3. An aerosol dispensing container according to claim 2, wherein the
   upper
   and lower sealing elements are spaced from each other.

4. A piston for an aerosol dispensing container comprising:
   a piston head;
   a depending generally cylindrical piston wall depending from the piston
   head;
   an upwardly facing annular sealing element extending from the piston wall
   below the piston head and in contact with a sidewall of the housing to sealingly
   separate the aerosol container into two chambers on opposite sides of said piston
   head; and
   a downwardly facing annular sealing element extending from the piston wall
   below the upwardly facing sealing element and in contact with the sidewall of the
   housing.

5. A piston for an aerosol dispensing container according to claim 1,
   wherein each of the upper and lower sealing elements is flexible.
6. A piston for an aerosol dispensing container according to claim 2, wherein the upper and lower sealing elements are spaced from each other.

7. An aerosol dispensing container comprising:
   a housing having a sidewall;
   a piston to sealingly separate the aerosol container into two chambers, an upper chamber and a lower chamber, on opposite sides of said piston, said piston having a generally cylindrical piston wall depending therefrom;
   an upper upwardly facing annular sealing element extending from the piston wall in contact with a sidewall of the housing;
   a lower downwardly facing annular sealing element extending from the piston wall in contact with the sidewall of the housing;
   a fluent product having a pressure $P_2$ in the upper chamber; and
   a propellant having a pressure $P_3$ in the lower chamber, the upper and lower sealing elements trapping a volume of gas having a pressure $P_1$ between the upper and lower sealing elements, the piston wall and the sidewall of the container, the pressure $P_1$ being less than the pressure $P_2$ or the pressure $P_3$.

8. An aerosol dispensing container according to claim 7, wherein the pressure $P_2$ is equal to the pressure $P_3$ when fluent product is not flowing from the container and only very slightly lower when fluent product is flowing.

9. An aerosol dispensing container according to claim 7, wherein each of the upper and lower sealing elements is flexible.

10. An aerosol dispensing container according to claim 7, wherein the upper and lower sealing elements are spaced from each other.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

| IPC | B65D83/64 |

According to International Patent Classification (IPC) or both national classification and IPC.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

| IPC | B65D |

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 practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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