Aug. 5, 1952 W. E. VENSEL 2,606,071

SPRAY CAP

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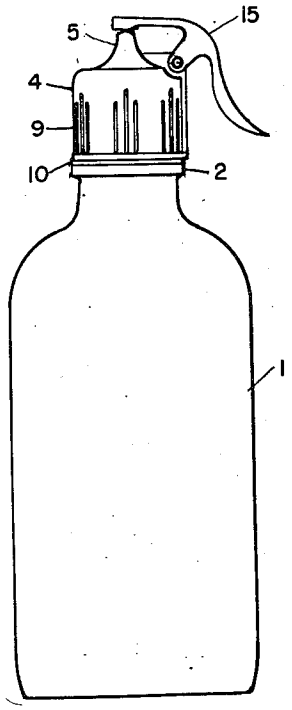


Fig. 1

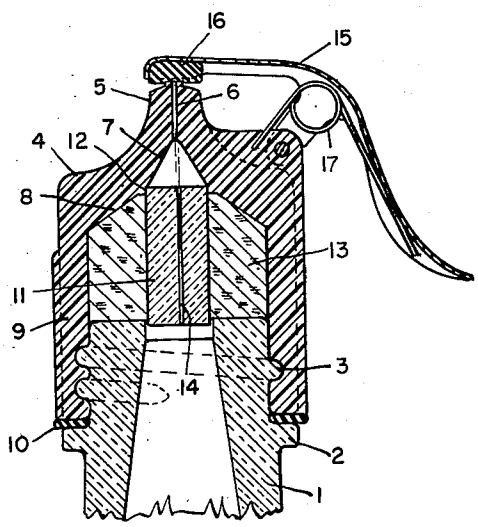


Fig. 2

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SPRAY CAP

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Continuation of application Serial No. 735,886, March 20, 1947. This application June 9, 1951, Serial No. 230,823

4 Claims. (Cl. 299—95)

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The present invention relating generally as indicated to an improved spray cap has more particular regard to that type of spray cap which is capable of dispensing readily vaporizable liquids, liquid solvents and vehicles such as ethyl chloride, ethyl ether, acetone, chloroform, tannic acid dissolved in freon and alcohol, and so forth.

This application is a continuation of my copending application Serial No. 735,886, filed March 20, 1947, and now abandoned.

As disclosed in my Patent No. 2,378,451 which issued on June 19, 1945, the dispensing of such vaporizable liquids, solvents and vehicles from a glass bottle or the like is effected by inverting the bottle and thus permitting the internal vapor pressure generated by the liquid within the bottle to force the liquid out through a very fine passageway, such passageway preferably including an expansion chamber intermediate its ends and being preferably larger at its upper end than at its lower end to thus assure that the liquid will be educted in the form of a very fine spray or mist as distinguished from a jet or stream.

It is one principal object of this invention to provide a spray cap which can be manufactured at very reasonable cost both because of its simplicity and the avoidance of the necessity of holding the parts to close tolerances except insofar as the diameters of the upper and lower ends of the eduction passageway are concerned. However, because the lower end of the passageway comprises commercial glass capillary tubing or thermometer tubing and because the upper end of the passageway is formed during molding of one of the parts, the maintaining of the diameters thereof within reasonable limits is not much of a problem.

It is another object of this invention to provide a spray cap which is operative to break up a liquid into a finer spray than has heretofore been possible with prior art devices.

It is another object of this invention to provide a spray cap which has simple and effective sealing means associated therewith to prevent loss of fluid by leakage.

It is another object of this invention to provide a spray cap in which the sealing means is substantially out of contact with the fluid and vapor within the bottle to thus minimize the possibility of chemical reaction between them.

It is another object of this invention to provide a spray cap in which the sealing means is substantially confined in an annular chamber whereby when the same is made of a non-compressible material such as rubber or synthetic rubber the vapor pressure within the bottle cannot force the same away from engagement with any of the walls with which it is in sealing engagement.

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It is another object of this invention to provide a spray cap in which auxiliary sealing means are employed to prevent leakage between the cap proper and the bottle and to function as a yieldable stop to indicate when the cap is properly secured to the bottle.

Additional objects and advantages of my invention shall become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, said invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail an illustrative embodiment of the invention, this being indicative, however, of but one of the ways in which the principle of the invention may be employed.

In said annexed drawing:

Figure 1 is an elevation view of a typical bottle with the spray cap constituting the present invention secured thereto; and

Figure 2 is an enlarged central vertical cross section view of the mouth of the bottle and the spray cap.

Referring now to the drawing, there is shown therein a typical glass bottle 1 having a radially outwardly projecting flange 2 and threads 3 above such flange which are adapted to be engaged by threads in the cap body 4. The cap body 4 is in the form of a hollow sleeve having a nozzle 5 at its upper end. Through such nozzle is a passage or orifice 6 leading into the vertex of a downwardly opening conical bore 7 which bore terminates in a radially extending end wall 8 preferably of frusto-conical shape as shown. Depending downwardly from such end wall 8 is an annular skirt portion 9 which has threads on its inner wall adapted to be engaged with the threads 3 on the bottle to firmly secure the body to the bottle. Interposed between the lower extremity of skirt 9 and the upper face of flange 2 is a yieldable gasket 10 of rubber or rubber-like material which functions both as a seal to prevent leakage of fluid between the body and the bottle and as a yieldable stop to prevent over-stressing of the hereinafter to be described packing in the body.

Within the body and concentric to the skirit 9 is an insert 11 which is preferably in the form

of a glass capillary tube or thermometer tube having its upper end telescoped within the lower cylindrical terminus 12 of the conical bore 7. Fitted into the annular recess defined between the exterior of the insert, the end wall 8, and the inner wall of skirt 9 is a packing 13, the lower exposed portion of which is adapted to be urged against the upper end face of the mouth of the bottle when the body is secured thereonto. The lower end of the insert preferably projects downwardly beyond the lower end of packing 13 and into the mouth of the bottle. Thus it can be seen that packing 13 is confined within a substantially closed chamber.

The upper end of insert 11 forms with the conical bore 7 the lower end wall of an expansion chamber disposed intermediate the upper passage 6 and the lower passage 14, the latter of which is in the insert to thus form a continuous passage having an enlarged intermediate portion. The lower end of this passageway, that is, the orifice 14, is preferably of size not greater than that of the orifice 6 whereby the combination of the expansion chamber with the particular relationship of the upper and lower ends of the passageway assures that the liquid will be discharged from the bottle when the bottle is inverted, in the form of a fine spray or mist rather than as a fine jet as is the case of other prior art devices. Such a spray conserves liquid in that the rate of discharge is considerably less than that of a jet and furthermore, as in the case of ethyl chloride when used for local anesthesia the spray will effect a much quicker freezing than is possible with a jet. While in the preferred embodiment of this invention the orifice 14 is smaller than orifice 6, it will be apparent to those familiar with hydraulic pressure drop principles that the same results can be obtained by making orifice 14 larger than that of orifice 6 and lengthening the insert 11 accordingly. In the form of spray cap illustrated using ethyl chloride as the vaporizable liquid, I have found that excellent results may be obtained by using an insert approximately $\frac{9}{16}$'' long and having a passage therethrough .010'' to .012'' in diameter, having a passage 6 about $\frac{3}{16}$'' long and approximately .018'' in diameter and having an expansion chamber of diameter of approximately .22'' at its large end. It is to be understood that for liquids having physical properties different from those of ethyl chloride, the passageway may have to be modified to compensate for such differences as viscosity, surface tension, and so forth.

As to the sealing means, it is now apparent that when the body 4 is screwed onto the bottle 1 the packing 13 will be squeezed between the upper end face of the bottle and the end wall 8 and because the packing is confined, the same will be caused to firmly and yieldably engage the exterior of the insert and the inner wall of the skirt 9. Thus the packing will be in sealing engagement with all four of the walls which define the chamber in which such packing is disposed. In addition, the end wall 8 being inclined, as shown, tends to more firmly urge the packing against the exterior of the insert to thus effect a firm seal therewith. With such a sealing arrangement the liquid and vapor in the bottle can contact the packing only in very small areas at the upper and lower inner corners thereof. Also because the packing is confined in a substantially closed chamber it will neither be extruded into the bottle nor will any pieces therefrom get into the bottle to contaminate the liquid therein or to cause clogging of the orifices 14 and 6.

Packing 13 is of cork or like material and may of course be of non-compressible material such as rubber or rubber-like material selected so as not to swell or to otherwise react with the contents of the bottle. The packing chamber herein described has the further advantage that when a packing of non-compressible material is used the vapor pressure in the bottle cannot shift the packing to a position out of contact with any of the walls thereof to permit leakage. The gasket 10 is extra precaution against leakage and in addition serves as a yieldable stop to prevent tightening of the cap to the point where the skirt 9 will be split open or the insert 11 crushed. That is to say that the lower end of the skirt contacts gasket 10 a part turn after the lower end of packing 13 engages the upper end face of the bottle. A still further advantage of using a confined chamber for the packing is that there is no cold flow and consequent leakage problem to contend with, as there is with the ordinary joint where a gasket is simply compressed between two opposed surfaces without any retaining walls or dams. Furthermore, the provision of retaining walls or dams preclude the possibility of pinching through the gasket when assembling the cap body onto the bottle.

Body 4 is preferably of plastic material molded to the form shown, thus requiring a minimum of subsequent machining. As previously indicated, the insert 11 can be simply made by cutting long pieces of glass tubing into desired short lengths. Likewise, packing 13 may be simply molded or else be made by cutting tubing into suitable lengths.

For retaining the top of passage 6 closed when the device is not in use, I prefer to employ a lever 15 pivotally connected between its ends to the cap body and provided with a rubber or rubber-like seating plug 16 at one end engaging the end of nozzle 5 and overlying the edge of passage 6. A torsion spring 17 with its opposite ends respectively anchored in said body and bearing against the opposite end of said lever serves to constantly yieldably press the seating plug into sealing engagement over the end of nozzle 5.

When it is desired to use the device, the bottle is simply inverted and the lever 15 is actuated to unseat plug 16. The vapor pressure within the bottle then forces the liquid out through the passageway in the cap, such liquid being discharged in the form of a fine spray because of the aforesaid relationship of the three portions of the passageway.

As a further feature of this invention, I have discovered that a much finer spray is produced by having the upper and lower passages 6 and 14 out of alignment as shown in Fig. 2. In this way, the stream of liquid educted from lower passage 14 strikes the wall of the expansion chamber 7 before passing through the upper passage 6, to thus effect a more complete breaking up the liquid with the ultimate result that the discharge from passage 6 will be a much finer spray than is attainable with a structure wherein passages 6 and 14 are in alignment. It is to be understood that the misalignment of passages 6 and 14 can be attained in any of several obvious ways and furthermore it is not essential that the passages 6 and 14 be parallel to one another as shown.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. A spray cap of the type adapted to be threadably secured to the threaded mouth of a bottle containing volatile liquid to be dispensed through a passage in said cap, such passage including contiguous upper, intermediate, and lower portions of which such intermediate portion is laterally enlarged relatively to such upper and lower portions, said cap comprising a one-piece body formed with a vertically disposed orifice through its upper end constituting the upper portion of such passage, and with a conical opening below and coaxial with such orifice, constituting the intermediate portion of such passage, the vertex of the conical opening being located at the lower end of the orifice, a substantially vertically disposed capillary tube in said body having its upper end extending into such conical opening and forming the lower end surface of the intermediate portion of such passage, the opening through said tube constituting the lower portion of such passage, said tube being of diameter substantially equal to the diameter of the mouth of the bottle, having its lower end extending below such conical opening, said body being further formed with a wall extending outwardly from such conical opening and above the lower end of said tube and with a downwardly depending skirt radially spaced from said tube and internally threaded at its lower end for engagement with the threads on the mouth of the bottle to which the cap is adapted to be secured, said body thus defining with said tube a downwardly opening recess, and a deformable annular packing ring in such recess having its entire upper end, interior and exterior surfaces respectively in sealed engagement with the aforesaid wall of said body, the exterior surface of said tube, and the interior surface of the skirt of said body, and said packing ring having its lower end surface exposed for sealed engagement with the upper end surface of the mouth of the bottle.

2. The structure of claim 1 further characterized that the lower end of said capillary tube is below the lower end surface of said packing ring whereby said tube is adapted to extend into the mouth of the bottle to which said cap is adapted to be secured.

3. The structure of claim 1 further characterized in that the opening through said capillary tube is directed toward the conical wall of the conical opening and out of line with the orifice at the vertex of the conical opening.

4. A spray cap of the type adapted to be threadably secured to the threaded mouth of a bottle containing volatile liquid to be dispensed through a passage in said cap, such passage including contiguous upper, intermediate, and lower portions of which such intermediate portion is laterally enlarged relatively to such upper and lower portions, said cap comprising a one-piece body formed with a vertically disposed orifice through its upper end constituting the upper portion of such passage, and with a conical opening flaring outwardly and downwardly from such orifice, such conical opening constituting the intermediate portion of such passage, said body being further formed with a wall extending outwardly from the lower end of the intermediate portion of such passage, and with a downwardly depending skirt internally threaded at its lower end for engagement with the threads on the mouth of the bottle to which said cap is adapted to be secured, a deformable annular packing ring within such skirt of said body having its upper end and exterior surfaces substantially in their entirety respectively in sealed engagement with the aforesaid wall of said body and the interior surface of the skirt of said body, a generally vertically disposed capillary tube within the skirt of said body extending through said packing ring and having its upper end surface forming the lower end surface of the intermediate portion of such passage, the opening through said tube constituting the lower portion of such passage, said packing ring having its lower end and interior surfaces respectively exposed for sealed engagement with the upper end surface of the mouth of the bottle and in sealed engagement with the exterior surface of said tube, said tube being of diameter substantially equal to the diameter of the mouth of the bottle and having its lower end surface exposed for contact by the liquid in the bottle whereby when said cap is assembled on a bottle, said packing ring is substantially enclosed within an annular chamber defined by the outwardly extending wall of said cap, the interior wall of the skirt of said cap, the exterior surface of said tube, and the upper end surface of the mouth of the bottle.

WILBUR E. VENSEL.

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