United States Patent

Winder

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[54] AEROSOL DISPENSING APPARATUS HAVING DISC-SHAPED SOLENOID-ACTUATED PLUNGER

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[51] **Int. Cl.**.....**G04c 23/38**

[58] **Field of Search**.....222/14, 16, 63, 70, 504

[56] **References Cited**

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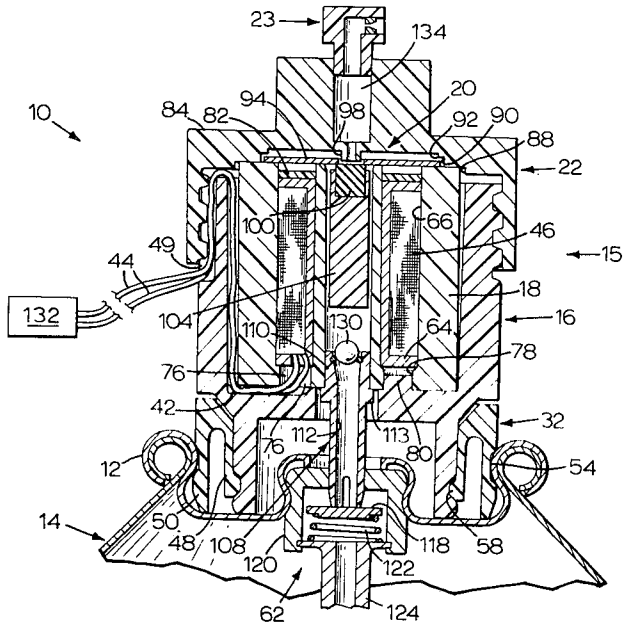
[57] **ABSTRACT**

An aerosol dispenser having a housing defining a chamber. The housing is adapted to be attached to an aerosol container to permit spraying liquid to leave the container and enter the chamber. An outlet opening in the top of the chamber leads from a valve seat in the chamber to a spray tip and a seal assembly is normally held in sealing engagement on the seat by pressure in the container. An electromagnetis coupled to the body and is operable to draw a plunger downwardly to move the seal assembly off the valve seat to periodically dispense a predetermined quantity of spraying liquid from the container.

10 Claims, 2 Drawing Figures



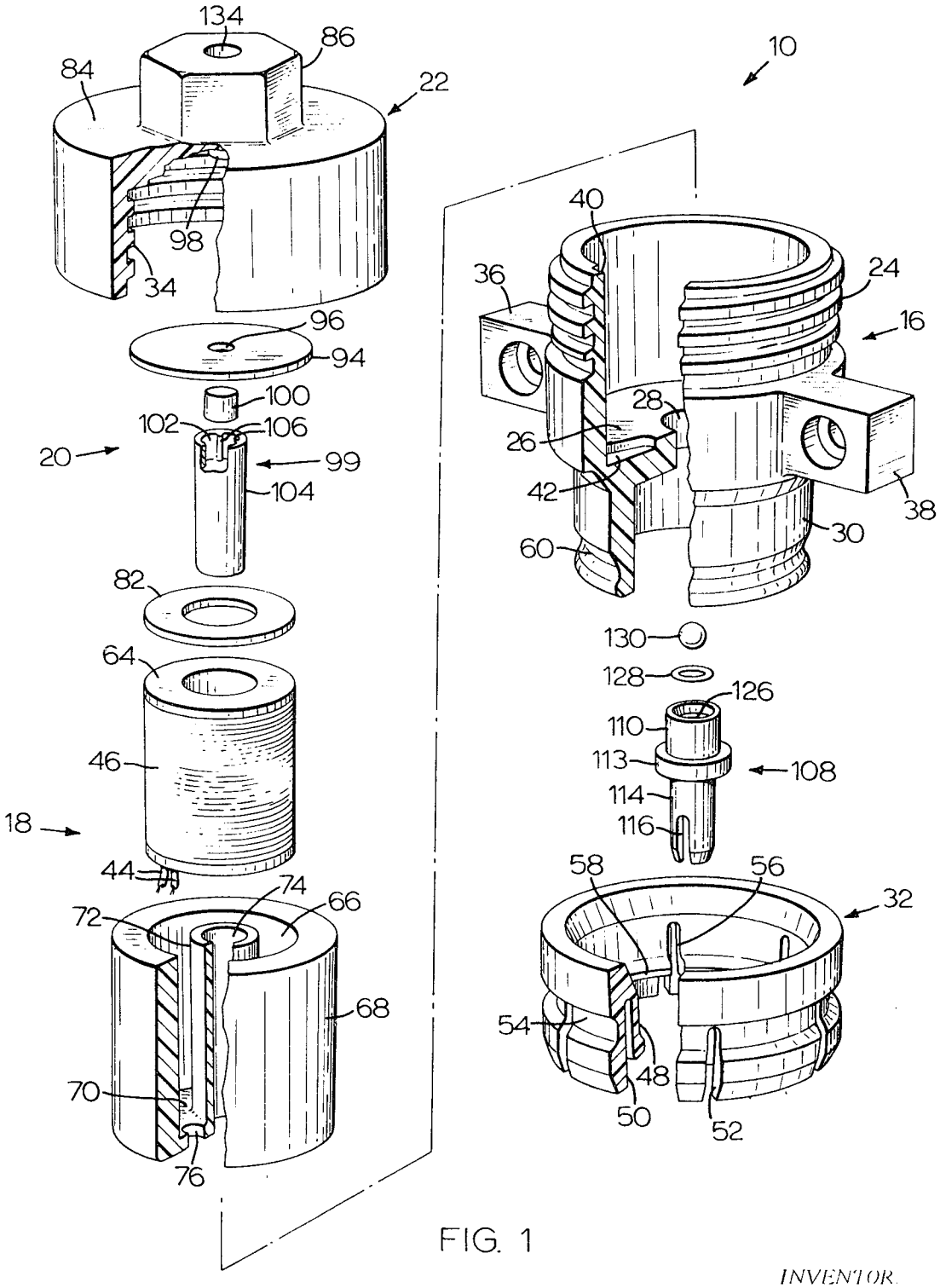


FIG. 1

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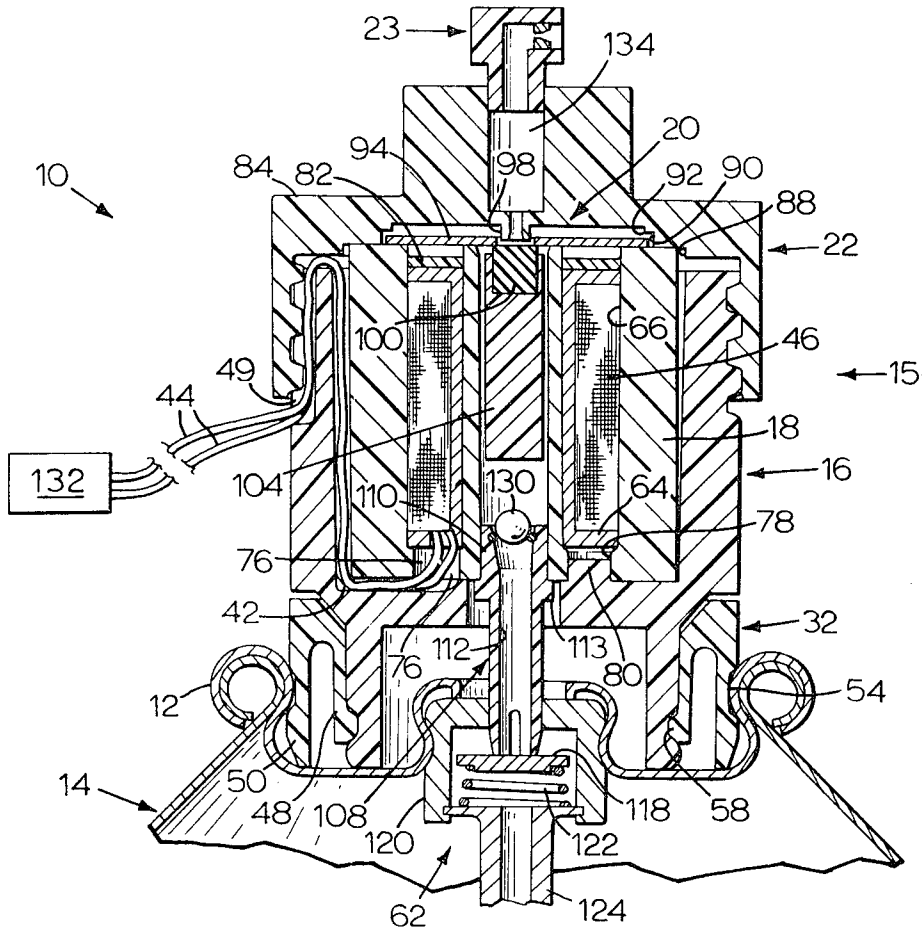

FIG. 2

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AEROSOL DISPENSING APPARATUS HAVING DISC-SHAPED SOLENOID-ACTUATED PLUNGER

This invention relates to apparatus for automatically and periodically dispensing pressurized spraying liquid from an aerosol container.

There are three basic types of devices for dispensing liquid from an aerosol container. The first type is adapted to be coupled to an alternating current supply and has an electric motor which runs continuously. As the motor rotates, it actuates an arm which periodically depresses a valve on the container to discharge spraying liquid. Although this type has the advantage that it is relatively quiet in operation, it has the distinct disadvantage that because it should be mounted on a wall, an unsightly electrical connection must be provided between the device and an electrical outlet.

A second of the types has a dry cell type of battery which is used to drive a small direct current electric motor. The motor is actuated periodically to expand a spring relatively slowly so that the current drawn from the battery is kept to a minimum for improved battery life. After a predetermined time interval, a time delay circuit trips a release mechanism which allows the energy stored in the spring to depress a valve of an aerosol dispenser. Devices of this type are satisfactory where noise is not a critical factor, but are not entirely suitable for use in places where noise would disturb people in the vicinity of the device.

The third type of device also uses a battery which is coupled through a time delay circuit to a solenoid. The time delay circuit energizes the solenoid periodically to open an aerosol valve thereby dispensing a predetermined quantity of spraying liquid contained in a measuring chamber. The valve remains open until all of the liquid in the chamber is dispersed whereupon the valve closes and more spraying liquid enters the chamber. In a variation of this third type, the chamber is connected directly with the aerosol container and the aerosol valve is opened for a predetermined time during which the liquid is sprayed from the device.

Devices of the third type have included seals at the solenoid valve to prevent loss of spraying liquid when the solenoid is not actuated, these seals are often attacked by the spraying liquid causing the seals to swell. As a result the aerosol valve no longer opens sufficiently to provide a proper spraying action.

According to a particular preferred embodiment of the present invention, apparatus is provided for automatically and periodically discharging an aerosol. The apparatus is generally cylindrical, having a longitudinal axis and includes an electromagnet constructed concentrically about an axial inlet tube which is adapted to fit into the dispensing opening of an aerosol valve to depress the valve. The electromagnet is contained in a lower housing and an upper housing defines a chamber and houses a plunger located above the electromagnet. A non-magnetic seal is located loosely in an inlet opening defined by the inlet tube and has a resilient seal at its outer end for engaging against a valve seat defined in the upper housing. The plunger has a central opening for clearing the valve seat so that when the electromagnet moves the plunger downwardly, the plunger engages the seal assembly and moves the seal assembly downwardly and away from the valve seat so that aerosol liquid is free to pass from the chamber and through an outlet opening associated with the valve seat. Once the electromagnet is de-energized, pressure from the aerosol lifts the seal assembly upwardly and the seal again engages against the valve seat to seal the chamber. Should the seal swell, the seal assembly is moved down the inlet opening and does not affect the movement of the plunger.

The invention will be better understood with reference to the drawings, wherein:

FIG. 1 is an exploded perspective view of a device built according to the invention; and

FIG. 2 is a sectional side view on the longitudinal axis of the device with the device engaged in the top of an aerosol can.

Reference is made to the drawings with particular reference to FIG. 2. A generally cylindrical dispensing device **10** is adapted to snap-fit into a rolled collar **12** on an aerosol container **14** for periodically dispensing aerosol spray. The device includes a housing **15** having a lower housing **16** and an upper housing **17**. Lower housing **16** contains an electromagnet **18** for operating a valve **20** which is normally held closed by aerosol pressure when the device is attached to the pressurized aerosol container **14**. As seen in FIG. **2**, upon activating the electromagnet **18**, the valve **20** is opened and a quantity of aerosol spraying liquid is discharged through a conventional spray tip **23**.

The device **10** is preferably used on an upright aerosol container as shown in FIG. **2**, and will be described in this position with a vertical longitudinal axis. However, the device may be used in any other position including the inverted position with suitable aerosol containers as will be described.

The lower housing **16** has an upper tubular portion **24** which is integrally attached at its lower end to a wall **26** having a central axial opening **28**. A lower tubular portion **30** extends downwardly from the wall **26** for engaging in an annular ring **32** for coupling the lower housing **16** to the aerosol container **14**. The upper tubular portion **24** is threaded externally for engaging in internal threads **34** in upper housing **22**, and a pair of diametrically spaced lugs **36, 38** are provided intermediate the tubular portions **24, 30** for attaching the device to a casing (not shown). An axial slot **40** in the inner wall of the upper tubular portion **24** terminates at its lower end at a generally rectangular recess **42** in the wall **26** to provide clearance for electrical conductors **44** on coil **46** of electromagnet **18**. The conductors pass upwardly in slot **40** and over the top of the lower housing **16** before engaging in an external axial slot **49** in the upper tubular portion **24** of the lower housing **16**.

Annular ring **32** has inner and outer skirts **48, 50** extending downwardly from the top of the ring. Axial slots **52** are formed in outer skirt **50** to weaken the skirt for engaging the ring **32** in bead **12** of aerosol container **14**. The skirt **50** defines an annular recess **54** for receiving bead **12** to locate the ring **32** on the container **14**.

Axial slots **56** are also provided in inner skirt **48** to permit the skirt **48** to flex for engaging an inwardly extending, radial enlargement **58** on skirt **48** in an annular recess **60** defined externally on lower tubular portion **30** of lower housing **16**. The annular recess **54** and the radial enlargement **58** are positioned axially relative to one another so that with the ring **32** on the container **14**, the lower housing **16** is automatically aligned with an aerosol valve **62** and located axially to hold the valve **62** open as will be described.

The electromagnet **18**, as previously described, includes the coil **46** and electrical conductors **44**. The coil **46** is wound about a bobbin **64** for engagement in an annular recess **66** extending axially downwardly of a core **68** and terminating at a bottom wall **70**. An internal tubular portion **72** extends upwardly from the wall **70** and is defined by the annular recess **66**. The portion **72** has an axial opening **74** defining an upper part of an inlet opening through which aerosol spraying liquid passes to the valve **20**. A pair of holes **76, 78** are provided in bottom wall **70** and are diametrically spaced about the tubular portion **72**. Hole **78** receives a locating stub **80** on the wall **26** of lower housing **16**, the stub being diametrically spaced from the rectangular recess **42**. When the stub **80** is positioned in hole **78**, the recess **42** is aligned with hole **76** for receiving conductors **44**.

As better seen in FIG. **2**, the bobbin **64** engages relatively tightly in the annular recess **66** and is sealed in place by a frictionally engaged plastic washer **82**.

The upper housing **22** has a top wall **84** from which a hexagonal projection **86** extends upwardly. The projection **86** permits a wrench to be attached to the upper housing **22** for threadably engaging the upper housing **22** on the lower housing **16**. The wall **84** defines three co-axial and stepped recesses **88, 90** and **92**. The lower recess **88** is of a diameter to locate the upper end of core **68** for sealing engagement against the

core to prevent loss of aerosol fluid from between the upper and lower housings. Intermediate recess **90** and upper recess **92** together define a chamber in which a plunger **94** moves in response to a magnetic field set up by the electromagnet **18**. The plunger is free to move only in the portion of the chamber defined by the recess **90** so that it will not stick to the upper extremity of the chamber. A central opening **96** in the plunger **94** provides clearance for moving over a valve seat **98** extending downwardly from the top wall **84** of the housing **22**. The valve seat **98** is adapted to sealably engage a seal assembly **99** having a resilient plug **100**, part of which is frictionally engaged in an axial recess **102** at the upper end of a non-magnetizable rod **104**. Recess **102** includes three inwardly extending axial ribs **106** for frictionally engaging the plug **100** and providing radial clearance for expansion of the plug should the aerosol spraying liquid attack the plug causing it to swell. This clearance also facilitates engaging the plug **100** in the rod **104**. However, if preferred, the ribs **106** can be omitted.

Rod **104**, is a loose fit in the upper part **74** of the inlet opening so that pressure from the aerosol can tends to force the plug **100** against the valve seat **98**. In the position shown in FIG. **2**, the plunger **94** has been drawn towards the electromagnet by activation of the coil **46** thereby engaging the top of plug **100** and pushing the plug away from the valve seat **98** to allow aerosol spraying liquid to leave the chamber defined by recess **90, 92**.

As described, the opening **74** in the tubular portion **72** of the core **68** defines an upper part of an inlet opening. A tubular extension **108** has an upper portion **110** frictionally engaged in the opening **74** and an axial opening **112** extends through the tubular extension **108** defining a lower part of the inlet opening. Aerosol liquid from container **14** passes through opening **112** and opening **74** before entering the chamber defined by recesses **90, 92**.

The upper portion **110** of the tubular extension **108** is forced into the core **68** until a shoulder **113** engages the underside of the core for proper location of the tubular extension **108**. A lower portion **114** of extension **108** terminates in its lower end in a pair of diametrically opposed axial slots **116** providing access into the inlet opening.

The tubular extension **108** is proportioned such that once the lower housing **16** enters the annular ring **32**, the lower end of the tubular extension **108** automatically engages in aerosol valve **62** and depresses a sealing disc **118** which is normally held in sealing engagement against a valve casing **120** by a compression spring **122**. A dip tube **124** extends downwardly from valve **62** to the bottom of container **14** for conducting pressurized spraying liquid from the bottom of container **14** to the valve **62**. If the apparatus is to be used with the can inverted, there would be no need for the dip tube **124**.

The upper portion **110** of the tubular extension **108** defines an internal annular recess **126** for receiving an O-ring **128**. A ball **130** is free to move in the inlet opening between O-ring **128** and seal assembly **99** to act as a check valve should the device **10** be removed from the container **14**. Upon removing the device **10** from the container **14**, the pressure of aerosol liquid above the ball forces the ball into sealing engagement with the O-ring to prevent loss of pressurized aerosol liquid. As soon as the device is again coupled to a container **14**, the pressure from the container equalizes that above the ball in the chamber and inlet opening, and the ball is again free to move off the O-ring.

To assemble the device **10**, the bobbin **64** together with coil **46** is inserted into the annular recess **66** of the core **68** and sealed in place by the washer **82**. The bobbin **64** must be positioned so that the electrical conductors **44** extend through opening **76** in the core **68**. Next, the core is dropped into the lower housing **16** and located on the stub **80** with the conductors located in the rectangular recess **42** and axial slot.

The plunger **94** is then positioned in recess **90** with the upper housing inverted, and then the conductors are held in the external slot **49** while housing **16** is screwed into the upper housing **22**. Next, the seal assembly **99** is dropped into the upper part **74** of the inlet opening and then the tubular extension **108** is pushed into the opening **74** to complete the assembly. The spray tip **23** is added subsequently depending upon the type of nozzle to be incorporated in the tip. The device is then ready for attachment to a ring **32** on a container **14**.

In use, the conductors **44** will be coupled to an electrical control circuit (shown diagrammatically at **132**) which periodically couples a dry cell type of battery to the electromagnet **18** for drawing the plunger **94** downwardly to permit spraying liquid to leave the chamber defined by recesses **90, 92** and pass through outlet opening **134** to spray tip **23**.

When the electromagnet **18** is not energized, pressure from the aerosol container **14** forces the rod **104** upwardly so that the plug **100** sealingly engages against the valve seat **98** to prevent loss of spraying liquid. As soon as the electromagnet is energized, the plunger **94** moves downwardly against the plug **100** thereby moving the seal assembly **99** downwardly and permitting aerosol liquid to move past the valve seat and out through the tip **23** for a time interval set by the timer circuit. Upon de-energizing the electromagnet, pressure from the aerosol again forces the seal assembly **99** upwardly and the plug **100** seals against the valve seat **98** thereby preventing further loss of aerosol liquid.

The resilient plug **100** can be of any suitable material which will seal against valve seat **98** under the influence of aerosol liquid pressure. However, many sealing materials will swell due to attack by the liquid and the effect of this swelling is simply to move the seal assembly **99** further into opening **74**. As a result the swelling has no effect on the operation of the plunger **94** in moving the seal assembly when a pulse of liquid is to be sprayed from tip **23**.

What is claimed as my invention is:

1. A device for periodically dispensing pressurized spraying liquid from an aerosol container, and comprising:

a housing defining a chamber for receiving spraying liquid from the container and further defining an inlet opening providing access to the chamber whereby when the device is coupled to the container, the spraying liquid is free to leave the container and to enter the chamber, and an outlet opening for directing the spraying liquid outwardly from the chamber when the device is actuated; a valve seat coupled to the housing and in communication with the chamber; a seal assembly of non-magnetizable material contained in the inlet opening and free to move axially between a lower position in which liquid is free to pass from the chamber and through the outlet opening, and an upper position in which the seal assembly is in contact with the valve seat such that a predetermined surface area of the seal assembly is covered by the valve seat to seal the chamber, the seal assembly being held in the upper position by a force which comprises the product of the predetermined surface area and the pressure in the aerosol; a plunger of magnetizable material contained in the chamber and free to move axially, the plunger being in contact with the assembly about the predetermined surface area; and an electro magnet coupled to the housing and operable to move the plunger axially downwards thereby moving the seal assembly from the upper position to the lower position for a predetermined time interval to permit spraying liquid to pass from the chamber through the outlet opening.

2. A device as claimed in claim **1** in which the housing comprises a lower housing containing the electro magnet and an upper housing defining the chamber.

3. A device as claimed in claim **2** in which the upper housing includes an internal screw thread and the lower housing includes an external screw thread for combining with the internal screw thread to assemble the upper housing on the lower housing such that the upper housing is engaged against the electro magnet to seal the chamber and prevent loss of aerosol liquid.

4. A device as claimed in claim 1 in which the electro magnet comprises a generally cylindrical axially extending core having an annular recess extending downwardly from its upper face; and an electrically conductive coil housed in the recess, and means sealing the coil in the recess.

5. A device as claimed in claim 4 in which the core defines an axially extending opening defining an upper part of the inlet opening, and in which the device further comprises a tubular extension coupled to the core and having an axial opening defining a lower part of the inlet opening, a lower end of the extension being adapted to engage an aerosol valve in the aerosol container and maintain the aerosol valve in an open position when the device is coupled to the aerosol container.

6. A device as claimed in claim 1 in which the seal assembly comprises: a rod member defining an opening extending downwardly from the upper end of the rod member; and a plug of resilient sealing material set in the opening for sealing by engaging the valve seat.

7. A device as claimed in claim 1 and further comprising valve means coupled to a lower part of the inlet opening for preventing downward flow of the spraying liquid from the chamber when the device is taken off the container.

8. A device as claimed in claim 1 in which the housing comprises a lower housing containing the electro magnet and an upper housing defining the chamber.

9. A device as claimed in claim 8 in which the electro magnet comprises a generally cylindrical axially extending core having an annular recess extending downwardly from its upper face; and an electrically conductive coil housed in the recess, and means sealing the coil in the recess.

10. A device as claimed in claim 1 and further comprising an annular ring having an outer skirt for engagement on the aerosol container and an inner skirt for guiding the housing onto the container and for locating the housing on the aerosol container such that the inlet opening is aligned with an aerosol valve assembly.

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