

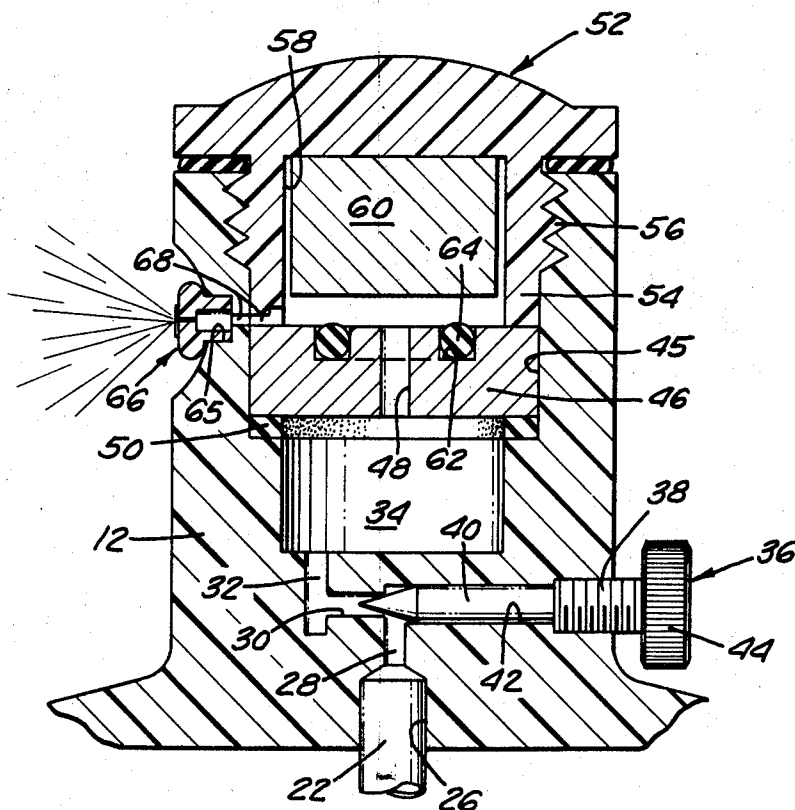
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 [21] Appl. No. **789,783**
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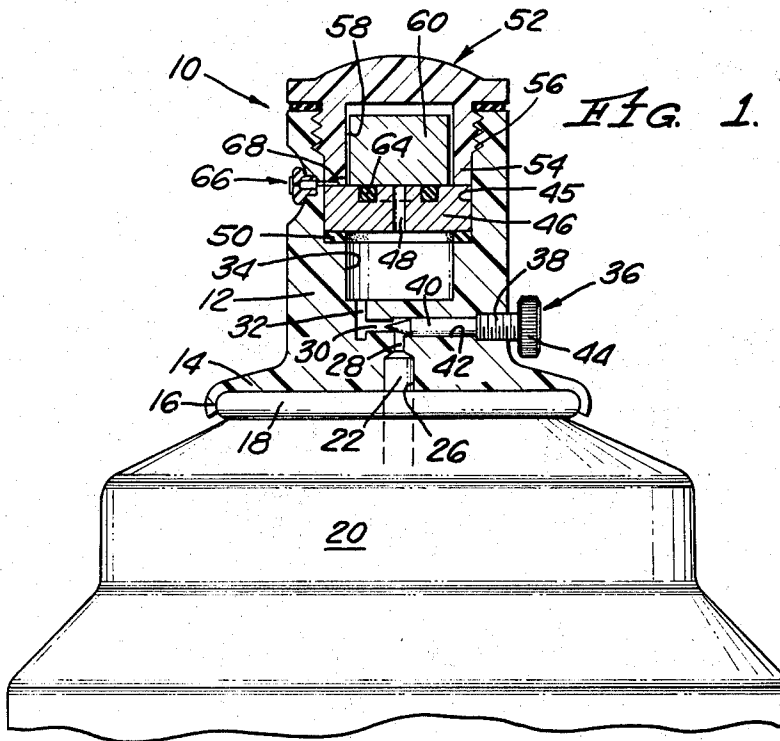
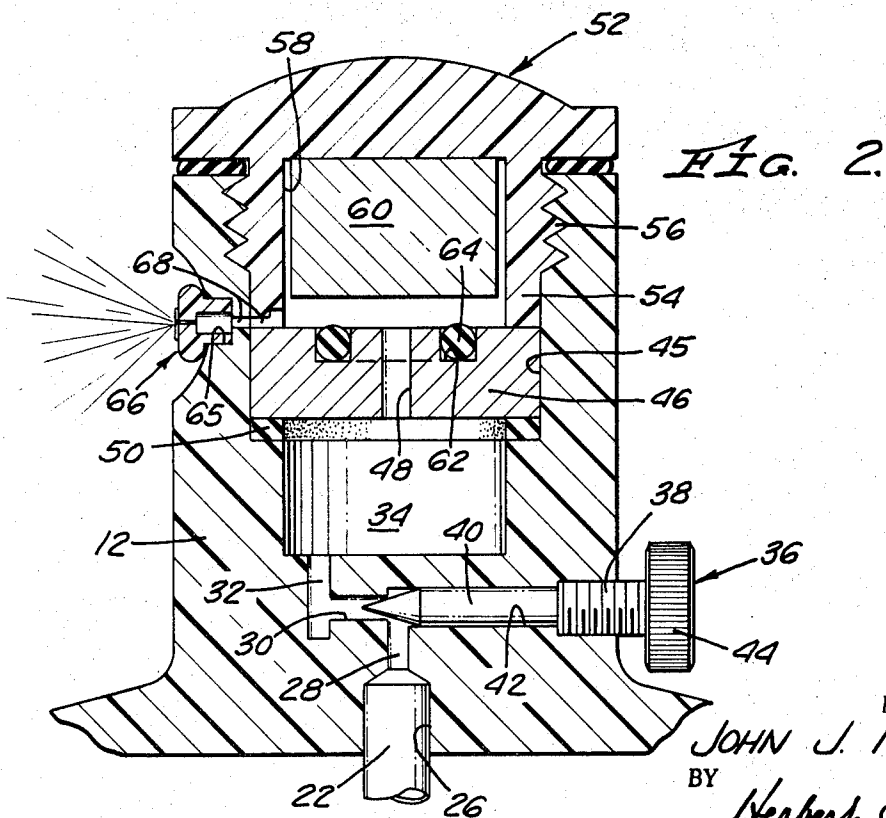
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[54] **AEROSOL DISPENSER CONTROLLED BY
 PERMANENT MAGNET**
 6 Claims, 10 Drawing Figs.

[52] U.S. Cl..... 222/70
 [51] Int. Cl..... B67d 5/08
 [50] Field of Search..... 222/52, 70,
 397, 402.2, 496, 497; 137/65

ABSTRACT: An automatic dispenser for periodically discharging a metered amount of fluid from an aerosol container. The pressurized fluid in the container is allowed to leak slowly into a metering chamber, which is closed off from the exit nozzle by a permanent magnet valve. When the pressure acting against the magnet exceeds the magnetic force holding the magnet against its seat, the magnet is abruptly unseated, and the accumulated fluid is allowed to escape through the valve and out the nozzle. With release of the pressure in the chamber, the magnet reseats itself, and the cycle is repeated.





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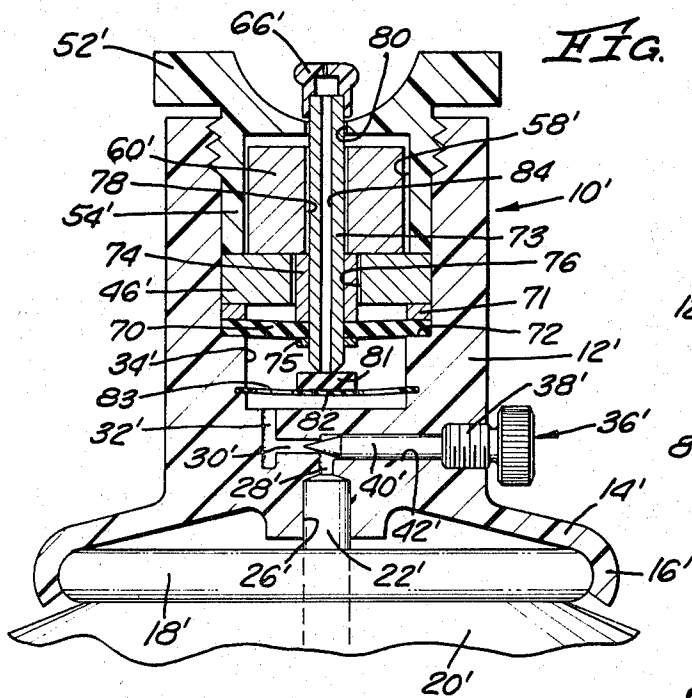


FIG. 3.

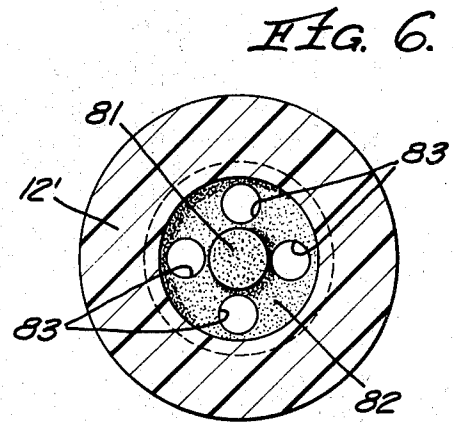


FIG. 6.

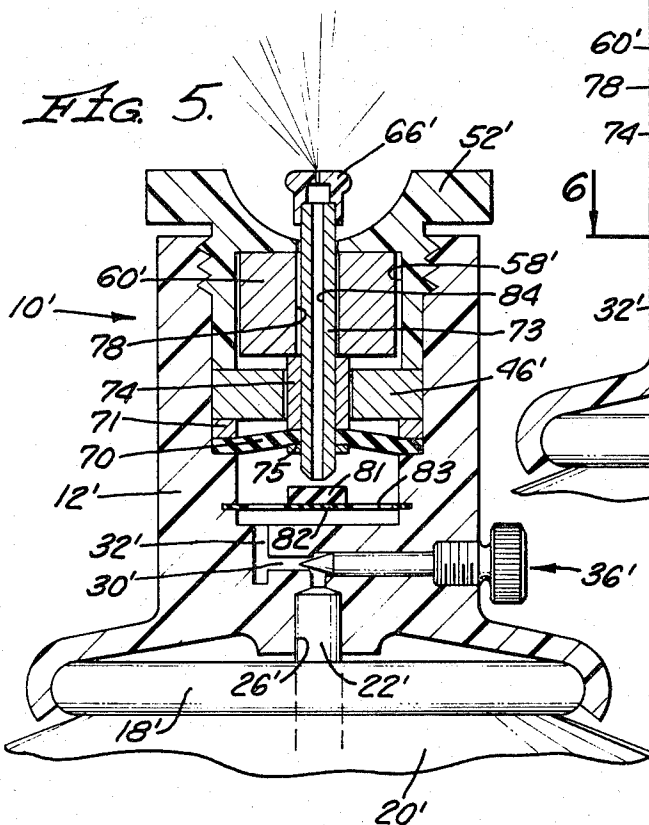


FIG. 5.

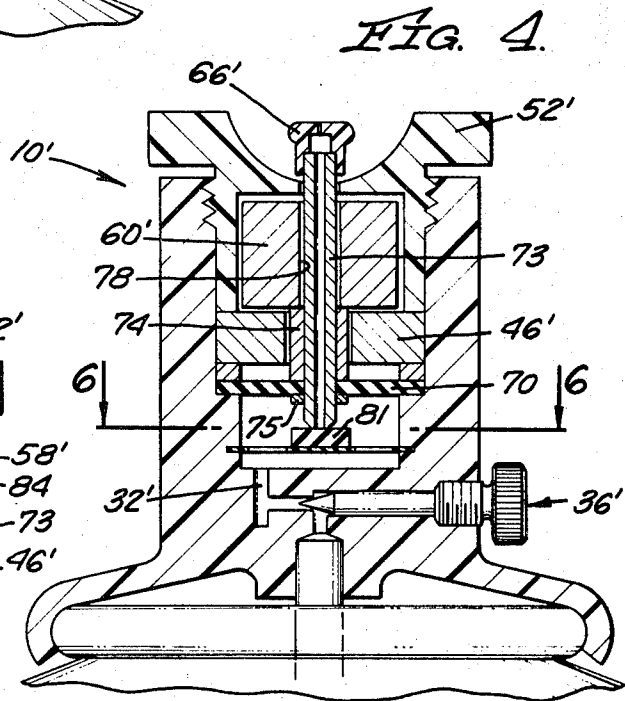
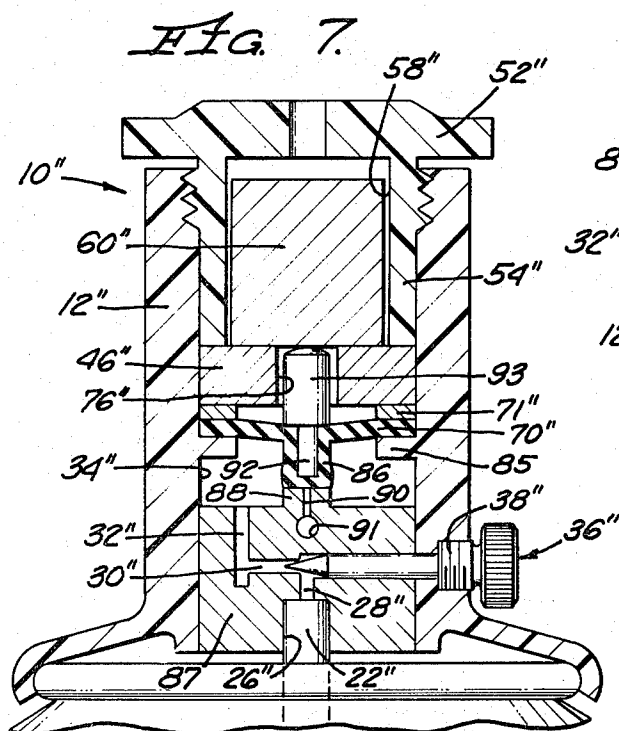
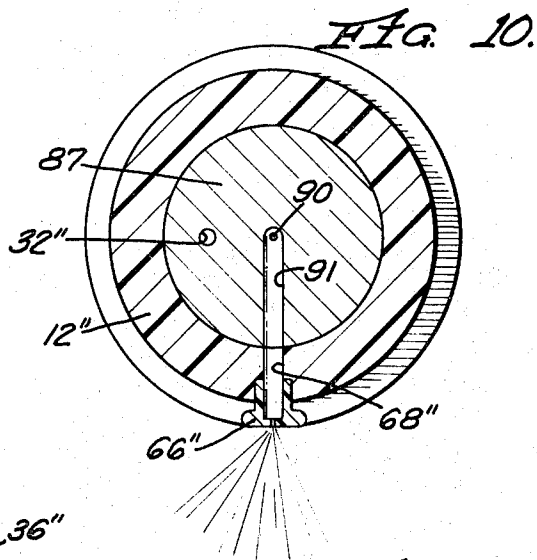
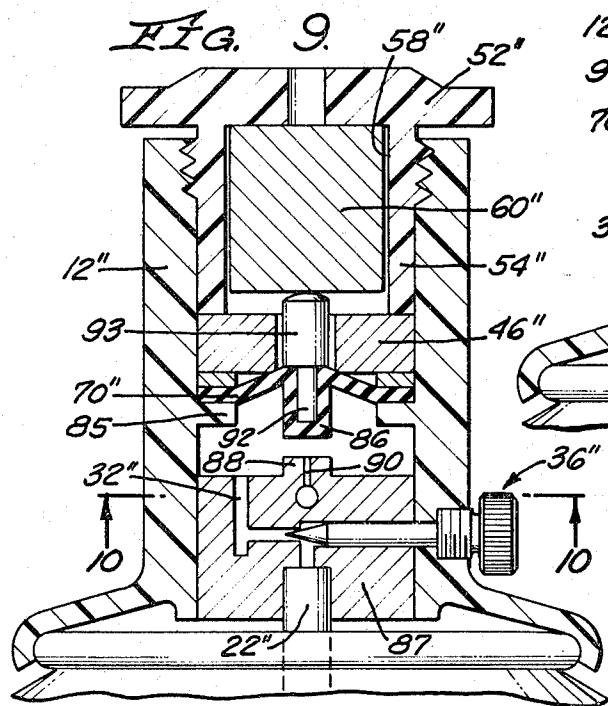
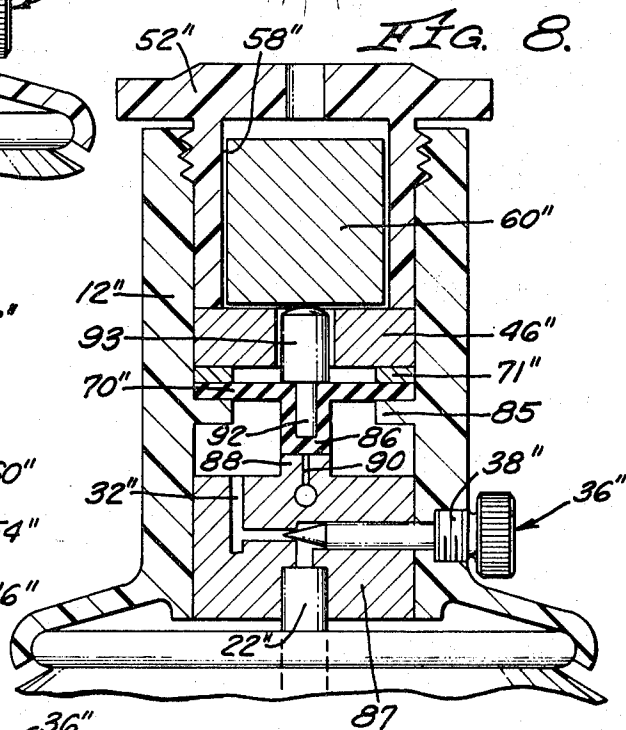


FIG. 4.

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AEROSOL DISPENSER CONTROLLED BY PERMANENT MAGNET

BACKGROUND OF THE INVENTION

This invention relates to automatic, timed-interval dispensers for containers filled with pressurized fluids; and more specifically, to 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, tubular valve stem projecting from the top end thereof, and when this valve stem is depressed, a fine spray of atomized liquid is discharged through a spray nozzle 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 the present invention is to provide an automatic, timed-interval dispenser of the class described which is inexpensive, self-contained, compact, and reliable.

Another object of the invention is to provide an automatic, timed-interval dispenser for containers filled with pressurized fluid, which utilizes the fluid pressure of the contents of the container to actuate the timing mechanism, and therefore requires no external source of power.

A further object of the invention is to provide an automatic dispenser of the class described, which is controlled by a permanent magnet that holds the valve closed until it is overcome by the gradual buildup of fluid pressure leaking at a controlled rate into a metering chamber. The fluid pressure acts against the magnet in the direction to lift it off its seat, which has the effect of opening the valve to allow the accumulated fluid in the metering chamber to escape through the spray nozzle. The attraction of the magnet to its iron seat is characteristically extremely high when they are in contact with one another, but the attractive force drops off abruptly with the slightest separation between them. Thus, when the fluid pressure overcomes the magnetic attraction and breaks the magnet away from its seat, the attraction is diminished almost instantly so as to be almost completely ineffective, thereby allowing the magnet to be snapped completely away from its seat by the pressure of the fluid, until such pressure has dropped off to a relatively low level, at which point the magnet is again attracted back to its seat. It is this "snap-action" of the magnet that makes it function in the desired way; holding the valve closed until a measured amount of fluid has escaped into the metering chamber, and then snapping off its seat to release the metered fluid in a short burst, before reseating itself.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description of three illustrative embodiments thereof, which are illustrated in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 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, with the permanent magnet closed against its seat while the pressurized fluid is leaking into the metering chamber;

FIG. 2 is a similar view of the same, drawn to a larger scale, showing the magnet lifted off its seat momentarily to discharge the metered fluid;

FIG. 3 is a sectional view through another embodiment of the invention, showing the magnet closed tightly against its seat;

FIG. 4 is a view similar to FIG. 3, showing the magnet just barely lifted off its seat by fluid pressure, and illustrating how the flexible diaphragm with its rubberlike valve seat follows the valve stem until the magnet has completely broken away from its seat;

FIG. 5 is another view of the same, showing the magnet completely unseated and in the fully-opened position;

FIG. 6 is a sectional view, taken at 6-6 in FIG. 4;

FIG. 7 is a sectional view through still another embodiment of the invention, showing the magnet closed tightly against its seat;

FIG. 8 is a view similar to FIG. 7, showing the magnet just barely lifted off its seat by fluid pressure, and illustrating how the elastomeric valve member holds the valve closed until the magnet has completely broken away from its seat;

FIG. 9 shows the magnet completely unseated and in the fully-opened position; and

FIG. 10 is a sectional view taken at 10-10 in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Attention is directed first to FIGS. 1 and 2, which show one embodiment of the invention. The device is designated in its entirety by the reference numeral 10, and consists of a generally cylindrical body 12 (preferably of molded plastic) having an outwardly flared base 14 formed with a downwardly curled lip 16 that is adapted to snap over and clamp itself to a roll flange 18 at the top edge of an aerosol container 20.

Projecting upwardly from the center of the closure at the top end of container 20 is a spring-pressed tubular stem 22, which constitutes the plunger of an internal valve (not shown) that is opened when the stem is depressed. Usually, there is an atomizer head mounted on the top end of the stem 22 with a laterally directed nozzle in one side thereof, through which the fine spray is discharged. The said atomizer head 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, and is formed as an integral part of the body 12. 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.

Formed in the bottom of body 12 at the center thereof is a bore 26 to receive the top end of stem 22. When mounted on the container 20, the body 12 depresses the stem 22, 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 a vertical passageway 32, leading to a metering chamber 34.

The flow of liquid from tubular valve stem 22 to chamber 34 is restricted to an extremely low leakage rate by 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 transverse passageway 32, and the conical point on the end of stem 40 closes against a seat formed by the junction of transverse passageway 40 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 and 32 into chamber 34.

Chamber 34 is a cylindrical, cuplike cavity formed at the bottom of a larger diameter cavity 45 extending down into the body 12 from the top end thereof. Seated snugly within the upper cavity 45 is a flat, cylindrical disk 46, of iron or other magnetically attractive material, having a central bore 48 of about the same diameter as passageway 32. An elastomeric sealing ring 50 is compressed between the underneath marginal edges of disk 46a and a shoulder formed by the junction of metering chamber 34 with cavity 45. Disk 46 is clamped down into the bottom of cavity 45 by means of a closure cap 52 having a tubular skirt portion 54, which is threaded at 56 to screw into companionate threads on the inside of cavity 45. The bottom end of skirt portion 54 bears against the top side of disk 46 and presses the same tightly down against seal ring 50 and its supporting shoulder.

Contained within the internal cavity 58 defined by the skirt portion 54 is a cylindrical permanent magnet 60, the bottom end of which is ground flat to make good contact with the top side of disk 46. Disk 46 has a circular groove 62 formed in its top side concentric with passageway 48, and seated within this groove is an elastomeric O-ring seal 64. O-ring seal 64 is compressed slightly by magnet 60 when the latter is seated on the disk 46, thereby sealing the clearance between the magnet and disk.

Inserted into an opening 65 in one side of the body 12 just above the top surface of disk 46 is an atomizer nozzle 66, which is connected by a passageway 68 to the interior of cavity 58. When magnet 60 is raised from its seat, as shown in FIG. 2, fluid which has accumulated in the metering chamber 34 escapes through passageway 48 into cavity 58, and thence through passageway 68 and atomizer nozzle 66 to the atmosphere. When magnet 60 is seated on disk 46, passageway 48 is closed by the magnet and O-ring 64, and fluid is prevented from escaping.

Magnet 60 is selected to have an attraction to iron disk 46 of sufficient strength to resist the pressure of the fluid and propellant in the metering chamber 34 acting against the underside of the magnet in the area enclosed by the line of contact with O-ring 64, until the pressure closely approaches the vapor pressure of the propellant within the container 20. Thus, if the area on the magnet encompassed by the O-ring is .0375 sq. in. a magnet having an attractive force of 1 pound would hold itself tightly to the disk 46 until the pressure within the metering chamber 34 approached 30 p.s.i. at which point the magnet would let go and be thrown up to the top end of cavity 58 by the jet of escaping gas and fluid issuing from passageway 48. Most of the Freon mixtures used as propellants at the present time have a vapor pressure of about 40 p.s.i. at 70°F. By the time the pressure within the metering chamber 34 has dropped to approximately 20 p.s.i., the magnet 60 is attracted back to its seat on disk 46, and again closes the passageway against any further escape of liquid within the metering chamber.

The primary advantage of the permanent magnet as a device for controlling the action of the dispenser is the instantaneous breakaway of the magnet when it finally loses contact with the disk 46. As long as there is full contact between the disk and the magnet, the latter exerts its full attractive force, until the vapor pressure reaches the predetermined limit. At this point, the magnet is lifted away from the disk sufficiently to break contact therewith and the resultant loss of attractive force causes the magnet to snap away from its seat almost instantaneously.

FIGS. 3 to 6 show another form of the invention, which will now be described. Those parts which are substantially the same as in the preceding embodiment are given the same reference numerals, with the prime (') suffix. The body 12' has a metering chamber 34' which is closed at the top by an elastomeric diaphragm 70, the outer marginal edges of which

are clamped between a ring 71 and shoulder 72. Passing through a hold in the center of the diaphragm 70 is a vertical tube 73, which is clamped tightly to the diaphragm between a tubular sleeve 74 and a ring 75. The tube 73 and sleeve 74 pass through a central opening 76 in an iron disk 46', and the top end of sleeve 74 forms a shoulder which is at the same level as the top surface of the disk 46' when the valve is closed, as in FIG. 1. The tube 73 passes up through a bore 78 in a permanent magnet 60' and through an opening 80 in the top of closure cap 52'. Mounted on the top end of the tube is the atomizer nozzle 66', which discharges its spray upwardly.

The magnet 60' is attracted to iron disk 46', and when seated thereon, the bottom of the magnet abuts against the top end of sleeve 74, pressing the latter downwardly to the same level as the top surface of disk 46'. Tube 73, being fixed to sleeve 74, is pressed downwardly with the latter, pushing the beveled bottom end of the tube against a pad 81, of soft, rubberlike elastomer, which is cemented to the center of a circular disk 82. Disk 82 is preferably made of spring brass stock, and its outer margin is embedded in the body 12'. Openings 83 in the disk allow the fluid and propellant to pass from one side of the disk to the other. Disk 82 is resilient, and its center is depressed slightly by the tube 73 when the tube is held down by pressure of the magnet 60' bearing downwardly against the top end of the sleeve 74.

In this embodiment of the invention, the vapor pressure in chamber 34' acts against the underside of flexible diaphragm 70', tending to push the center of the diaphragm upwardly. The pressure on the diaphragm is transmitted by sleeve 74 to the underside of magnet 60'. The pressure of magnet 60' against sleeve 74 pushes the beveled bottom end of the tube 73 down against the resilient pad 81, thereby sealing the central bore 84 of tube 73 and preventing the escape of fluid and propellant in the metering chamber 34'. The pressure of tube 73 against pad 81 also deflects the center of spring disk 82 downwardly slightly, as mentioned earlier, and the purpose of this is to allow the pad 81 to follow the bottom end of the tube 73 for the first few thousandths of an inch of upward travel, while the magnet 60' is beginning to break away from iron disk 46'.

FIG. 4 shows the magnet 60' lifted a few thousandths of an inch from disk 46' at the instant of breakaway, and illustrates how the pad 81 stays closed against the bottom end of tube 73. At this point, the magnetic attraction of magnet 60' for disk 46' falls off almost instantaneously to a much lower value than is the case when they are in solid contact with one another, and as a result, the magnet is thrown up to the top end of cavity 58' by the vapor pressure in chamber 34' acting against diaphragm 70. With the bottom end of tube 73 thus uncovered by pad 81, the accumulated fluid and propellant in chamber 34' escapes through the bore 84 and atomizer nozzle 66', as shown in FIG. 5. With the escape of part of the fluid in chamber 34', the upward pressure against diaphragm 70 falls off rapidly, and magnet 60' is again attracted back to its seat on disk 46', thereby closing the bore 84. One advantage of this embodiment over the one shown in FIGS. 1 and 2 is that the magnet 60' is not exposed to the fluid contents of container 20', and therefore is less likely to become stuck or corroded by the liquid and its solute.

The third embodiment of the invention is shown in FIGS. 7 to 10, inclusive, to which attention is now directed. In this embodiment, those parts which are substantially the same as their counterparts in FIGS. 1 and 2 are given the same reference numerals with the double prime (") suffix.

Body 12'' is here shown as a molded plastic part of generally tubular configuration, having a plug 87 in the bottom end thereof which forms the bottom of the metering chamber 34''. Passageways 28'', 30'' and 32'' are formed within plug 87, as shown. Chamber 34'' is closed at the top end by a flexible diaphragm 70'' of resilient elastomer, the marginal edges of which are clamped between a ring 71'' and shoulder flange 85. Projecting downwardly from the center of diaphragm 70'' is a cylindrical valve protuberance 86, the bot-

tom end of which is flat and seats against a flat-topped valve seat 88 rising from the top surface of plug 87. At the center of valve seat 88 is an exit passageway 90, which intersects a transverse passageway 91. Passageway 91, in turn, connects with passageway 68", which terminates in atomizer nozzle 66" as shown in FIG. 10.

Embedded in the center of protuberance 86 is a pin 92, which projects downwardly from a cylindrical post 93. Post 93 extends upwardly from the top surface of diaphragm 70" through opening 76" in iron disk 46", and its rounded-off top end bears against the underside of magnet 60". The length of post 93 is such that when magnet 60" is solidly seated on disk 46", the protuberance 86 is pressed downwardly against seat 88 with sufficient force to compress the protuberance slightly, bulging its sides slightly as shown in FIG. 7. The purpose of this compression, aside from ensuring good seating contact of the bottom end of the protuberance on the valve seat, is to allow the magnet to break away from the disk 46" to the extent of a few thousandths of an inch before opening the passageways 90, 91. FIG. 8 shows the magnet lifted a few thousandths of an inch from disk 46" by the diaphragm 70", at the instant of breakaway, and illustrates how the compressed protuberance 86 expands to its normal length, thereby keeping passageway 90, 91, closed.

FIG. 9 shows the condition of the dispenser an instant later, in which the magnet has released its hold on disk 46" and has been hurled upwardly to the top end of cavity 58" by pressure of diaphragm 70". The passageway 90, 91 is now open, and the accumulated fluid and propellant in chamber 34" escapes through the atomizer nozzle 66". As the vapor pressure in chamber 34" drops to a lower level, the magnet 60" reseats itself on disk 46", closing passageway 90, 91 again, and the cycle is repeated. In this embodiment, as in the embodiment of FIGS. 3-6, the magnet is not exposed to the fluid contents of the container, but acts through a flexible diaphragm of suitable elastomeric material, such as neoprene.

With each of the above-described embodiments, the metering chamber 34 is proportioned to give the desired application, such as 100 milligrams per discharge, for example. The needle valve 36 is manually adjustable to control the rate of leakage of fluid and propellant from the container 20 into chamber 34, thereby regulating the rate of operation. To speed up the rate of dispensing, the needle valve 36 is opened slightly to allow a slightly faster rate of flow of the fluid; while closing the valve slightly has the effect of slowing down the dispensing rate. The time interval between discharges can be regulated from a fraction of a second to as much as 5 to 10 minutes, depending upon the adjustment of the needle.

While I have shown and described in considerable detail what I believe to be the preferred embodiments of the invention, it will be understood by those skilled in the art that the invention is not limited to these specific embodiments but might take various other forms, without departing from the scope of the claims.

I claim:

1. An automatic, timed-interval, spray dispensing device for use with a container filled with fluid under pressure and having a tube through which said fluid is delivered, said device comprising:

- a body member mounted on said container and having a cavity therein defining a metering chamber, said metering chamber being connected to said tube so as to receive fluid therefrom;
- means on said body member for restricting the flow of fluid from said tube to said chamber;
- an atomizer nozzle communicating with said metering chamber;
- valve means for periodically discharging fluid that has accumulated in said chamber through said atomizer nozzle;
- said valve means including a permanent magnet and a seat to which said magnet is attracted, said magnet being operable to prevent the escape of fluid from said chamber through said nozzle as long as the magnet is seated on its seat;

said seat comprising a member of magnetically attractive material disposed at one end of said chamber, said member having an orifice extending through it from one side thereof to the other;

the underside of said magnet seating on the side of said member opposite said chamber, directly over said orifice; sealing means surrounding said orifice and contacting the underside of said magnet at a distance spaced radially outward from the orifice, whereby fluid pressure in said chamber is exerted against the underside of the magnet over the area encompassed by said sealing means; and the attraction of said magnet to its seat being slightly less than the maximum unseating force exerted on the magnet by fluid pressure in said metering chamber as the chamber fills to a predetermined extent with pressurized fluid from said container, whereby said magnet is abruptly unseated by said fluid pressure, allowing the accumulated fluid in said chamber to discharge through said nozzle.

2. An automatic, timed-interval, spray dispensing device as set forth in claim 1, wherein:

said magnet is enclosed within a cavity in said body chamber, and has a limited amount of movement therein toward and away from said seat;

said nozzle being in communication with said cavity, whereby fluid escaping through said orifice into said cavity is discharged through the nozzle; and

said magnet being attracted back to its seat as soon as the pressure in said chamber has been substantially reduced by the escape of pressurized fluid therefrom.

3. An automatic, timed-interval, spray dispensing device for use with a container filled with fluid under pressure and having a tube through which said fluid is delivered, said device comprising:

- a body member mounted on said container and having a cavity therein defining a metering chamber, said metering chamber being connected to said tube so as to receive fluid therefrom;
- means on said body member for restricting the flow of fluid from said tube to said chamber;
- an atomizer nozzle communicating with said chamber;
- a flexible diaphragm closing one end of said chamber, one side of said diaphragm being exposed to fluid pressure in said chamber;
- a permanent magnet and a seat to which said magnet is attracted, said magnet and said seat being disposed on the other side of said diaphragm;
- valve means controlled by said magnet for periodically discharging fluid that has accumulated in said chamber through said nozzle;
- said valve means including a first member of resilient elastomeric material and a cooperating second member of relatively hard material;
- one of said members being attached to said diaphragm and being held against the other member by pressure of said magnet acting through the diaphragm, said resilient elastomeric first member maintaining sealing contact with said relatively hard second member during initial movement of said magnet as the latter is unseated, said first member becoming separated from said second member only when said magnet has moved an appreciable distance away from its seat;

said magnet being operable to hold said valve means closed against the fluid pressure acting against said one side of said diaphragm until the pressure exceeds a predetermined level; and

said diaphragm acting against said magnet to unseat the latter and thereby open said valve means when the pressure in said chamber exceeds said predetermined level.

4. An automatic, timed-interval, spray-dispensing device as set forth in claim 3 in which said one valve member that is attached to said diaphragm comprises:

- a discharge tube attached to and passing through the diaphragm, said tube projecting upwardly through said

opening in said seat member and through an alined opening in said magnet;

the outer end of said tube projecting beyond said body member and said atomizer nozzle being attached to the projecting end of said tube;

the inner end of said tube constituting a movable valve member which is movable between open and closed positions by said diaphragm;

said other valve seat member being engageable by said inner end of said tube when the latter is in said closed position;

said magnet being operable to hold said tube downwardly with said inner end pressed firmly against said other valve member when the magnet is seated on its seat; and

said diaphragm being operable to lift said magnet off its seat and to raise said inner end of said tube away from said other valve member when the fluid pressure in said chamber exceeds a predetermined level.

5. An automatic, timed-interval, spray dispensing device as set forth in claim 4, wherein:

said other valve member is mounted on a spring member;

said spring member being yieldable and deflecting a few thousandths of an inch under pressure exerted by said tube, whereby said other valve member is enabled to follow said inner end of said tube for the first few thousandths of an inch travel as said magnet initially breaks away from its seat, said magnet being thereafter

moved an appreciable distance away from its seat by said diaphragm; and

said tube being raised by said diaphragm so that said inner end thereof is lifted clear of said other valve member.

6. An automatic, timed-interval, spray dispensing device as set forth in claim 3, wherein:

said one valve member comprises a protuberance projecting downwardly from the center of said diaphragm, the bottom end of which seats against said other valve member; a post having its lower end attached to said diaphragm and extending upwardly through an opening in said seat, the upper end of said post abutting against the underside of said magnet;

said protuberance being elastically compressed a few thousandths of an inch in length when said magnet is seated on its seat, whereby said protuberance is enabled to expand to its normal uncompressed length and thereby keep said valve means closed during the first few thousandths of an inch travel of said post as said magnet initially breaks away from its seat; said magnet being thereafter moved an appreciable distance away from its seat by said diaphragm; and

said protuberance being raised by said diaphragm so that the bottom end thereof is left clear of said other valve member.

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