

Jan. 15, 1952

N. O. LOVEN ET AL
DISPENSING APPARATUS

2,582,262

Filed Nov. 10, 1947

3 Sheets-Sheet 1

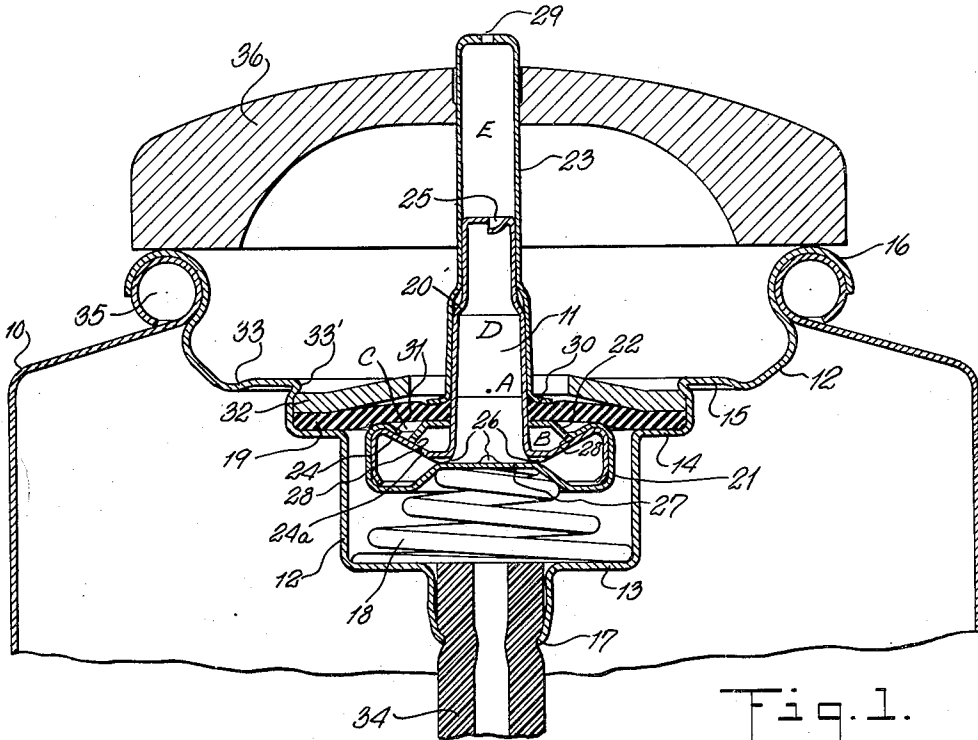


Fig. 1.

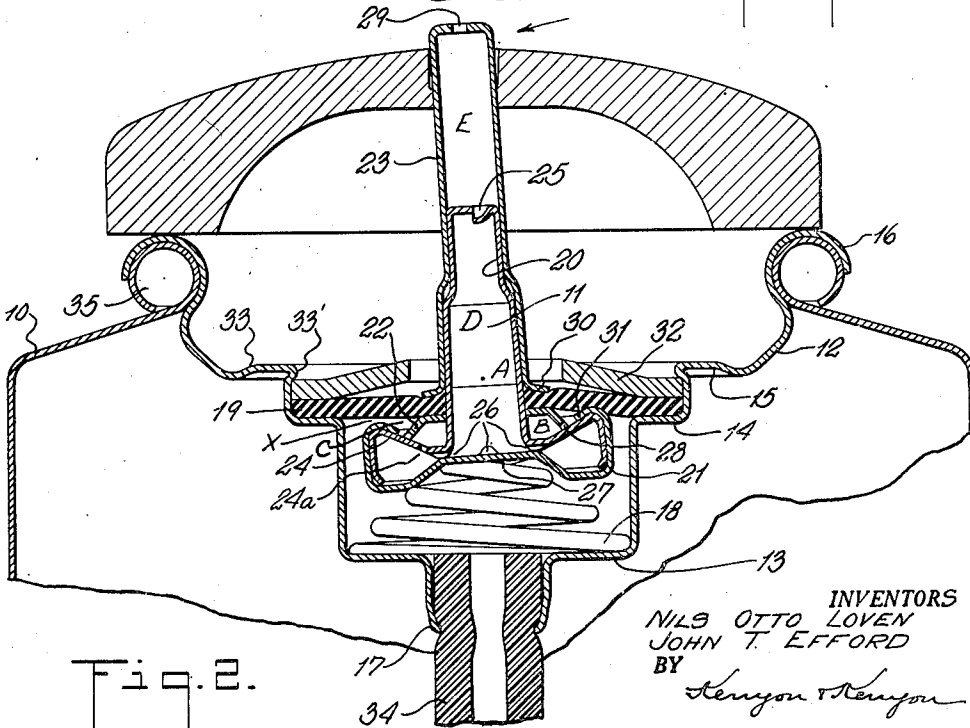


Fig. 2.

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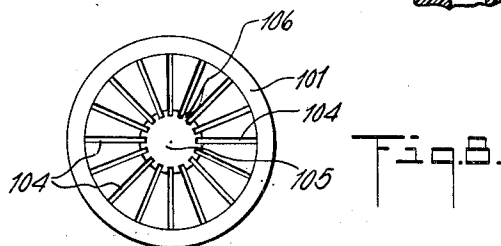
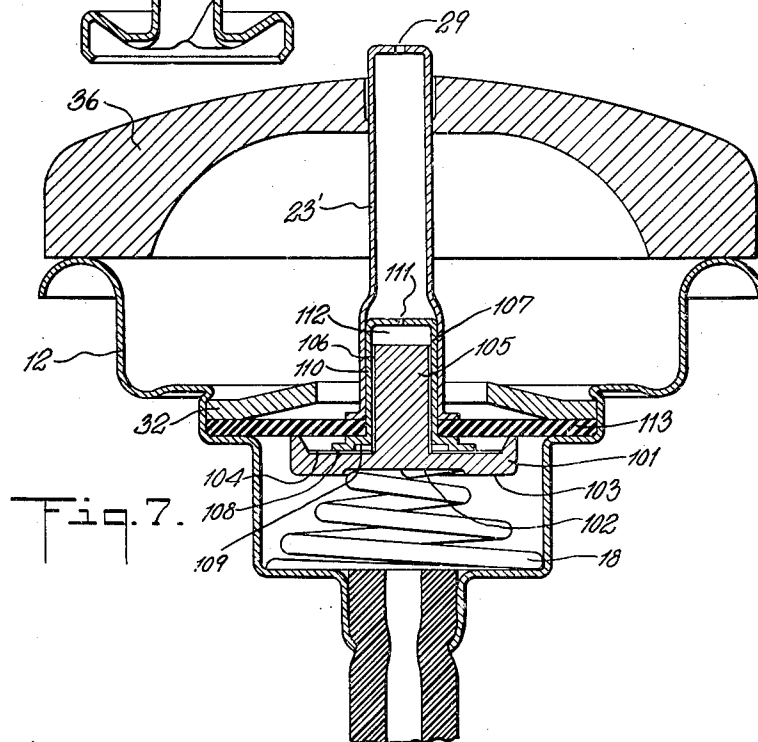
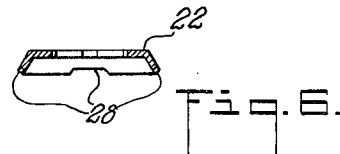
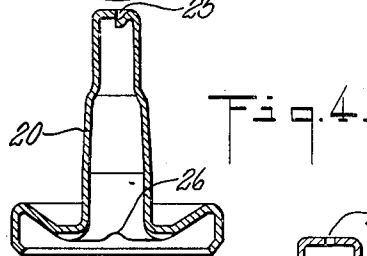
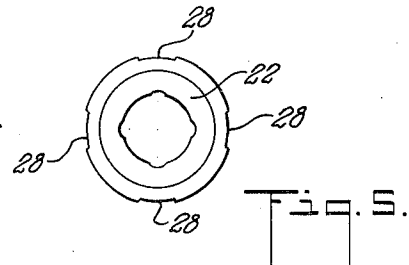
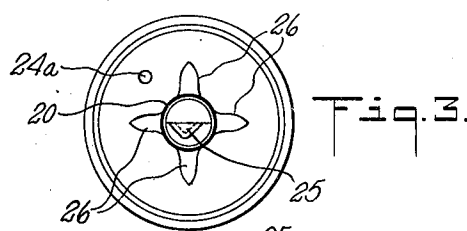
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3 Sheets-Sheet 3

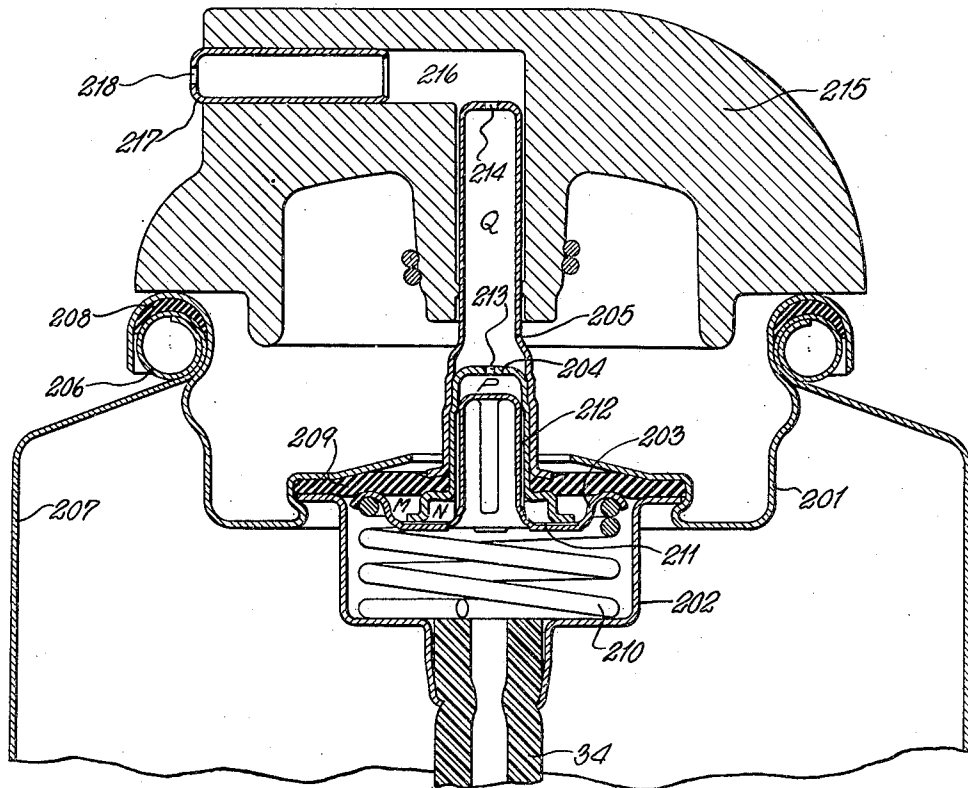


Fig. 9.

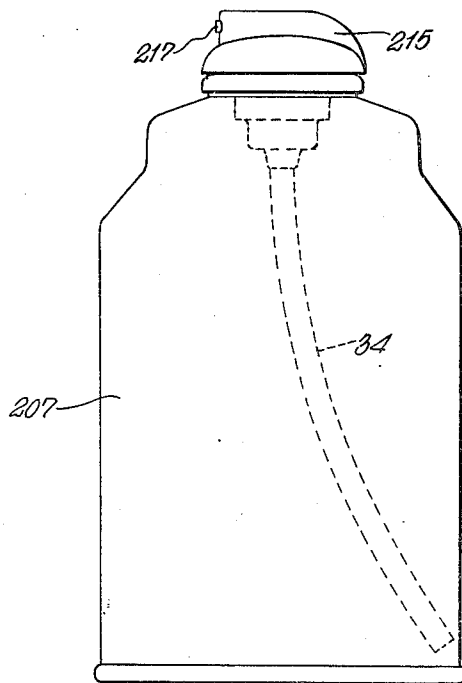


Fig. 10.

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DISPENSING APPARATUS

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8 Claims. (Cl. 299—95)

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This invention relates to dispensing apparatus for use in connection with the distribution or dispersion of fluids in small particles. It is more specifically addressed to the provision of a low-cost valve for the formation of aerosols from liquids under superatmospheric pressure. While our new valve is particularly suited to the application of insecticides, fumigants, hormones or the like, it is also adapted to the dispensing of other substances where dispersion in extremely small particles is desired, such as coatings, medicinals, nasal sprays, and the like.

In the application of insecticides, fumigants or the like, it is essential for maximum effectiveness that the active agent be suspended in the space to be treated for as long a period as possible. It is well known that the period of suspension is an inverse function of particle size, and that extremely fine particles, of colloidal magnitude, may be distributed in the air and remain suspended without settling for long periods. Similarly, in the production of fine films of coating or treating material, uniformity and economy require that the material be supplied to the surface being coated or treated in extremely small particles of substantially uniform size. Desirable colloidal dispersions of finely divided solids or liquids in air are known as aerosols. A method suggested for effecting such a dispersion is to maintain a solution of the active agent or agents in a liquefied gas confined under high pressure in a container and to release it into the atmosphere through an orifice, thereby obtaining rapid evaporation of the solvent and dispersion of the solution into small particles. However, the advantages to be derived from extremely small particle size are such that they cannot be achieved to the fullest extent by using previously known devices for dispersing them. The problems involved in the formation of the desired small particles, and especially of aerosols, are increased when the dispersion is to be effected from a liquid maintained at a relatively low degree of superatmospheric pressure—for example, in the neighborhood of 50 lbs. per square inch (gauge) or lower. At such pressures, orifice design, multiple stage expansion, and the provision of appropriate expansion chambers between orifices, become of critical importance. It will be understood, in addition, that a proper dispersion device must be capable of low cost manufacture, lest the advantages of safety and low container costs be nullified by high cost dispersion means.

An object of this invention is an improved valve device for dispensing or dispersing insecticides, or other substances, by which the substance can be dispersed in the form of an aerosol even from its relatively low pressure solution in a liquefied gas, or from solution under pressure in other readily volatilizable liquids. A further object is

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to provide such a device in a form which can be inexpensively and readily manufactured, and is easily manipulated to dispense any desired part of the contents of the container to which it is affixed, at other times serving as a seal to prevent leakage and loss. Moreover, the device is suitable for permanent attachment to a container holding under pressure the fluid to be dispensed, so that the orifice and chamber sizes can be fixed by the manufacturer to correspond with the properties of the fluid and the particle size required, so as to assure uniformity of operation throughout the charge, with no adjustments to be made by the user.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a sectional view of one form of our valve device showing a preferred method of mounting it on a container;

Fig. 2 is the same device as shown in Fig. 1, but with the valve unseated, in the position it takes when the contents of the container are being dispersed;

Fig. 3 is a top view of one of the elements of our device, the same being shown in longitudinal section in Fig. 4;

Fig. 5 is a top view of another element which is shown in longitudinal section in Fig. 6;

Fig. 7 shows in section a modified form of our valve;

Fig. 8 being a top view of one of its elements;

Fig. 9 is a sectional view of a second modification; and

Fig. 10 shows this modification attached to a container.

A dispensing device embodying the invention includes a receptacle or container which receives under pressure a liquefied gas or other readily vaporizable liquid containing in solution insecticides, fumigants, hormones, coating materials, etc. The generally cylindrical metal container or receptacle 10, only a part of which is indicated in the drawings, may be approximately six inches long and approximately three inches in diameter so that it may be readily held in a person's hand and directed as desired, but it will be understood that these dimensions are in no way critical, and that the container may be as large or as small as is appropriate to the service required. At one end, the receptacle is provided with suitable means for valving the receptacle contents into the atmosphere in such manner as will insure their dispersal into the desired aerosol.

The discharge means and valve assembly 11 is preferably assembled from members of diverse form, which may be commonly denominated as "eyelets" in accordance with trade practice, together with other parts which will be described

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below. The eyelets may conveniently and economically be made of brass, but other suitable metals may be employed.

An embodiment of our discharge and valve assembly adapted to the dispersion of insecticides and other materials requiring extremely small particle size from solutions even at moderate or low superatmospheric pressures, such as 50 lbs. per square inch gauge and lower, may be assembled within an outer eyelet 12, which as shown in the drawings is generally cup shaped and drawn or formed with portions of different diameters, thus providing annular shoulders 13, 14, 15, and 16, and being provided at its bottom with an opening or passageway 17. A spring 18 is seated on the lowest shoulder 13 and engages at its upper end the main valve assembly which is forced by the spring 18 to bear against flexible gasket 19 as will be hereinafter described. The valve and gasket assembly is constructed from eyelets 20, 21, 22 and 23 in the following manner.

Eyelet 20 is a three diameter piece, having substantially convex annular shoulder 24, provided with orifice 24a, near its lower end, which is open, and a smaller diameter at its top end which is deformed as shown, and closed except for orifice 25 which is provided in the deformed portion of the top so that its axis is inclined at a considerable angle, preferably substantially 90°, from the vertical axis of the valve. Spaced at intervals about the bottom of the main stem of eyelet 20 are arched openings 26, the purpose of which will be described below.

Eyelet 21 is preferably a cup shaped vessel with a dished bottom 27 adapted for engagement with the upper part of spring 18. Eyelet 22 is essentially a frustro-conical annular member with an inwardly extending annular shoulder at its upper end, its conical wall being provided at its lower end with symmetrically arranged weirs 28. Eyelet 23 is essentially a two diameter cylindrical stem, its narrow upper end being sealed except for orifice 29 and its wider lower end terminating in a relatively flat shoulder 30. In assembling the main valve and disperser body, eyelet 20 is inserted into eyelet 21 whereupon the end 31 of eyelet 21 is forced inwardly forming a shoulder in engagement with shoulder 24 of eyelet 20. Eyelet 22 is next slipped over eyelet 20 as shown in the drawings, followed by flexible gasket 19 and eyelet 23. The gasket 19 may be cut from nylon, synthetic rubber or other suitable flexible and yieldable material, selected so as to exhibit a minimum of swelling and other deleterious effects when in contact with the fluid to be dispersed. The upper cylindrical portions of eyelets 23 and 20 are so proportioned that, when eyelet 23 is forced down onto eyelet 20, the result will be a vapor tight fit. The assembly just described, to which metal washer 32 is added as shown, is placed within eyelet 12, with the dished bottom 27 of eyelet 21 resting on the upper end of spring 18. Shoulder 33 is then deformed as at 33' to apply pressure to metal washer 32 and thereby hold the main valve assembly in place. It will be observed that the flexible gasket 19 is seated on a shoulder of eyelet 12, thereby providing a vapor tight joint, and that spring 18 forces the shoulder formed from lip 31 of eyelet 21 into sealing engagement with the face of gasket 19. If it is desired to use our dispersing valve in substantially the vertically upright position shown in Figures 1 and 2, flexible tube 34, which may be made of suitable plastic or other material, is affixed in the

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lower opening 17 of eyelet 12 by crimping the lower lip of the eyelet as shown. Tube 34 is long enough to reach a point adjacent to the bottom of the container 10. The valve and dispersing device is now ready for affixing to a container charged with the fluid to be dispersed. This may be a drawn seamless can, but any other suitable container may be used. When a can is used, it is preferably provided with a bead 35 at its open upper end, which engages with shoulder 16 of eyelet 12. After the dispersing device is applied to the bead 35 of the container the wall of eyelet 12 just below the bead is expanded so as to hold the valve firmly in place on the container. If desired, a sealing compound known in the art may be applied to the bead of the can before the dispersing valve is attached. The container may be charged either before the valve means is affixed, by operating under suitable refrigeration, or the charge may be inserted, after the valve means is attached, through a suitable opening in the can which is thereafter sealed. In any event, the fluid, which may be a solution of the active ingredient in a volatile solvent and a propellant, is so selected as to exert the desired superatmospheric pressure, which may, with our valve, be as low as 50 lbs. per square inch, or lower, at ordinary atmospheric temperature. The fluid pressure tends to force the shoulder formed from lip 31 into sealing engagement with flexible gasket 19, which sealing pressure is reinforced by spring 18.

It will be observed that our valve 11 comprises an annular chamber B, connected to the circumferential region C by the weir-shaped openings 28 and by the orifice 24a to the interior of eyelet 20, which forms chamber D communicating with chamber E by means of orifice 25. Region C is sealed against the fluid in container 10 by the engagement of shoulder 21a with the sealing ring 19, this engagement being maintained by the compression of spring 18 and the pressure of the fluid within the container. Thus, the assembly constitutes a valve, shoulder 21a functioning as the valve member and the ring 19 as the valve seat. The valve may be unseated either by inward movement of eyelet 23, which may be brought about by pressing it inwardly against the reaction of spring 18, thereby wholly disengaging the shoulder 21a from the sealing ring 19, or by tilting eyelet 23 by radially applied pressure, thereby rotating it about point A and disengaging the rim from the ring in that region of the seat toward which the eyelet is tilted, as shown at X in Fig. 2. When the valve is unseated, communication is established between the interior of container 10 and chamber C, thence through openings 28 to B, thence through orifice 24a and passages 26 into chamber D through orifice 25 into chamber E, in which the position of orifice 25 gives the partially expanded fluid a swirling or rotary motion, and finally through orifice 29 into the space to be treated, where dispersal of the contents and evaporation of the solvent and propellant takes place. Release of the pressure on eyelet 23 will cause the valve to be resealed by the action of the spring 27, the internal pressure of the fluid, and the self-restoring force of diaphragm or gasket 19. Yoke 36 may optionally be attached to the valve as shown, and can then be used as a handle or trigger to unseat the valve.

Our valve, when constructed and operated in the above-described manner provides three expansion stages, through orifices 24a, 25 and 29, respectively. We have found that this is the op-

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timum number of stages for aerosol formation from a fluid at pressures of 50 lbs. per square inch or less. The openings 28 have the dual function of metering the rate of flow and blocking the passage of any solid particles which would plug the orifices. The orifices are preferably graduated in size, the first through which the fluid passes being the smallest. Thus, in a valve adapted to the dispersion of an insecticide such as pyrethrum in solution in a volatile solvent to which a propellant has been added, we have found that good results are obtained when orifice 24a is approximately .015 inch in diameter, orifice 29 approximately .020 inch, and orifice 25 is intermediate the two. With such a valve, and from a solution having a specific gravity of approximately 1.35 and a Saybolt Universal viscosity of 15 to 25 seconds, we have produced dispersions having an aerosol particle size of approximately 5 to 8 microns radius with initial fluid pressures in the neighborhood of 25 to 40 pounds per square inch (gauge) and a flow rate of about 45 grams per minute. When the valve is intended for other applications than insecticides, such for example as coatings, the size of the orifices and their number will vary, according to the ultimate particle size desired. The fewer the number of expansion stages, the lower the pressure, the larger the particles, and the larger the orifices, the larger the particles, all other conditions remaining constant.

Since the production of the desired aerosol depends on the expansion and evaporation of a liquid on its release from pressure, it is essential that the fluid entering chamber B be liquid. Therefore, if it is desired to use the dispersing device with the orifice 29 at its upper end, tube 34 is provided, communicating with the interior of eyelet 12 and extending at its lower end (not shown) substantially to the bottom of the container 10. This tube is preferably a small-bore plastic tube although a metal tube can also be used. In the latter case, it is preferably encased within a tubular sheath made of synthetic rubber or other flexible material. The tube and sheath are pressed into aperture 17, preferably in constricted form as shown, so as to form a fluid-tight joint.

Where it is desired to operate the dispenser with the orifice 29 directed in a downward direction tube 34 is omitted from the device.

In operation, the container 10 is charged with a solution of insecticide, or other desired active agent, in a liquefied gas, or in a readily vaporizable liquid which may if desired have a vapor pressure as low as 50 lbs. gauge, or lower, at normal temperatures. Among such solvents are low-boiling hydrocarbons, halogenated hydrocarbons and the like. In some cases, the pressure may be increased by the addition of small amounts of propellant, such as carbon-dioxide or other compressed gases. When an insecticide aerosol is desired, pyrethrum is a desirable active agent. Other solvents and modifiers may be added to the solution, which of itself does not form part of our invention. The valve assembly seals the liquid from flowing into chamber B. When the valve is unseated, the pressure of the vapor in equilibrium with the liquid in container 10 forces the liquid up through tube 34 (in the form of device intended for use with the dispenser end uppermost) and aperture 17, and thence into chamber B, and through orifice 24a and passageways 26 into chamber D where it is partially expanded and vaporized. The partly vaporized

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fluid then passes through orifice 25 into chamber E, where it is further expanded and partially vaporized while moving in a substantially rotary path under the influence of the position of orifice 25. The final expansion occurs as the fluid passes through orifice 29 into the atmosphere, where the reduction in pressure causes rapid and substantially complete dispersion and evaporation, thus producing a finely divided aerosol with optimum, or long-time settling qualities. When the valve is resealed, as by relieving the inward or radial pressure on eyelet 23, the fluid remaining in the container will be maintained under pressure for further use as desired.

A dispenser designed for downward dispersion is operated in the same manner, except that the container is inverted before the valve is unseated, and the liquid flows directly into aperture 17.

Figs. 7 and 8 show a modification of the valve which embodies the same principles but has certain advantages of manufacture and operation which will be set forth below.

In this form of the valve, member 101 may be made of a single stamping or assembled from two eyelets, depending on the relative convenience of manufacture. The bottom surface of this member has a slightly dished center portion 102 and a flat outer annular portion 103 whereby this member, when the valve is completely assembled, cooperates with a spring such as spring 18 in the same manner as does eyelet 21. The upper surface of member 101 is provided with a number of radially arranged ribs 104, .004" to .006" in width and a central vertical stem 105, closed at its upper end and having longitudinal ribs or flutings 106 of approximately the same dimensions as ribs 104.

Fig. 8 shows a top view of member 101.

Eyelet 107, is preferably formed as shown with a smooth annular bearing surface 108 and a slightly dished annular lower surface 109 and a central hollow stem 110 terminating in a closed upper end in which is orifice 111. The outer diameter of annular surface 108 is smaller than the inner diameter of the rim on the upper face of member 101, and the inner diameter of stem 110 and the outer diameter of stem 105 are so related that a pressed fit can be obtained between members 107 and 101. When this pressed fit is achieved, face 108 comes in contact with the ribs 104 and the ribs 104 and ribs or flutings 106 provide channels or passageways terminating in chamber 112. Flexible gasket 113 has a central opening of a size adapted to permit it to receive stem 110 and the outer diameter of stem 110 is adapted to form a pressed fit with eyelet 23'. It will thus be observed that in this form of our valve, members 101 and 107 correspond with members 21 and 20 respectively, and that flexible gasket 113 corresponds with the gasket or diaphragm 19 in the form of the valve shown in Figs. 1-6. The operation of this valve is generally similar to that of the other form. By displacement of eyelet 23' the seal effected by gasket 113 is broken and communication is established between the contents of the container and the space between the upper edge of member 101 and the annular edge of member 107. The spaces between the ribs 104 and between the vertical ribs 106 permit passage of the fluid, and have the same function as an orifice, the fluid thus passing into expansion chamber 112, thence through orifice 111 into the next expansion chamber formed by the head of the stem of eyelet 23' and finally through orifice 29. We have found that providing

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the ribs 104 and 106 to form passageways instead of the orifices shown in the other form of the valve, we can reduce the manufacturing tolerances and provide a more uniform device. Moreover, the slotted passageways formed by the ribs or flutings are less subject to clogging than orifices. For some applications, we have found it advantageous to provide only a single channel in place of the plurality of passageways provided by the ribs 106, in which instances we may also provide only a single passageway instead of the plurality of spaces formed between the ribs 104. Expansion chamber 112 may be smaller than the corresponding intermediate expansion chamber in the other form of the valve, which results in the retention of a smaller volume of fluid in this chamber and hence a more rapid termination of flow from orifice 29 when the displacement of gasket 113 is discontinued and the seal reestablished.

The operation of the second embodiment of our invention above described is generally similar to the first. When the stem of the valve is displaced, the seal formed by the normal pressing of eyelet 101 against gasket 113 is broken, and the valve operates as above described. Release of the force displacing the valve stem allows the seal to be reestablished by the same forces as were described in connection with our first embodiment.

Fig. 9 shows the construction of another modification of our dispensing valve. It will be noted that the assembly for this valve comprises five eyelets 201, 202, 203, 204 and 205. A lip at the upper end of eyelet 201 serves as the means of attachment of the assembly to the bead 206 of a container 207, a vapor tight seal being assured by packing or sealing compound 208. The lower part of eyelet 201 is formed as shown to position and provide a support for flexible gasket 209. As in the other embodiments of our invention, the support for the top of the flexible gasket is so shaped that there is room for any swelling of the gasket that may occur due to the action of the material to be dispensed. It will be observed that the outer edge of gasket 209 is held firmly in place between eyelets 201 and 202 and that its inner portion is held firmly between shoulders of eyelet 205 and 204. Spring 210 rests on a shoulder of eyelet 202 and bears against a shoulder formed at the outer periphery of eyelet 203, thereby tending to force the shoulder of eyelet 203 into sealing engagement with the gasket 209. The vapor pressure of the fluid in container 207 also acts to force eyelet 203 into sealing engagement with the gasket. The upper face of the flat base portion of eyelet 203 is formed as shown, with channels 211 extending from the outer edge of the base portion to its center. These channels are closely calibrated and their dimensions and number vary with the nature of the material to be dispensed. In the case shown in the drawing, there are four such channels evenly spaced along the upper surface of the base of eyelet 203. The vertical portion of eyelet 203 also has one or more longitudinal slots or channels 212 formed in its outer surface as shown. The upper end of the central stem portion of eyelet 203 is closed. The inner surface of the stem of eyelet 204 is in vapor tight engagement with the outer surface of the stem of eyelet 203, and the lowest shoulder of eyelet 204 is in close engagement with the upper surface of the flat base of eyelet 203. As a result, the only way in which fluid can pass from annular chamber M into chamber P is by passing through the channels in the base of eyelet 203,

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into annular chamber N and thence through the slots or channels 212 in the outer surface of the vertical stem of eyelet 203. Access from chamber P to chamber Q is afforded through orifice 213 in the top of eyelet 204, and an orifice 214 is provided in the top of eyelet Q.

As shown, there is fitted to eyelet 205 a trigger 215, which may be made of plastic or any desirable material and which may be provided with channel 216, in which may be an additional eyelet 217 having at its tip an opening 218. We wish to make it clear, however, that trigger 215, whether with or without channel 216 and eyelet 217, is not an essential part of our device. Where it is desired to dispense material with the valve uppermost, flexible tube 34 is provided for the same purpose as in the devices previously described.

Fig. 10 shows a device of the form just described attached to a suitable container. The operation of this embodiment of our invention is similar to that of the forms previously described. When eyelet 205 is displaced in a direction generally at right angles to its vertical axis, the seal between the shoulder of eyelet 203 and gasket 209 is broken and the material to be dispensed, which may be an insecticide or coating or other material dissolved in a solvent of appropriate vapor pressure as already described, is forced through tube 34 and into chamber M, whence it passes through channels 211 and slots 212 into chamber P. At this stage of the passage of the fluid, there will in most cases be an initial bubbling and breaking up of the fluid due to the primary expansion, which may bring about partial vaporization. As the fluid passes through orifice 213 into chamber Q it will be further expanded and partially vaporized, and a final expansion is achieved in its passage through orifice 214. Ordinarily, we prefer that the expansion to substantially atmospheric pressure shall be complete at this point, opening 218 when it is employed serving primarily to direct the aerosol stream. When desired, however, we may so proportion the sizes of the orifices that the final substantial expansion to atmospheric pressure will take place as the fluid passes through 218. As in the embodiments previously described, we prefer to make orifice 214 larger than orifice 213, and the dimensions of the orifices will be governed by the rules previously set forth.

The device shown in Figs. 9 and 10, like our other devices, makes possible the provision of a low cost valve for forming aerosol dispersions from fluids under pressure, and even from fluids of as low pressures as 50 pounds per square inch gauge and below.

We have provided a new and useful self-seating valve, for the dispersion of aerosols and similar finely divided particles, that can be readily manufactured at a low cost. Our valve, by utilizing a plurality of expansion chambers, makes possible the use of fluids at relatively low pressure. Change in direction of flow of the fluid passing through the various parts of our valve may be provided where desired. Moreover, it will be apparent to those skilled in the art that, if additional stages of expansion are desired, they can be obtained by including additional cup shaped eyelets each provided with an appropriate orifice.

It is, of course, understood that various other modifications may be made in the dispensing apparatus above described, without in any way departing from the invention as defined in the

appended claims, and that our valve may be used wherever it is desired to release a fluid from a container where it is maintained under pressure, in finely divided form into the atmosphere or any other relatively low pressure space.

We claim:

1. A dispensing valve assembly including a flexible gasket having a hole therethrough and an extended area around said hole to form a flexible diaphragm, a substantially cup-shaped member positioned on the inner side of said gasket and having a rim seating against said inner side within the periphery of said extended area, a stem member connected with said cup-shaped member and projecting through said hole and of such length as to extend a substantial distance beyond the outer side of said gasket, said stem member having clamping means engaging with and pressing on the inner side of said gasket at a location radially spaced inwardly from said cup member's rim, and a tubular member positioned on the outer side of said gasket and encircling said stem member and having clamping means pressing on the outer side of said gasket so that said gasket is clamped between both said clamping means, said stem member and said tubular member being tightly and firmly interfastened by frictional force in a normally permanent manner, said tubular member being of such length as to extend a substantial distance beyond said stem member from the outer side of said gasket and having a discharge orifice spaced beyond said stem and being otherwise closed to form a chamber beyond said stem member, said assembly providing a passage extending from the space formed within said cup-shaped member's rim and the inner side of said gasket to said chamber, said gasket being free to flexibly twist to permit tilting of said cup-shaped member's rim relative to the inner side of said gasket when tilting force is applied to said tubular member.

2. A dispensing valve assembly including a flexible gasket having a hole therethrough and an extended area around said hole to form a flexible diaphragm, a substantially cup-shaped member positioned on the inner side of said gasket and having a rim seating against said inner side within the periphery of said extended area, a stem member connected with said cup-shaped member and projecting through said hole and of such length as to extend a substantial distance beyond the outer side of said gasket, said stem member having clamping means engaging with and pressing on the inner side of said gasket at a location radially spaced inwardly from said cup member's rim, and a tubular member positioned on the outer side of said gasket and encircling said stem member and having clamping means pressing on the outer side of said gasket so that said gasket is clamped between both said clamping means, said stem member and said tubular member being tightly and firmly interfastened by frictional force in a normally permanent manner, said tubular member being of such length as to extend a substantial distance beyond said stem member from the outer side of said gasket and having a discharge orifice spaced beyond said stem and being otherwise closed to form a chamber beyond said stem member, said assembly providing a passage extending from the space formed within said cup-shaped member's rim and the inner side of said gasket to said chamber, said gasket being free to flexibly twist to permit tilting of said cup-shaped member's rim relative to

the inner side of said gasket when tilting force is applied to said tubular member, said passage being formed by a slot formed in the outer surface of said stem member and extending longitudinally along said stem member.

3. A dispensing valve assembly including a flexible gasket having a hole therethrough and an extended area around said hole to form a flexible diaphragm, a substantially cup-shaped member positioned on the inner side of said gasket and having a rim seating against said inner side within the periphery of said extended area, a stem member connected with said cup-shaped member and projecting through said hole and of such length as to extend a substantial distance beyond the outer side of said gasket, said stem member having clamping means engaging with and pressing on the inner side of said gasket at a location radially spaced inwardly from said cup member's rim, and a tubular member positioned on the outer side of said gasket and encircling said stem member and having clamping means pressing on the outer side of said gasket so that said gasket is clamped between both said clamping means, said stem member and said tubular member being tightly and firmly interfastened by frictional force in a normally permanent manner, said tubular member being of such length as to extend a substantial distance beyond said stem member from the outer side of said gasket and having a discharge orifice spaced beyond said stem and being otherwise closed to form a chamber beyond said stem member, said assembly providing a passage extending from the space formed within said cup-shaped member's rim and the inner side of said gasket to said chamber, said gasket being free to flexibly twist to permit tilting of said cup-shaped member's rim relative to the inner side of said gasket when tilting force is applied to said tubular member, said tubular member comprising a sheet metal eyelet of smaller inside diameter than the effective outside diameter of said stem member and said eyelet being press-fitted over said stem member.

4. A dispensing valve assembly including a flexible gasket having a hole therethrough and an extended area around said hole to form a flexible diaphragm, a substantially cup-shaped member positioned on the inner side of said gasket and having a rim seating against said inner side within the periphery of said extended area, a stem member connected with said cup-shaped member and projecting through said hole and of such length as to extend a substantial distance beyond the outer side of said gasket, said stem member having clamping means engaging with and pressing on the inner side of said gasket at a location radially spaced inwardly from said cup member's rim, and a tubular member positioned on the outer side of said gasket and encircling said stem member and having clamping means pressing on the outer side of said gasket so that said gasket is clamped between both said clamping means, said stem member and said tubular member being tightly and firmly interfastened by frictional force in a normally permanent manner, said tubular member being of such length as to extend a substantial distance beyond said stem member from the outer side of said gasket and having a discharge orifice spaced beyond said stem and being otherwise closed to form a chamber beyond said stem member, said assembly providing a passage extending from the space formed within said cup-shaped member's rim

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and the inner side of said gasket to said chamber, said gasket being free to flexibly twist to permit tilting of said cup-shaped member's rim relative to the inner side of said gasket when tilting force is applied to said tubular member, said cup-shaped member's rim having a radially smoothly curving convex shape throughout its area seating on the inner side of said gasket.

5. A fluid dispensing device including a container adapted to contain fluid under pressure and having a recess with an outlet opening in its bottom; a valve assembly comprising a flexible gasket having a hole therethrough and a peripheral mounting portion around said hole and radially spaced therefrom, said gasket being arranged with said mounting portion overlying said bottom around said outlet opening and fastened thereto, a substantially cup-shaped member on the inside of said gasket and having a rim seating thereagainst around said hole and radially spaced inwardly from said peripheral mounting portion, a stem portion connected with said member and projecting outwardly through said hole and extending a substantial distance beyond the outside of said gasket, said stem portion having a clamping surface pressing on the inside of said gasket, and a tubular stem on the outside of said diaphragm and telescoped towards said diaphragm over said stem portion and press-fitted over and frictionally fastened to the latter, said tubular stem having a clamping surface pressing on the outside of said gasket opposite to the first-named surface and said gasket being clamped therebetween, said gasket being free to twist so that tilting of said tubular stem relative to said gasket causes said rim portion to tilt from the inside of said gasket, a passage formed by said assembly and extending from a location inside of said rim portion to the inside of said tubular stem, the latter being substantially longer than said stem portion; said container recess having an outer rim and said tubular stem of said valve assembly extending out from said recess to a location beyond said rim and said stem having an outlet in its outer end portion; and a trigger in the form of a cap covering said recess and having a peripheral surface resting on said rim, said cap having a hole through which said tubular stem rockingly extends and being fastened to said tubular stem and thus held in position, said trigger cap being slidable transversely respecting said container to thereby rock said tubular stem.

6. A dispensing valve assembly comprising a flexible sealing diaphragm having a hole therethrough, a cup-shaped valve member having a rim engaging one side of said diaphragm for sealing purposes, a stem projecting from the inside of said cup-shaped valve member and extending through the hole in said diaphragm, a hollow member of greater length than said stem force-fitted over said stem on the other side of said diaphragm and constructed and arranged to form beyond the end of said stem an expansion chamber having an outlet beyond the end of said stem, said stem having a groove extending longitudinally of said stem and defining inside of said hollow member a passageway extending along said stem and affording communication between the interior of said cup-shaped valve member and said expansion chamber.

7. A dispensing valve assembly comprising a flexible sealing diaphragm having a hole therethrough, a cup-shaped valve member having a rim engaging one side of said diaphragm for sealing purposes, a stem projecting from the inside

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of said cup-shaped valve member and extending through said hole in said diaphragm, a diaphragm-clamping member surrounding said stem, and a hollow member of greater length than said stem force-fitted over said stem on the other side of said diaphragm and having a diaphragm-clamping flange engaging said diaphragm adjacent to said stem and clamping it against said diaphragm-clamping member and constructed and arranged to form an expansion chamber beyond the end of said stem, said hollow member having a discharge orifice and otherwise forming a closed chamber, a passageway being formed along said stem and communicating between the interior of said cup-shaped valve member and said expansion chamber.

8. A dispensing valve assembly comprising a cup-shaped container closure adapted to be fitted in the mouth of a container to form a recess and having an aperture in the bottom thereof, a flexible diaphragm closing the aperture in said cup-shaped closure member and having a hole therethrough, a cup-shaped valve member having a rim engaging the inner side of said diaphragm for sealing purposes, a stem projecting from the inside of said cup-shaped valve member and extending through said hole in said diaphragm, an inner diaphragm-clamping member surrounding said stem, a hollow member of greater length than said stem force-fitted over said stem on the outside of said diaphragm and having a diaphragm clamping flange engaging the outside of said diaphragm adjacent to said stem and clamping said diaphragm against said diaphragm-clamping member and constructed and arranged to form an expansion chamber at the end of said stem and having an outlet beyond the end of said stem, a passageway being formed along said stem and communicating between the interior of said cup-shaped valve member and said expansion chamber, a cover member covering said cup-shaped closure member and having an aperture fitted on said hollow member and providing means for exerting lateral force on said hollow member to rock said stem and said cup-shaped valve member to break contact between said diaphragm and portions of the rim of said cup-shaped valve member.

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