July 17, 1962 J. G. ELLIS 3,044,713

LIQUID SPRAYING DEVICE

Filed May 29, 1959

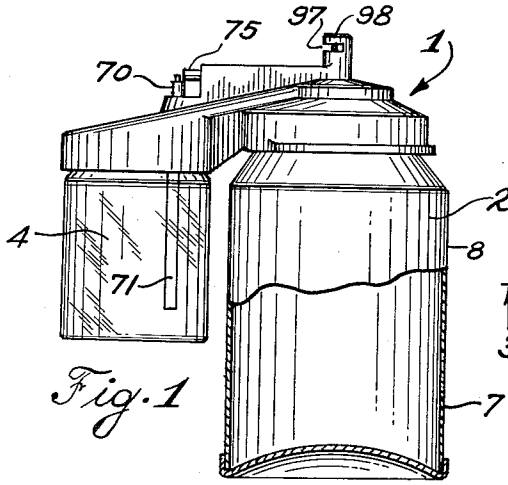

Fig. 1

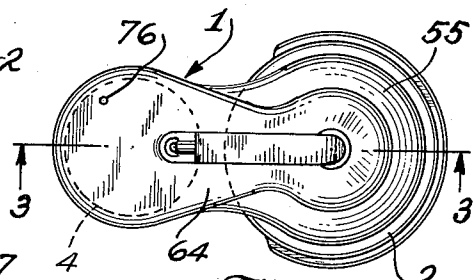

Fig. 2

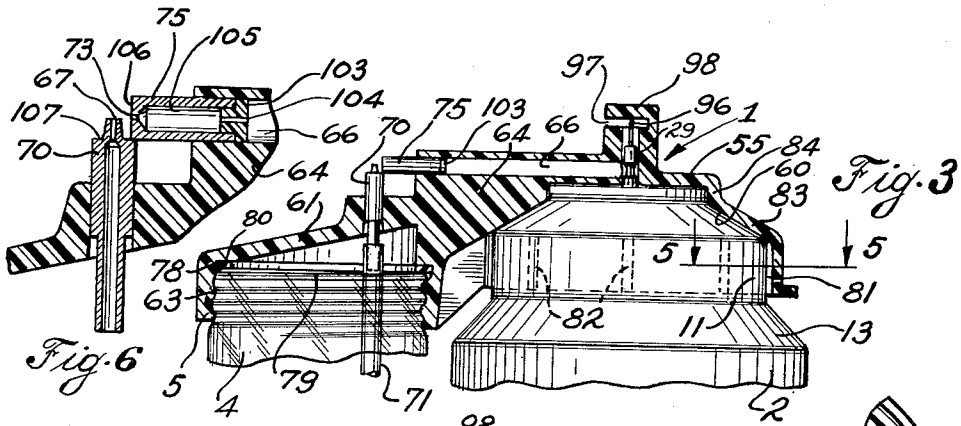

Fig. 3

Fig. 6

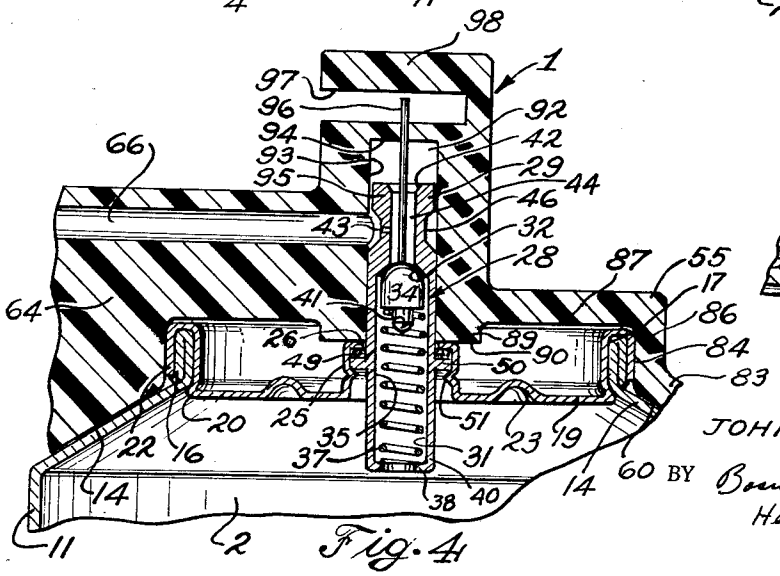

Fig. 4

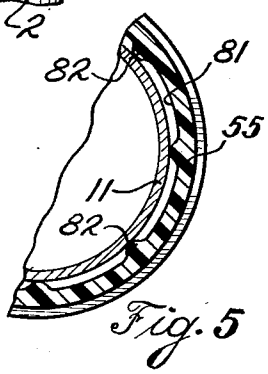

Fig. 5

INVENTOR.
JOHN G. ELLIS

BY Bosworth, Sessions, Herrstrom & Knowles

ATTORNEYS

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LIQUID SPRAYING DEVICE

John G. Ellis, Shaker Heights, Ohio, assignor to Sprayon Products, Inc., Cleveland, Ohio, a corporation of Ohio

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This invention relates to liquid spraying devices and more particularly to devices for spraying paint and other liquids from a container or receptacle by means of a pressurized propellent gas carried within and released from a separate container.

The packaging and use of liquified gaseous propellents, such as dichlorodifluoromethane mixed with a liquid or other substance to be sprayed has become common. Such sprays are known as aerosols and the cans in which the mixtures of propellent and product to be sprayed are commonly called aerosol cans. Common aerosol cans are of 3, 6, 12 or 16-ounce capacity.

Paints are among the substances which have been extensively packaged, sold and used in aerosol cans and many colors of paint have been packaged in aerosol cans. Paint sprayed by a volatile propellent has not, however, had as great use as might otherwise be possible and advantageous because of the standardization of can sizes in the aerosol spray industry and the fact that only one kind or color of paint can be packaged in a single can. These limitations, inter alia, have precluded the use of aerosol paints in the many instances wherein the volume of a given kind or color of paint to be sprayed is not sufficient to warrant the production and marketing of an ordinary aerosol can or the stocking of a large number of aerosol cans in order to have a complete line of kinds and colors of paints. For similar reasons, the marketing of other products such as lacquers, enamels, lubricants, cosmetics, insecticides, and medicinal materials in aerosol cans has been limited.

Also aerosol cans containing a mixture of propellent and liquid to be sprayed have not been usable in those instances wherein the propellent and the liquid are not compatible or miscible or the liquid corrodes or otherwise attacks the metal container in which the propellent is confined.

It is therefore a general object of this invention to provide an improved liquid spray device, which can be economically manufactured and by means of which cans of a liquified volatile gas can be used to supply propellent for spraying materials such as paints, enamels, lacquers, lubricants, cosmetics, medicines, insecticides and the like from a separate container or receptacle.

Further objects of this invention are to provide an improved liquid spray device which is particularly adapted for use with standard aerosol cans; which supports and holds both the aerosol can of propellent and a separate container for the liquid to be sprayed; which sprays without mixing and/or retention of the propellent and liquid to be sprayed in a common container; which is easily and economically manufactured from plastic, as by molding, in a single unitary structure, except for fittings; which provides for ready and positive operation of the discharge valve of the aerosol can; which provides a simple, effective and efficient sealing engagement and positioning means with the aerosol can whereby to provide for ready attachment and removal of an aerosol can while substantially preventing accidental leakage of propellent therefrom or accidental interference with the functioning or operation of the valve mechanism; which is pleasing in appearance and safe and efficient in use and operation; which is compact and provides a relatively short passage for the propellent between the aerosol can and container of liquid to be sprayed; which does not interfere with the spray pattern of the aerosol as it issues from the device; which is easily attached to and detached from the aerosol can and the container of liquid to be sprayed; which is easily cleaned after use; which includes an expansion space providing increased efficiency in the utilization of the propellent; and which can be easily handled and used by the operator with the use of only a single hand.

The manner of attaining these and other objects and advantages of this invention will become apparent from the following description of a preferred form thereof, reference being had to the drawings in which:

FIGURE 1 is an elevation, partly in section, of a liquid spraying device embodying a preferred form of this invention;

FIGURE 2 is a plan view of the device shown in FIGURE 1;

FIGURE 3 is a sectional view, on an enlarged scale, taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a fragmentary sectional view, similar to FIGURE 3 but on an enlarged scale, showing the sealing engagement between the aerosol can and the spray head;

FIGURE 5 is a fragmentary sectional view taken along the line 5—5 of FIGURE 3; and

FIGURE 6 is a fragmentary sectional view, similar to FIGURE 3 but on an enlarged scale, showing the orifice and nozzle.

A complete spraying device embodying my invention is indicated generally in FIGURE 1 of the drawings, and comprises a spray head **1**, an aerosol can **2** and a container **4** for the material, such as paint, to be sprayed.

Container **4** is preferably a small glass jar having a threaded top **5**, FIGURE 3, although the spray head **1** may be used with containers made of other materials and having other kinds of tops.

Aerosol can **2** is of well known type comprising a body **7** having a cylindrical side wall **8** to which a concave bottom is secured, FIGURE 1. In order to provide for closing can **2** and mounting a discharge valve mechanism therein, the upper end of body **7** is shaped to provide a cylindrical wall **11** of lesser diameter than wall **8** and connected therewith by an integral conical portion **13**, FIGURE 3. A second, flatter conical wall portion **14** extends upwardly and inwardly from wall **11** and is crimped and doubled back at its top, as at **16**, to define the mouth **17** of the can, FIGURE 4. The mouth **17** is closed by a dished cover **19** which is crimped to the top of the can as at **22** and extends slightly under the doubled portion **16** as at **20**. The cover is embossed as at **23** to provide greater strength and is provided with a cylindrical central boss **25** having an apertured flange **26** through which the valve mechanism, indicated generally at **28**, extends.

Valve mechanism **28** is of a well known type and includes a nipple **29** having a stepped cylindrical bore **31** therein, the step forming a valve seat **32**, facing toward the can **2**. A ball type valve **34** is disposed within the inner (lower as viewed) end **35** of bore **31** and is urged into sealing engagement with seat **32** by a spring **37** which seats upon an inturned flange **38** formed at the inner end **40** of nipple **29**. Valve **34** is preferably provided with a projection **41** which extends into spring **37** and centers the valve and spring. The released propellant exits through the open end **42** of nipple **29** or the orifice **43** which intersects the outer (upper as viewed) end **44** of bore **31**. Nipple **29** is also provided with an external, arcuate groove **46** which is in communication with orifice **43**. A gasket or seal **49** is disposed about nipple **29** between the apertured flange **26** and a suitable flange **50** provided on nipple **29**. The valve mechanism **28** is held in place by crimping or indenting boss **25** immediately below flange **50**, as at **51**.

As noted above, the can and valve are of standard or well-known construction. The spray head **1** makes possible the use of such a can in a convenient and inexpensive spraying device. To this end spray head **1** comprises a plastic body member **55**, FIGURE 3, which is molded as a unitary structure from a suitable plastic such as polyethylene.

Spray head body **55** defines a cavity **60** for the reception of can **2** and another cavity **61** having internal threads **63** for holding the container **4**. A connecting bridge or structural portion **64** extends between the cavities. Bridge **64** provides the body with sufficient rigidity and structural strength to support the can **2** and container **4** and so that the assembly can be readily handled. A transverse bore **66** extends through bridge **64** for conducting the propellant from the can **2** to an orifice **67** through which the liquid to be sprayed is drawn from container **4** by the stream of passing propellant. Orifice **67** is preferably formed in a metal fitting **70** which is pressed into an opening in body **55** and extends into cavity **61** and the liquid to be sprayed is conducted to fitting **70** through a plastic tube **71** extending to a point near the bottom of the container. Bore **66** preferably terminates in a nozzle **73** formed in a separate fitting **75** and adapted to direct a stream of propellent over orifice **67** so that the reduced pressure over the orifice coupled with the atmospheric pressure exerted on the liquid in container **4** through aperture **76** (see FIGURE 2), causes the liquid to flow from container **4** into the stream of propellent by which it is atomized and carried away. A gasket **78** is preferably provided within cavity **61** between the top **79** of the container **4** and a suitable seat **80** formed integrally with body **55**.

In order to secure the spray head **1** to the can **2**, cavity **60** is adapted to engage over the top of the can and is defined in part in body member **55** by a cylindrical straight wall **81**, FIGURES 3 and 5, which is of somewhat greater diameter and less height than wall **11** of can **2**. The interior of wall **81** is provided with a plurality of radially spaced, axially extending ribs **82**. The inner surfaces of the ribs define a diameter slightly less than the diameter of wall **11**. The ribs and wall **81** are somewhat distortable; thus the spray head body **55** is able to make a proper frictional engagement with cans of propellent even though the walls **11** of the cans are out of round or of varying diameter within ordinary commercial tolerances.

Cavity **60** is also defined in part by a conical wall **83**, FIGURES 3 and 4, which is complementary to and disposed adjacent to and preferably in slightly spaced relationship with wall **14** of can **2** when the can is properly seated in cavity **60**. Cavity **60** also includes an inner shallow cylindrical portion **84**, FIGURE 4. Portion **84** of cavity **60** is defined by a cylindrical side wall **86**, which surrounds and is preferably slightly spaced from the crimped portion **22** of cover **19**. A flat transversely extending wall **87** extends inwardly from side wall **86** and has a depending central boss **89** having a flat seat **90** which is adapted to engage the apertured flange **26** of cover **19** when can **2** is properly seated in cavity **60**. When seat **90** of spray head **1** is properly seated on flange **26**, the spray head and the valve mechanism are properly positioned relative to each other. It is to be noted that the vertical location of the spray head with respect to the can is determined entirely by the engagement between surface **90** and flange **26**. Therefore, when surface **90** is seated properly, the spray head and the valve mechanism, which is also located by flange **26**, are correctly positioned for easy actuation of the valve, without regard to the degree of bulging of the cover **19** relative to the can **2** because of the pressures within the can.

Cavity **60** also includes an inner relatively deep cylindrical opening **92** extending inwardly (upwardly as viewed) from seat **90** and defined by side wall **93** and top wall **94**. The side wall **93** is adapted to enclose and tightly engage nipple **29** between flange **26** and groove **46** so as to prevent leakage of the propellent from the spray

head except along the desired escape path. Bore **66** intersects opening **92** in approximate lateral alignment with groove **46** and when the valve is open the propellent flows into bore **66** either over the upper end of nipple **29** and through the clearance space between the wall **93** and the upper portion **95** of the nipple **29**, which portion is of slightly reduced diameter, or through orifice **43**.

In order to provide for operating the valve member **34**, the top wall **94** above bore **93** is pierced and a push rod **96** is positioned therein. The push rod **96** frictionally engages the pierced opening in the wall **94** so that it remains in place when the spray head is separated from the can tube. When the spray head is in position on a can the push rod **96** extends into the open end **42** of the nipple **29** to a position where it can engage the valve **34**. The push rod is of sufficient length to extend between the top of the valve **34** and into the notched opening **97** in the projecting top **98** of the spray head. The notch **97** makes the top **98** into what is in effect a hinged flap so that the user may, without difficulty, press the top downwardly into engagement with the rod **96** and thus move the rod **96** downwardly to move the valve **34** from its seat and discharge the propellent gas from the can. The movement required to remove the valve **34** from its seat is small—of the order of $\frac{1}{32}$"—so that the device can be operated easily and without fatigue on the part of the operator. The fit between the rod **96** and the pierced opening in the top **94** is snug enough to prevent any substantial leakage of propellent around the rod, but the spring **37** is strong enough to overcome the frictional engagement between the rod **96** and the pierced opening and close the valve whenever the flap **98** is released.

In order to provide a clear path for the spray of propellent gas and finely divided liquid, the upper surface of body **55** above the container **4** is sloped downwardly beyond the nozzle **73** and orifice **67** as shown. It will be noted that the fitting **70** and the tube **71** which carry the material to be sprayed to the orifice **67** are offset from the center of the container **4** toward the can **2**. This provides a more compact construction and makes the bridge **64** shorter than would be required if the tube **71** were centrally located in the container **4**.

In order to increase the efficiency with which the propellent gas is expended, i.e., to increase the weight of material that can be sprayed for a given weight of propellent, the fitting **75** is provided with a metering orifice and a small expansion chamber as shown in FIGURE 6. To accomplish this the fitting **75** consists of a hollow cylindrical member which fits snugly within and projects from the outer end of bore **66**. The fitting has a small plastic insert **103** providing a metering orifice **104** at its inner end, an expansion chamber **105** in its central portion, and an end wall **106** through which the orifice constituting the nozzle **73** extends. The provision of the two orifices with the expansion chamber **105** between them results in more accurate outlet metering of the flow of propellent gas and, as noted above, greater efficiency of use of propellent in discharging the material to be sprayed.

Efficiency in operation requires that the nozzle **73** and the orifice **67** be disposed accurately with respect to each other. In the present design this is accomplished easily because the bore **66** and the opening in which the fitting **70** is disposed are accurately located in the molded plastic body member **55** by the die used in the molding operation. The fitting **70** and the fitting **75** are small screw machine parts that can be formed with a high degree of accuracy. The fitting **70** is provided with a horizontal shoulder **107** surrounding the orifice **67** so that in assembly it is only necessary to insert the fitting **75** into the bore **66** to the correct depth and then push the fitting **70** upwardly through the opening in the body member **55** until the shoulder **107** engages the end of the fitting **75** as shown. By this means the orifice **67** and the nozzle **73** are accurately aligned with respect to each other in both vertical and horizontal directions.

In operation the can **2** of liquified propellent is pushed into cavity **60** and a jar **4** containing the desired material to be sprayed, paint, for example, is screwed into cavity **61**. The user then lifts the spray gun by grasping can **2** and placing his thumb or forefinger, as desired, on flap **98**. Nozzle **73** is then directed at the object or place to be sprayed and the user presses on flap **98** with his thumb or forefinger, as the case may be, to push down on rod **96** and thereby displace valve **34** inwardly against the force of spring **37** to release the propellent. The propellent travels up bore **31**, through the end of nipple **29** or orifice **43**, and thence along bore **66**, expands through orifice **104** into the expansion chamber **105** and issues at high velocity from nozzle **73**. The stream of propellent then passes over orifice **67** where it picks up and atomizes the paint or other material to be sprayed and carries it to the object to be sprayed or coated, or disperses it into the air, as desired.

The structure of spray head **1** is such that the can **2** is held in sealing, though readily detachable, engagement, and the spray head can be manufactured economically as a unitary molded plastic member, except for the fittings described. The invention is described herein as adapted to a standard aerosol can and a well-known type of valve. It is to be noted, however, that spray heads embodying this invention may be adapted for use with cans of liquified propellent having other types of valve mechanism and other types of valve mechanism for cans of liquified propellent may be adapted for use with spray heads embodying this invention.

Those skilled in the art will appreciate that other changes and modifications can be made in the invention without departing from the spirit and scope thereof. The essential features of the invention are described in the appended claims.

I claim:

1. A spray head adapted for use with a container of liquid to be sprayed and a can of liquefied gaseous propellent, said can including a body having a cylindrical wall portion, a cover having a central boss with a top and an aperture therein, a conduit extending through said aperture for discharging propellent from said can and valve means for controlling the discharge of propellent through said conduit, said spray head comprising a unitary body member having a first portion having a cavity for the reception of said container, a second portion having a cavity for the reception of said can, and a third portion structurally interconnecting said first and second portions and having a transversely extending bore therein, said cavity in said section portion being defined in part by a cylindrical wall for frictionally engaging said cylindrical wall portion of said can, a horizontal wall portion defining a seat and adapted to engage upon said boss top to position said spray head vertically relative to said can and a cylindrical wall portion adapted to have sealing engagement with said conduit, means having an orifice opening above said first portion of said spray head body member for conducting the fluid to be sprayed from said container through said first portion, said bore in said third portion of said body leading from said cavity in said second portion and being adapted to be in communication with said discharge conduit and having nozzle means at its opposite end opening above said first portion of said spray head body member and directing a stream of propellent across said orifice, said spray head also including means for actuating said valve means.

2. The spray head according to claim 1 in which said cylindrical wall has a plurality of axially extending, radially spaced ribs extending into said second cavity for engaging said cylindrical wall portion of said can.

3. A spray head adapted for use with a container of liquid to be sprayed and a can of liquified gaseous propellant, said can including a body with a cylindrical wall portion and a sloping wall portion extending upwardly and inwardly therefrom to define a mouth for the can, a cover crimped over said body to form a bead and closing the can mouth and having a central boss with a flat apertured top, a nipple extending through the aperture in said boss top, an opening at the exposed end of said nipple through which propellent exits from the can and valve means within the nipple for releasing the propellent, said spray head comprising a unitary body having a first portion defining a first cavity for the reception of said container, a second portion defining a second cavity for the reception of said can and a bridge portion interconnecting said first and second portions, said bridge portion having a transversely extending bore leading from said second cavity and opening above said first portion of said spray head body member, said first portion of said spray head having an upper surface sloping downwardly and outwardly relative to said open end of said transverse bore, a first fitting in said first portion of said spray head body member and extending from said first cavity to above said upper surface, said first fitting having a bore extending therethrough comprising an orifice and having an external upwardly facing shoulder above said upper surface, said second portion of said body member having a lower cylindrical wall portion defining a part of said second cavity, said lower cylindrical wall portion having a plurality of axially extending radially spaced ribs extending into said second cavity and being adapted to frictionally engage said cylindrical wall portion of said can, said second cavity also having a sloping wall portion extending upwardly and inwardly from said lower cylindrical wall portion and adapted to extend parallel with and spaced from said sloping wall portion of said can, a middle wall portion adapted to be spaced from and parallel with said can bead, a horizontal wall portion comprising a seat adapted to engage upon said boss top to position said spray head relative to said can, and upper cylindrical wall portion extending upwardly from said seat and a top, said upper cylindrical wall portion being adapted to engage said nipple in sealing relationship intermediate said can and said nipple opening, said transverse bore intersecting said second cavity above said area of sealing engagement of said upper cylindrical wall portion with said nipple, a push rod extending through said top of said second cavity for engaging said valve means to open the same, said second portion of said body member including an integral hinged flap extending over the outer end of said push rod in operative relation therewith, said spray head also comprising a second fitting disposed within and extending outwardly from said open end of said transverse bore, said second fitting comprising a hollow expansion chamber having a cylindrical wall engaging the side of said bore and axially spaced transverse walls, an aperture in each said transverse wall, the outer of said apertures comprising a nozzle and directing a stream of propellent across said orifice of said first fitting and the inner aperture constituting a metering orifice, said cylindrical wall of said second fitting providing an abutment against which said shoulder of said first fitting is engaged to position said nozzle relative to said first fitting orifice.

4. A spray head adapted for use with a container of liquid to be sprayed and a can of liquified gaseous propellent, said can including a body with a cylindrical wall portion and a cover having a central boss with a flat apertured top, a nipple extending through the aperture in said boss top, an opening at the exposed end of said nipple through which propellent exits from the can and valve means within the nipple for releasing the propellent, said spray head comprising a unitary body having a first portion defining a first cavity for the reception of a said container, a second portion defining a second cavity for the reception of said can and a bridge portion interconnecting said first and second portions, said bridge portion having a transversely extending bore leading from said spray head second cavity and opening above said first portion of said body member, said first portion of said spray head having an upper surface sloping downwardly and outwardly relative to said open end of said bore, a

first fitting in said first portion of said spray head body member and extending from said first cavity to above said upper surface, said first fitting having a bore extending therethrough comprising an orifice and having an external upwardly facing shoulder above said upper surface, said second cavity being defined in part by a lower cylindrical wall portion adapted to frictionally engage said cylindrical wall portion of said can, a horizontal wall portion defining a seat adapted to engage upon said boss top to position said spray head relative to said can and an upper cylindrical wall portion extending upwardly from said seat, said upper cylindrical wall portion being adapted to engage said nipple in sealing relationship intermediate said can and said nipple opening, said transverse bore intersecting said second cavity above said area of sealing engagement of said upper cylindrical wall portion and said nipple, means to operate said valve means to open the same, said spray head also comprising a second fitting disposed within and extending outwardly from said open end of said transverse bore, said second fitting comprising a nozzle having a cylindrical wall engaging the sides of said bore, said nozzle directing a stream of propellent across said orifice of said first fitting and said cylindrical wall of said second fitting providing an abutment against which said shoulder of said first fitting is engaged whereby to position said nozzle relative to said first fitting orifice.

5. The spray head according to claim 1 in which said nozzle means comprises a fitting disposed in said open end of said transverse bore and having a housing defining a hollow expansion chamber having a side wall engaging the sides of said transverse bore and axially spaced transverse walls, and an aperture in each of said transverse walls, the one of said apertures more remote from said can comprising a nozzle and being disposed in operative relation with said orifice means and the other of said apertures constituting a metering orifice.

6. A spraying device for liquids including in combination a can of liquified gaseous propellent, a container of liquid to be sprayed and a spray head detachably supporting said can and container and selectively conducting said propellent into operative relation with the liquid to be sprayed, said can including a body member having a cylindrical wall portion and a conical wall portion extending upwardly and inwardly therefrom and defining the mouth of said can, said can also including a cover engaging over the edge of said mouth and having a central cylindrical boss with a horizontal top having an aperture therein and a release mechanism extending through said aperture, said release mechanism including a nipple having a stepped bore with a downwardly facing shoulder defining a valve seat, a ball type valve member and a spring urging said valve member into sealing engagement with said seat, said stepped bore having an opening more remote from said can than said seat through which the propellent exits from said can, said spray head comprising a unitary body member defining a first cavity for the reception of said container, a second cavity for the reception of said can and a bridge portion having a transverse bore leading from said second cavity, said second cavity having a cylindrical wall portion with axially extending, arcuately spaced ribs for engaging said cylindrical portion of said can, a conical wall portion parallel with and slightly spaced from said conical wall of said can, a dished wall portion parallel with and spaced from said cover and the edge thereof, a transversely extending seat portion engaging said top of said cover boss and positioning said spray head axially relative to said can, an inner cylindrical wall portion extending upwardly from said seat portion and engaging said nipple in sealing relationship intermediate said can and stepped bore opening, and a top wall, a slot extending transversely of said spray head body member more remote from said can than said top wall of said second cavity and forming an operating flap, an aperture extending from said slot through said top wall to said second cavity, a push rod tightly though slidably engaged in said aperture and being adapted to operate said valve member, said transverse bore in said bridge portion of said spray head intersecting said second cavity more remote from said can than said sealing engagement between said inner cylindrical wall portion and said nipple, said transverse bore having nozzle means at its opposite end to direct a jet stream of propellent, said spray head also including means extending into the liquid to be sprayed and through said spray head body member and having an orifice in operative relation with said nozzle.

7. The combination according to claim 6 in which said first cavity is defined by a first portion of said spray head body member, said nozzle means opens above said first portion of said spray head body member and said first portion of said spray head body member has an upper surface sloping downwardly and outwardly relative to said nozzle means.

8. The spray head according to claim 1 in which said orifice means comprises a bore extending through said portion of said spray head body member from said first cavity in said first portion and a fitting disposed in said bore and extending above said first portion.

9. A spray head adapted for use with a container of liquid to be sprayed and a can of liquefied gaseous propellent, said can including a body having a cylindrical wall portion, a cover having a central boss with a top and an aperture therein, a conduit extending through said aperture and having an opening for discharging propellent from said can and valve means for controlling the discharge of propellent through said conduit, said spray head comprising a unitary body member having a first portion having a cavity for the reception of said container, a second portion having a cavity for the reception of said can, and a third portion structurally interconnecting said first and second portions and having a transversely extending bore therein, said cavity in said second portion being defined in part by a cylindrical wall for frictionally engaging said cylindrical wall portion of said can, a horizontal wall portion defining a seat and adapted to engage upon said boss top to position said spray head vertically relative to said can and a cylindrical wall portion adapted to have sealing engagement with said conduit intermediate said boss top and said discharge opening, means having an orifice opening above said first portion of said spray head body member for conducting the fluid to be sprayed from said container through said first portion, said bore in said third portion of said body leading from said cavity in said second portion and being adapted to be in communication with said discharge opening and having nozzle means at its opposite end opening above said first portion of said spray head body member and directing a stream of propellent across said orifice.

10. The spray head according to claim 14 in which said cavity in said second portion is defined in part by a horizontal end wall portion adapted to overlie said discharge conduit and said means for actuating said valve means comprises an aperture in said end wall, a push rod disposed in said aperture and having a sliding fit therewith, said push rod having an inner end adapted to operate said valve means and an outer end extending outwardly from said end wall, and a hinged flap formed integrally with said spray head body member and extending over said outer end of said push rod in operative relation therewith.

11. In a spray head adapted for use with a container of liquid to be sprayed and a can of liquefied gaseous propellent and having means including an orifice through which the liquid to be sprayed is discharged from the container and a conduit for conducting said propellent from said can and directing it in the gaseous state across

said discharge orifice, the improvement of nozzle means in said conduit, said nozzle means comprising a housing defining an expansion chamber and having a cylindrical side wall and axially spaced end walls with one end wall upstream of the other, an aperture in each said end wall, the aperture in said one end wall comprising a metering orifice for admitting propellent into said chamber and the other said aperture comprising a nozzle and being disposed to direct a stream of propellent across said discharge orifice.

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