

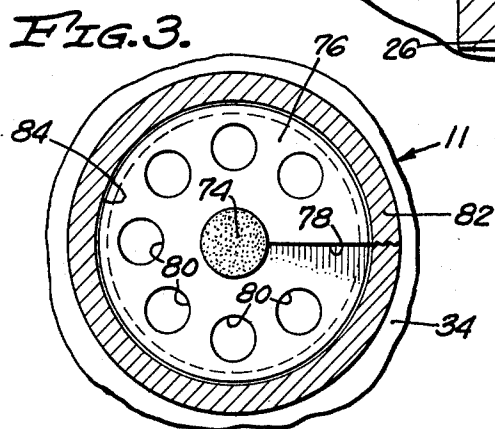
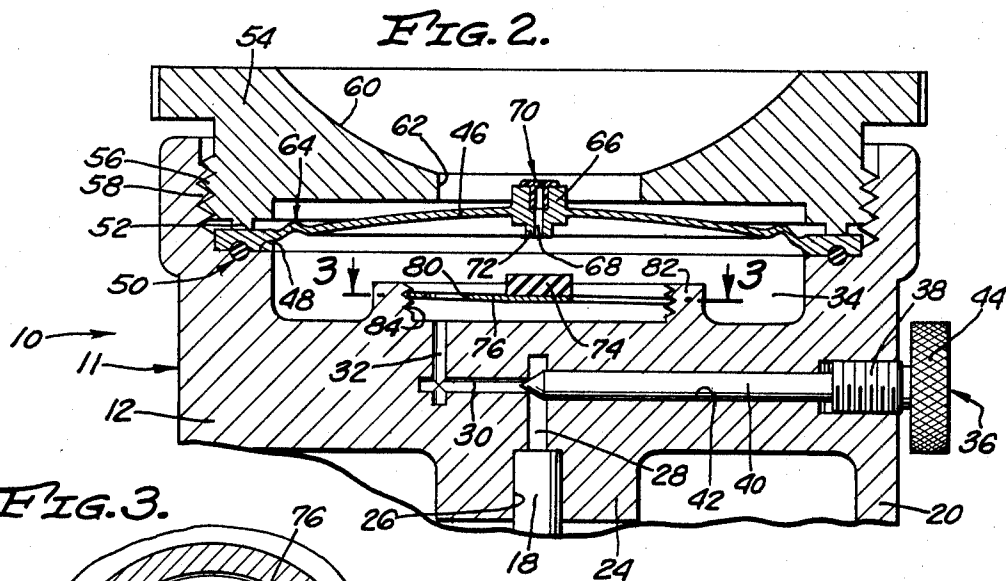
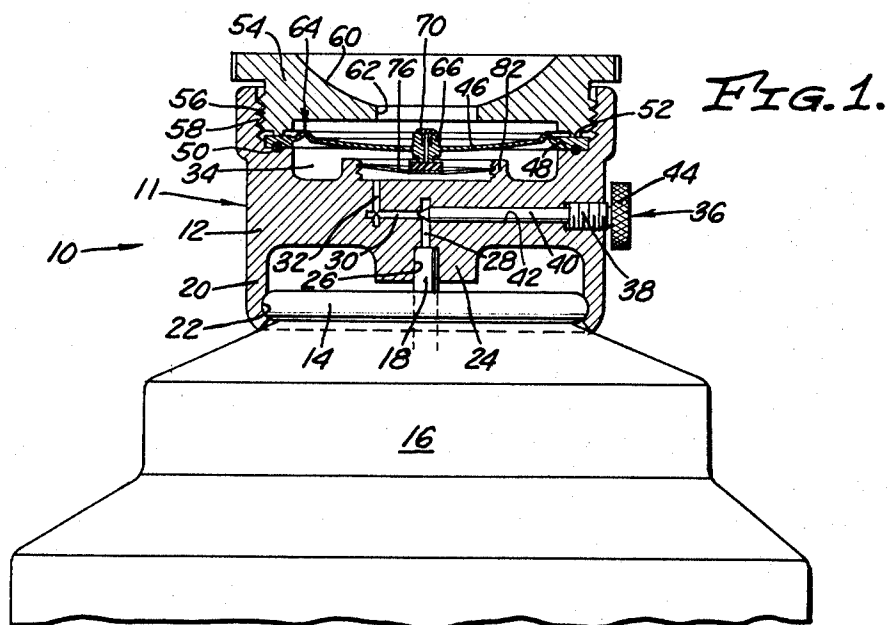
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J. J. MANGEL

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AEROSOL DISPENSER ACTUATED BY PROPELLANT PRESSURE

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INVENTOR
JOHN J. MANGEL
BY
William T. Wise
AGENT

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**AEROSOL DISPENSER ACTUATED BY
PROPELLANT PRESSURE****John J. Mangel, Riverside, Calif., assignor to Dart Industries Inc., Los Angeles, Calif., a corporation of Delaware****Filed Feb. 29, 1968, Ser. No. 709,394****Int. Cl. B67d 5/08; B65d 83/14; F16k 31/50****U.S. Cl. 222—70****5 Claims****ABSTRACT OF THE DISCLOSURE**

A flow-control valve allows pressurized liquid to leak slowly from an aerosol container into a chamber having a valve-actuating, snap-action diaphragm on one side thereof. The diaphragm is spherically crowned toward a first, valve-closed position, and any pressure applied against the concave side creates internal stresses within the diaphragm, causing it to resist deflection under load. As pressure builds up in the chamber, it pushes the diaphragm past a certain point, causing it to snap over to a second, valve-open position. As pressure is released through the open valve, the diaphragm snaps back to its original valve-closed position.

Background of the invention

This invention relates to automatic, timed interval dispensers for containers filled with pressurized liquid, and its primary object is to provide a dispenser which is self-contained and requires no external power, such as batteries, electric motors, spring motors, and the like, for its operation.

More specifically, the invention relates to automatic dispensers for aerosol containers filled with an active ingredient and a pressurized liquid propellant, such as halogenated fluorocarbon (Freon), of which there is a wide variety on the market. The liquid preparations are packed in containers usually having a spring-loaded valve stem projecting from the top end thereof, and when this valve stem is depressed, a fine spray of atomized liquid is discharged into the atmosphere.

There are times when it is desirable to maintain a more-or-less constant dispersion of finely divided mist in the air to obtain continuous effect of the active ingredient. For example, it might be desired to spray metered quantities of an insecticide, or room freshener, or pharmaceutical preparation, into the air at predetermined intervals of time so as to keep a particular area completely free of insects, or to keep it constantly fresh, or to maintain at least a certain minimum concentration of the pharmaceutical preparation dispersed in the air for continuous and long-lasting effect.

A number of such devices are already known in the art, which function to discharge metered quantities of spray into the air at predetermined intervals of time. Most of these use a spring-powered or electric clockwork timer, or a battery-powered, electronic timer having a solid state circuit, which periodically actuates a cam or solenoid mechanism to depress the valve stem momentarily. The chief disadvantage of these prior devices is that they are complicated, relatively expensive, and in the case of the electrically powered units, must be located adjacent an electrical outlet, or else have batteries replaced at frequent intervals.

Summary of the invention

One important object of this invention is to provide an automatic, timed interval dispenser of the class described, which is actuated by the vapor pressure of the propellant in the aerosol container. This is accomplished by means of an arrangement wherein pressurized liquid from the container is allowed to leak at a very slow, controlled rate

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into a chamber having a valve-actuating, snap-action diaphragm on one side thereof. The diaphragm is spherically crowned so that it is normally convex downwardly into the said chamber, in which position it closes an outlet valve opening to the atmosphere. The diaphragm is of elastic material and tends to resist upward bowing under pressure of the propellant acting against the convex side thereof. However, as the leakage progresses and pressure builds up, the elastic resistance of the diaphragm is finally overcome, and it snaps over to a second position, in which the outlet valve is open, allowing the pressurized liquid in the chamber to escape into the air as a very fine mist.

Another object of the invention is to provide an automatic dispenser of the class described which is inexpensive, compact, and reliable.

A further object of the invention is to provide a dispenser for aerosol containers, wherein the frequency of the dispensing cycle may be quickly and easily adjusted over a wide range.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment thereof, which is illustrated in the drawings.

Brief description of the drawings

FIGURE 1 is a sectional view of an automatically timed dispenser embodying the principles of the invention, showing the same mounted on the top end of an aerosol container, the diaphragm being illustrated in normal, valve-closed position;

FIGURE 2 is a similar view of the same, drawn to a larger scale showing the diaphragm in its momentary valve-open position, at the instant of discharge; and

FIGURE 3 is a fragmentary sectional view taken at 3—3 in FIGURE 2, showing the resilient disk upon which is mounted a rubber pad forming the seat for the outlet valve.

Description of the preferred embodiment

The invention is designated in its entirety by the reference numeral 10, and consists of a body member 11 comprising an assembly of parts which form the unit as a whole, the major component of which is a generally cylindrical body 12. The body 12 fits over and grips a rolled flange 14 at the top end of an aerosol container 16. Projecting upwardly from the center of the closure at the top end of the container 16 is a spring-pressed tubular stem 18, which constitutes the plunger of an internal valve (not shown) which is opened when the stem is depressed. Usually, there is an atomizer head mounted on the top end of the stem 18 with a laterally directed nozzle in one side thereof, through which the fine spray is discharged. The said nozzle head usually serves as a button which is depressed by one finger to discharge the aerosol spray. In the present invention, the said atomizer head is dispensed with. The internal valve of the aerosol container usually has a dip tube extending down to the bottom of the container, so that the liquid is discharged from the bottom of the container when the same is upright.

The body 12 has a cylindrical skirt, or flange 20 projecting downwardly from its under side, and formed in the inner surface of the skirt near the bottom edge thereof is a shallow annular groove 22, which receives the rolled flange 14 to hold the body 12 to the can. The skirt 20 is a snap-fit over the flange 14, and is sufficiently elastic to permit stretching slightly to enable it to snap over the flange. The skirt 20 may also be slotted longitudinally, if desired, to provide increased resiliency so that its bottom end is able to stretch when pressed down over the flange 14.

Projecting downwardly from the under side of the body 12 is a central boss 24 having a bore 26 at its center to receive the top end of stem 18. When mounted on the container 16, the body 10 depresses the stem 18, thereby keeping the internal valve open at all times and allowing the pressurized liquid within the container to feed into the unit under control of the valve mechanism, which will be described presently. Extending upwardly from the bore 26 and coaxial therewith is a passageway 28, which is intersected by a transverse passageway 30. Passageway 30 is intersected, in turn by an entrance aperture 32, leading into a chamber 34.

Flow of liquid from tubular valve stem 18 to chamber 34 is restricted by a first valve mechanism, in the form of a needle valve 36 having a threaded shank 38 which is screwed into an internally threaded aperture in one side of the body 12. Needle valve 36 also has a stem 40 passing through a bore 42, which is coaxial with the intersecting passageway 30, and the conical point at the end of stem 40 closes against a seat formed by the junction of horizontal passageway 30 with vertical passageway 28. A knurled head 44 on the outer end of needle valve 36 provides a finger grip for adjusting the valve to increase or decrease the rate of flow of liquid through the passageways 28, 30, 32 into chamber 34.

Chamber 34 is defined by a cup-like cavity molded in the top end of body 12, which is closed by a flexible diaphragm 46 of resilient plastic, or spring steel or brass. The peripheral edge of the diaphragm is thickened, and rests on an upwardly facing shoulder 48 on the body 12, surrounding the cavity 34. An O-ring 50 between the thickened peripheral edge of the diaphragm and the shoulder 48 seals against leakage of pressurized liquid fluid at this point. The thickened outer edge of the diaphragm is clamped down against shoulder 48 by an annular contact ridge 52 projecting downwardly from the bottom edge of a head 54, having external threads 56, which are screwed into internal threads 58 formed in the body 12. The head 54 has a spherical cavity 60 formed in its top side, and a central aperture 62 through which the pressurized liquid in the container is discharged in the form of a finely divided aerosol mist.

Diaphragm 46 is spherically curved, and is normally arched downwardly into chamber 34, as shown in FIGURE 1. Because of its spherical curvature, the diaphragm strongly resists upward deflection, due to internal stresses which are set up immediately when upward pressure is exerted against the diaphragm. However, if the upward pressure is sufficiently strong to overcome this resistance, the diaphragm yields slowly until it reaches a certain point, and then suddenly snaps up to a second position, shown in FIGURE 2. This point at which the diaphragm suddenly snaps up to the position of FIGURE 2 might be termed the "snap-action" point. If the pressure is then removed from the bottom of the diaphragm the internal stresses in the diaphragm will cause it to snap back to its initial position, shown in FIGURE 1. This type of action is well-known, and is popularly called "oil canning" because it is widely used in oil cans. To increase its resiliency, the diaphragm 46 may be formed with a shallow, annular corrugation, or "ripple" 64 around its outer edge, which has a bellows-like effect, allowing the diaphragm to bend at this point without creating excessive stresses in the material.

Formed in the center of the diaphragm 46 (or attached thereto) is a second valve means consisting of a cylindrical valve member 66 having a central exit orifice 68. At its top end, the member 66 is counter bored to form a circular cavity concentric with the exit orifice 68, and pressed into this cavity is an atomizing nozzle 70 having a very small diameter passageway (of the order of 10 to 15 thousandths of an inch) at its center, through which the liquid in the chamber 34 exits at high velocity and is broken up into a finely divided aerosol mist.

Projecting downwardly from the bottom surface of the valve member 66 concentric with the orifice 68 is a narrow, annular contact lip 72, which is adapted to seat against a valve seat member 74. The seat member 74 is preferably in the form of a small pad of synthetic rubber or elastomer, which is cemented to the top side of a resilient support member 76 at the center thereof.

Support member 76 is a circular disk of resilient spring metal (preferably either steel or brass) which is slit at 78 from its outer edge to the edge of the pad 74. The member 76 also has a series of apertures 80 formed therein, through which the liquid from the container 16 passes in traveling from the entrance aperture 32 to the chamber 34. Member 76 is supported around its edges by a raised, annular ridge 82 projecting upwardly from the bottom of chamber 34 and centered therein. The annular ridge 82 has internal threads 84 formed in its inner surface, and the outside diameter of the disk 76 is slightly less than the root diameter of the threads 84. The disk is screwed down into the threads, and the slit 78 permits the outer edge of the disk to separate at this point and assume a helical configuration, so that it can follow the threads 84. By turning the disk 76 in the threads 84, the disk can be raised or lowered with respect to the diaphragm.

The function of the resilient member 76 is to follow the diaphragm for a portion of its travel as the diaphragm yields slowly to the rising pressure in chamber 34. By this means, the rubber valve seat member 74 is held against the annular contact lip 72 in sealing engagement therewith until the diaphragm reaches the snap-action point, at which point the diaphragm snaps suddenly up to the position shown in FIGURE 2, raising the valve member 66 away from seat member 74 and allowing the pressurized liquid within chamber 34 to escape through the exit orifices 68 and atomizing nozzle 70. In practice, I have found that with a diaphragm 46 having an effective diameter of about one inch, and a spherical curvature about as shown in the drawings, the travel of the diaphragm in moving from its first position (FIG. 1) to its second position (FIG. 2) is about .090"; while a half-inch diameter disk 76 has a follow-up movement of about .050".

In operation, the propellant and active ingredient from the container 16 flow out of the tubular stem 18 and through passageways 28, 30 and 32 into the chamber 34; the rate of flow being controlled by the needle valve 36 to very slow leakage. As the liquid flows into the chamber 34, the pressure rises, exerting increasing pressure against the convex side of the diaphragm 46. With increasing pressure, the diaphragm yields slowly upward, while the resilient disk 76 follows the diaphragm up and holds the rubber pad 74 tightly against the valve member contact lip 72. When the diaphragm finally reaches the "snap-action" point, it snaps suddenly up to the upwardly-arched position shown in FIGURE 2, raising the valve member 66 clear of the seat member 74 and allowing the mixture of liquid and gas in the chamber 34 to escape through the exit orifice 68 and atomizing nozzle 70 into the atmosphere, in the form of a finely divided aerosol mist. With the sudden release of pressure acting against the underside of the diaphragm 46, the latter snaps back down to its initial position, and the cycle is repeated. The time interval between discharges is regulated by turning the needle valve to increase or decrease the rate of flow of liquid from the container 16 to the chamber 34. Turning the valve in toward its seat to decrease the rate of flow has the effect of lengthening the interval between discharges, while turning it out has the opposite effect.

With some modifications, the invention could be used for a variety of purposes other than those mentioned earlier, such as, for example, a Freon-powered fog horn; an interval timer; an automatic, timed interval dispenser of any liquid or gas; or for any other similar purpose requiring a timed-interval operation.

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While the embodiment shown and described in considerable detail herein is believed to be the preferred form of the invention, it will be apparent to those skilled in the art that the invention might take various other forms, and such details are not restrictive.

What is claimed is:

1. In an automatic spray device for use with a pressure pack containing a pressurized fluid which comprises a body member defining a chamber therein and having an entrance aperture communicating with said pressure pack and an exit orifice, a diaphragm mounted within said chamber adapted to move from a first position to a second position in response to the build-up of a predetermined pressure within said chamber and valve means associated with said diaphragm adapted to permit fluid to flow through said orifice from said chamber when said predetermined pressure has been reached within said chamber and said diaphragm has moved to said second position; the improvement which comprises said exit orifice being formed in said diaphragm and said valve means comprising, in combination with said exit orifice, a pad of resilient material which is maintained in sealing relationship with said exit orifice when said diaphragm is in said first position.

2. An automatic spray device according to claim 1 wherein said diaphragm moves slowly from said first position toward said second position as the pressure builds up within the chamber behind the diaphragm until it reaches a point of snap action at which point said diaphragm snaps suddenly to said second position, said pad being mounted on a resilient support adapted to move a

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limited distance under the pressure of said diaphragm and said resilient support being adapted to follow said diaphragm for a portion of its travel thereby holding said pad in sealing contact with said exit orifice until said diaphragm has reached the point of snap action.

3. An automatic spray device according to claim 2 wherein said resilient support is adjustably mounted on said body for movement towards and away from said diaphragm whereby the distance said resilient support following said diaphragm can be regulated.

4. An automatic spray device according to claim 3 wherein said resilient support is in the form of a spring disc which is supported around its edges on said body member.

5. An automatic spray device according to claim 4 wherein said spring disc is screwed into threads on said body member and is adjustable toward and away from said diaphragm by turning in said threads.

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ROBERT B. REEVES, Primary Examiner

H. S. LANE, Assistant Examiner

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137—624.14; 222—499