April 27, 1954 D. RATHSPRECHER 2,676,845

ATOMIZING CLOSURE DEVICE FOR LIQUID RECEPTACLES

Filed Nov. 4, 1949 2 Sheets-Sheet 1

Fig.1.

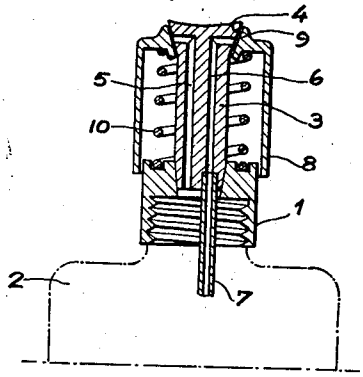


Fig 1a

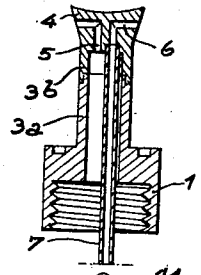


Fig.2.

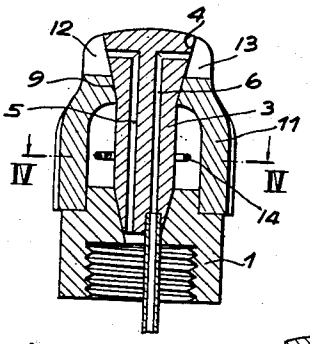


Fig 3

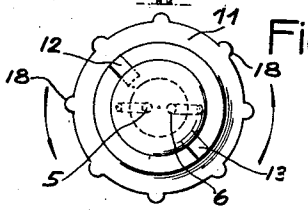


Fig. 4.

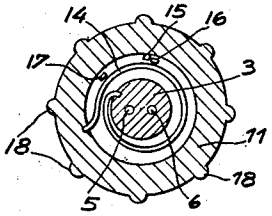
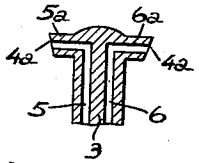


Fig. 1b



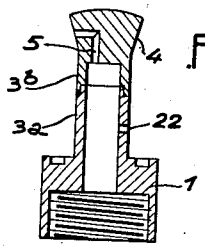


Fig 5a

Fig.5.

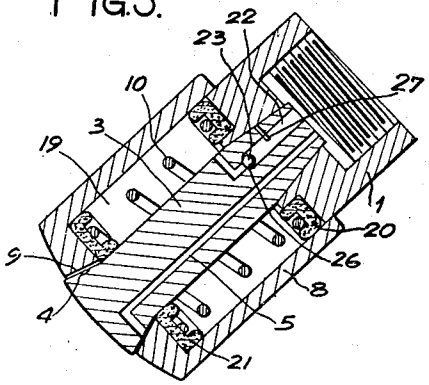
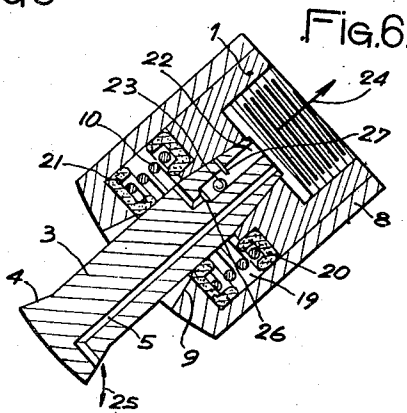


Fig.6.



Inventor
D. Rathsprecher
By Glascock Downing Seibold
Attys.

April 27, 1954 D. RATHSPRECHER 2,676,845

ATOMIZING CLOSURE DEVICE FOR LIQUID RECEPTACLES

Filed Nov. 4, 1949 2 Sheets-Sheet 2

Fig. 7.

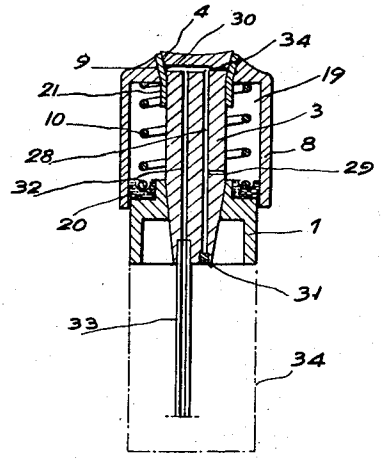


Fig. 8.

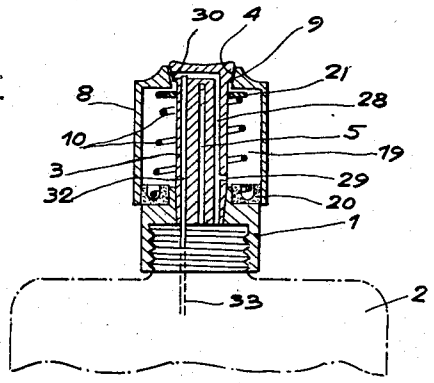
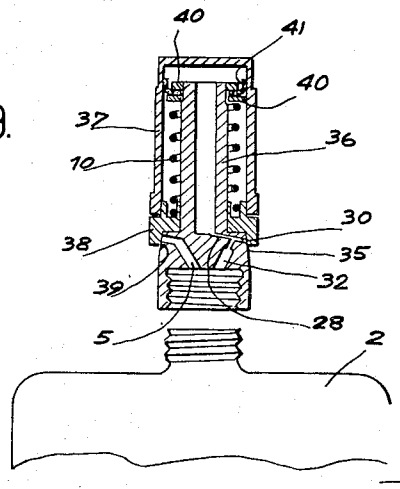


Fig. 9.



Inventor
D. Rathsprecher
By Glascock Downing Seibold
Attys.

Patented Apr. 27, 1954

2,676,845

UNITED STATES PATENT OFFICE

2,676,845

ATOMIZING CLOSURE DEVICE FOR LIQUID RECEPTACLES

David Rathsprecher, Ixelles-Brussels, Belgium, assignor, by mesne assignments, to General Closure Corp., New York, N. Y., a corporation

Application November 4, 1949, Serial No. 125,475

15 Claims. (Cl. 299—88)

1

The present invention relates to a closure device for liquid containers and has for an object to provide an improved closure device which by a very simple and convenient manipulation permits liquid or other material contained in the receptacle to be poured, distributed, dosed or atomized or vapourised, and which after use automatically causes the receptacle to be hermetically sealed.

The closure device according to one use of the invention is applied with advantage to closure of perfume bottles and other receptacles containing liquid perfumery products. It eliminates drawbacks of conventional screw-on caps or conical stoppers which for each use had to be unscrewed and screwed on again or withdrawn and replaced, and which were liable to jamming or seizing.

The device according to one embodiment of the present invention comprises on the one hand a distributor piece provided at the opening of the receptacle, said distributor piece optionally and preferably having a conical or oblique seat penetrated by at least one passage communicating with the interior of the receptacle and leading to an orifice or nozzle that opens on the said seat, and a movable closure element having a surface co-operating with the surface of the said seat, elastic means being optionally and preferably provided for keeping the closure element applied against the seat in a position in which it hermetically closes the said orifice or nozzle, but against the action of which optional elastic means the closure element or obturator element can be manually displaced so as to free the said orifice or nozzle and permit liquid or other material contained in the receptacle to move out through the orifice or nozzle.

The closure element may be axially movable so that it can be lifted from the seat against the action of a spring tending to apply it against the seat. Alternatively the closure element may be mounted so as to be free to be turned while remaining constantly in contact with the seat and comprise for each orifice of the seat a recess which can be moved manually to coincide with said orifice against the action of an optional spring which tends to return the obturator element to an angular position in which the recesses do not coincide with the orifices.

When the closure element is axially movable and is constituted by a sleeve enclosing the distributor piece and spaced from said distributor piece the air space between the sleeve and said piece can, with the help of sealing joints, form

2

a part of an air pump. I can thus provide a closure device which also functions as a dosing device or as a vaporizer or atomizer, with the passages required for the operation of the dosing or vaporising or atomizing device being provided in the distributor piece. Further features of the invention will appear from the following description and the annexed drawings, which represent by way of example various embodiments of the invention.

In all forms the base of the closure device according to the invention may, according to the intended use, be screwed or otherwise fixed on the mouth of the receptacle, or it may be introduced into this mouth in the manner of a removable stopper, or it may be integral with the receptacle.

In the drawings:

Fig. 1 is an axial section of a closure device forming a pourer with an axially movable closure sleeve;

Fig. 1*a* illustrates another embodiment of the distributor rod of the closure device according to Fig. 1;

Fig. 1*b* illustrates another modification of the distributor rod of Fig. 1;

Fig. 2 is an axial section of a closure device forming a pourer with a rotary closure element;

Fig. 3 is a plan view of the device according to Fig. 2;

Fig. 4 is a cross-section on line IV—IV of Fig. 2;

Fig. 5 is an axial section on a larger scale of a closure device forming a liquid closing device, the device being shown in its initial position before the dispensing of a dose;

Fig. 5*a* shows on a smaller scale another form of the distributor rod, and of the closure and dosing device of Fig. 5;

Fig. 6 is an axial section of the closure and dosing device of Fig. 5 near the end of a dosing operation;

Fig. 7 is an axial section of a closure device forming a vaporising or atomizing device;

Fig. 8 is an axial section of an obturator or closure device which also provides a pouring and vaporising or atomizing device;

Fig. 9 is an axial section of an inverted model of a closure device forming a pourer and vaporiser or atomizer.

In the embodiment illustrated in Fig. 1, the base of the closure device comprises a screw-threaded cap 1 adapted to be screwed on the neck of a bottle schematically indicated at 2. Plugged in the

cap 1 is a distributor rod 3, the enlarged head of which is shaped to provide a longitudinal seat 4 which has an inverted frusto-conical shape, as one example. Extending from the lower to the upper end of the rod 3 is a pouring passage 5 and an air entry passage 6, both of which are in communication with the interior of the bottle 2. At its outer end, each passage 5 and 6 has a lateral port which terminates in the valve seat 4, between the inner and outer ends of rod 3. The air entry passage 6 may be extended downwardly if necessary by an immersion tube 7. The distributor rod 3 is surrounded by a sleeve 8 which fits slidably over the cap 1 and which has at its upper portion a valve surface 9 which fits exactly upon the conical seat 4 of the rod 3. A spring 10 upwardly biases the sleeve 8 so as to apply the valve surface 9 against the valve seat 4 and thus hermetically seal the orifices or outlet ports of the passages 5 and 6, while permitting this sleeve to be manually pressed down to expose the said orifices.

In order to pour out liquid from the bottle 2 it is only necessary to lower the sleeve 8, for example, by pressing it down or inwardly with the tip of a finger of the hand holding the bottle, whereafter liquid can be poured through the passage 5, while air to replace the poured liquid enters the bottle 2 through the air inlet passage 6. Upon releasing the sleeve 8, the spring 10 automatically lifts the sleeve 8 and thus closes hermetically the upper ports or openings of the passages 5 and 6 by applying the valve surface 9 of the sleeve against the valve seat 4 of the rod 3.

To facilitate manufacture it may be of advantage to divide the rod 3 transversely into two parts. This can be carried out in the manner illustrated in Fig. 1*a*. In this embodiment the lower part 3*a* of this rod is integral with the cap 1, and the upper part 3*b* is connected to said lower part 3*a* by a plug-and-socket joint or in any other appropriate manner.

In Fig. 1*b* the passages 5 and 6 end in nozzles 5*a*, 6*a*, the outer ends of which are chamfered to form an oblique or tapered valve seat 4*a*. I prefer to use a closure device which is axially shiftable.

Figs. 2 to 4 show a closure device suitable for pouring, comprising a rotary closure element, the other elements being the same, and being designated by the same reference numerals as in Fig. 1. In this embodiment, the closure element is a sleeve 11 which is so mounted between the conical valve seat 4 of the rod 3 and a shoulder of the cap 1 as to be rotatable about the longitudinal axis of rod 3. The sleeve 11, the valve surface 9 of which fits accurately on the valve seat 4 of the rod, is provided at its upper edge with two recesses or notches 12 and 13 (Figs. 2 and 3), which in one position of the sleeve 11 register with the orifices of the passages 5 and 6 in valve seat 4, while a torsion spring 14 normally holds the sleeve 11 in closing position in an angular position relative to the rod 3 in which the notches or channels 12 and 13 do not register with the passages 5 and 6. A lug 15 fixed to the sleeve 11 moves between two stops 16 and 17 which are fixed to the cap 1, or to rod 3, so as to limit the angular movement of the sleeve 11. When the sleeve, under the action of the spring 14, occupies its normal closure or sealing position illustrated in Figs. 3 and 4, in which the lug 15 is in contact with the stop 16, the notches 12 and 13 are laterally displaced in relation to the orifices of the passages 5 and 6, so that the latter are hermetically sealed by the valve surface 9 of the sleeve 11. When, however the sleeve 4 is turned in the direction of the arrows of Fig. 3 until the lug 15 prevents further movement by striking the stop 17, the notches 12 and 13 register with the orifices of the passages 5 and 6 as illustrated in Fig. 2, thus permitting liquid to be poured from the receptacle as in the embodiment of Fig. 1. Similarly, when the sleeve 11 is released the optional spring 14 will automatically return the sleeve 11 to the position of Figs. 3 and 4, thus ensuring hermetic closure of the passages 5 and 6. Manual turning of the sleeve 11 is facilitated by providing the sleeve with a handle or with ribs 18 projecting from its periphery.

By making the passages 5 and 6 of a closure and pouring device according to the invention suitably narrow, one can obtain a drop-by-drop dispensing of the poured liquid, thus obtaining very practical and eminently hygienic drop counters, the orifices of which are always automatically closed after use.

When the desired fine bore of the passages is not obtained during initial manufacture, it can be obtained by inserting therein a suitably calibrated small tube.

In the embodiments which will now be described, and which are illustrated in Figs. 5 to 8, a chamber 19 of variable volume, formed between the axially movable sleeve 8 and the stationary distributor rod 3, is utilised to form an air pump, thus permitting the provision of closure devices which at the same time form dosers or vaporisers or atomizers for liquid.

With this object in view a sealing ring 20 is provided on the cap 1 to provide a seal relative to the axially slidable sleeve 8, and in the upper portion of this sleeve 8 a packing ring 21 is provided to form a seal with the rod 3.

When the sleeve 8 is moved from its outer blocking position of Fig. 5 to its inner unblocking position of Fig. 6, the air-confining members 20 and 21 confine the air sufficiently in the air space or air chamber 19, to force the air from said chamber 19 into the receptacle. During the outward stroke of sleeve 8 to its outer position of Fig. 5, there is enough leakage to replenish the supply of air in chamber 19. It is well-known in hydraulic pumps and in air pumps to provide a one-way packing which is fluid-tight during the compression stroke and which yields during the reverse stroke so as to be not fluid-tight during the reverse stroke.

Figs. 5 and 6 illustrate a closure device forming a liquid doser in which the distributor rod 3, in addition to the dispensing passage 5 which ends in an orifice or port provided in the valve seat 4, is provided with a second passage 22 communicating with the interior of the receptacle at the top of the cap 1, and ending at the side of the distributor rod 3, in the part of the chamber 19 which is most remote from the valve seat 4. When a receptacle carrying this closure and dosing device is suitably inclined, and the sleeve 8 is pressed from the normal sealing position illustrated in Fig. 5 to the dispensing position illustrated in Fig. 6, the air contained in chamber 19 is displaced through the passage 22 into the receptacle as indicated by the arrow 24, thus causing a corresponding always equal quantity of liquid to be expelled through the port of passage 5, as indicated by the arrow 25. To prevent liquid from passing through the passage 22, I may provide therein a one-way valve opening towards the interior of the receptacle. In the

illustrated example this one-way valve is a ball valve 23 which forms a hermetic seal against a tapered or frusto-conical seat 26 formed in the passage 22. A pin 27 prevents the ball 23 from moving out of the passage 22.

Fig. 5*a* shows that in this embodiment, the distributor rod can also be divided into two parts 3*a*, 3*b*, as previously explained with reference to Fig. 1*a*. In the case of Fig. 5*a* the passage 22 is formed in the part 3*a* of the rod, this part being integral with the cap 1.

Fig. 7 illustrates a closure device which forms a vaporising or atomizing device for liquids. In this embodiment a passage 28 is provided in the distributor rod or stem 3. This passage 28 is connected to a passage 29 whose outer end communicates with air-space or chamber 19. The upper or outer end of passage 28 communicates with a lateral aspiration passage 30, which has an outlet port in the frusto-conical valve-seat 4 of the rod or stem 3. The lower end of the passage 28 is plugged at 31. Adjacent the passage 28, the aspiration passage 30 communicates with a passage 32 which also extends through the rod 3 and is continued downwardly by a tube 33 extending into the liquid. When the cap 8 is pressed down, the air compressed in the chamber 19 is ejected through passage 29 and upwardly through passage 28 into the aspiration passage 30 and, in moving past the open upper end of the passage 32, produces a suction therein which causes liquid to rise therein to be ejected in the form of an atomized jet, which is discharged through the outlet port of aspiration passage 30. A small passage 34 also ending on the seat 4, is provided for permitting air to be aspirated into the chamber 19 when the sleeve 8, under the action of the spring 10, rises again. In this embodiment, the valve seat 9 includes a sealing insert or ring 21.

The closure device as described can be used in various ways. Instead of being screwed on a bottle by means of a screw-threaded cap 1, said closure device may be inserted into the mouth of a bottle by suitably shaping the lower end of the distributor rod 3, like a conventional conical stopper. Such a closure and vaporising or atomizing device can also be removed from the bottle as a unit, in order to apply the liquid, for example a perfume, with the aid of the small tube 33 or, if the latter is not provided, with the lower end of the rod 3 itself.

On the other hand, the part 1, instead of being a cap intended to be fixed on a bottle or other receptacles, may itself constitute the upper part of a small receptacle whose body is indicated in broken lines at 34*a*, thus constituting an extremely convenient pocket vaporiser.

In the embodiment illustrated in Fig. 7, it is shown how the upper sealing ring 21 can be so arranged as not only to form a seal against the cylindrical portion of the rod 3, but also to cover the surface 9 of the sleeve 8 and supply a hermetic packing layer for the valve seat 4 of the rod 3.

Fig. 8 shows a closure device which is capable of providing a pourer and a vaporiser, and which for this purpose comprises both the pouring passage 5 and the passages 28 and 32 which form the vaporising system.

Fig. 9 finally shows an embodiment in which the valve seat and valve are at the inner end of the closure. This arrangement may be applied to the other embodiments. Instead of having a valve seat, which flares outwardly and which is provided at the upper end of a rod, this embodiment of Fig. 9 comprises a valve seat 35 which

flares inwardly and which may be formed directly on a cap 1 adapted to be fixed on the bottle 2. This cap is extended by a tube 36, the upper end of which is open and is surrounded by a sleeve 37 closed at its upper end. A ring 38 is fitted into and fixed to the lower end of this sleeve 37. This ring 38 can slide under moderate friction on a tube 36 and said ring 38 is provided internally with a frusto-conical valve surface 39 fitting accurately on the frusto-conical surface of the valve seat 35. The cap 1 is provided with the pouring passage 5 which connects the interior of the receptacle to an orifice or port located on the frusto-conical seat 35, while the vaporising or atomizing passage 28 connects the lower end of the tube 36 with the vaporising or atomizing orifice 30, which is also located on the valve seat 35, and the passage 32 opens into the passage 28 to lead into it the liquid to be vaporised or atomized. At the upper end of the tube 36 is mounted a sealing ring 41 held between two rigid rings 40 and serving to form a seal between the upper end of the tube 36 and the slidable sleeve 37.

A spring 10 is interposed between the ring 38 and the lower ring 40 and tends to apply the valve surface 39 of ring 38 to the seat 35 to close hermetically the orifice of the pouring passage 5 and the vaporising orifice 30.

By slightly lifting the sleeve 37 and with it the ring 38, the seat 35 is cleared and liquid can be poured out through the passage 5. If a pumping action is exerted by repeated up and down movement of the sleeve 37, liquid is vaporised or atomized or ejected through the orifice 30.

When the device is not manually operated, the spring 10 always acts to lower the ring 38 upon the cap 1 so that the valve surface 39 of said ring is applied upon the seat 35 and ensures hermetic sealing.

It should be understood that the invention is not limited to the embodiments which have been described with reference to the annexed drawings and that the invention may be incorporated in other embodiments without abandoning its principle.

Thus, the spring is only one preferred means for keeping the parts in normal selected relative positions and other changes and omissions and substitutions and additions may be made without departing from the scope of the invention. Thus, while the interfitting flared shape of the valve and valve seat is preferable, other interfitting shapes of the inner and outer parts of the device may be used to provide a seal when the parts are in their selecting normal positions and gaskets and the like may be used to provide said seal.

For convenience, the sleeve 8 is designated as the outer body member, and this designation applies to the member 37—38 of Fig. 9. The rod 3 is designated as the internal body member, and this designation applies to the combined rod or tube 36 and the cap 1 of Fig. 9.

At least a part of the internal body member is located within the outer body member, and the internal body member extends through at least one end of the outer body member.

The internal body member has at least one delivery passage, which has respective inner and outer end-ports. The inner end-port is located to communicate with the receptacle. The outer end-port is located in the internal body member, intermediate the inner and outer ends of said internal body member.

The external body member is movable relative

to the internal body member to a selected closure or block-position in which said external body member blocks or closes said outer end-port. The external body member is also movable to a selected opening or unblocking position in which said external body member unblocks said outer end-port.

Said internal body member optionally and preferably has a longitudinal axis, and the relative movement between said body members is optionally and preferably an axial movement.

I claim:

1. A closure device for a receptacle, said closure device comprising a sealing member which has a longitudinal periphery and which is shaped to make sealing contact with the mouth of the receptacle, a longitudinal internal body member which is fixed to said sealing member, said internal body member extending longitudinally outwardly from said sealing member and being of smaller diameter than said sealing member and being spaced laterally inwardly of said longitudinal periphery, said internal body member having a longitudinal delivery passage which has an inlet port and an outlet port, said outlet port being lateral and extending laterally through the wall of said internal body member inwardly of the outer end of said internal body member, said outer end of said internal body member being closed, said lateral outlet port being longitudinally further away from said sealing member than said inlet port, said closure device also comprising a longitudinally disposed sleeve which is movable relative to said internal member and said sealing device to blocking position and unblocking position, said sleeve having an internal longitudinal wall of greater diameter than said internal member and said longitudinal periphery, said internal longitudinal wall of said sleeve substantially interfitting with said longitudinal periphery to provide a bearing for said sleeve at said longitudinal periphery, said internal member being shaped at said lateral port to provide a tapered valve-seat, said sleeve being shaped at said valve-seat to provide a tapered valve which closes said lateral port when said sleeve is in blocking position and which opens said lateral port when the sleeve is in unblocking position, a biasing spring which normally holds said sleeve in blocking position, said biasing spring being located wholly in the space between said sealing member and said internal body member and said sleeve.

2. A closure device according to claim 1, said device having means to maintain said sleeve in said blocking position.

3. A closure device according to claim 1, said device having spring means which bias said sleeve to said blocking position and which yieldingly maintian said sleeve in said blocking position.

4. A closure device according to claim 1, in which said internal member and said sleeve have a common longitudinal axis, the outer end-wall of said internal body member is imperforate, and said sleeve is movable in the direction of said axis relative to said internal body member.

5. A closure device according to claim 1, in which said internal body-member also has an air passage which has an air-inlet-port and an air-outlet-port, said air-outlet-port being located to deliver air from said passage to the receptacle, said air-inlet-port being also located between the inner end and the outer end of said internal body member and being located to be blocked by said sleeve in its blocking position and to be unblocked by said external body member in its unblocking position.

6. A closure device according to claim 1, in which said blocking means consist of a tapered valve seat and a tapered valve surface provided respectively in said internal member and said sleeve, said valve seat and said valve surface having interfitting shapes.

7. A closure device according to claim 1, in which the proximate walls of said internal member and said sleeve are spaced from each other to provide an intermediate air space, and said closure device has a spring located in said intermediate air space, said spring biasing said sleeve to said blocking position and yieldingly maintaining said sleeve in said blocking position.

8. An atomizer device which comprises an internal body member and an external body member, each said body member having an inner end and an outer end, at least part of said internal body member being located within said external body member, said body members having a common longitudinal axis, the proximate longitudinal walls of said body members being spaced laterally from each other to provide an intermediate air space, said internal body member having a liquid-delivery passage which has an inlet port and an outlet port, said outlet port being located intermediate the inner and outer ends of said internal body member, said internal member also having an aspiration passage which communicates with said outlet port, said internal body member also having an air passage which has an air-inlet-port and an air-outlet-port, said air-inlet-port being located between the inner and outer ends of said internal body member and opening into said air space, said air-outlet-port opening into said aspiration passage, said external member being longitudinally movable relative to said internal member to respective blocking and unblocking positions, said body members having blocking means to block said outlet port in said blocking position and to unblock said outlet port in said unblocking position, said body members also having means to prevent substantial leakage of air out of said air space when said external member is moved from blocking position to unblocking position, the movement of said external member from blocking position to unblocking position forcing air from said air space through said air passage and said aspiration passage to exert an aspiration effect on said liquid-delivery passage at said outlet port.

9. An atomizer device which comprises a longitudinal stem and a longitudinal sleeve, said stem having a part thereof located within said sleeve, the proximate longitudinal walls of said stem and said sleeve being spaced laterally from each other to provide an intermediate air space, the outer end of said stem being closed, said stem having a liquid-delivery passage which has an inlet end at the inner end of said stem and an outlet end which communicates with a lateral aspiration passage which has an outlet port at one end of said aspiration passage in the wall of said stem inwardly of the closed outer end of said stem, said stem also having an air-passage, one end of said air-passage communicating with said aspiration passage, the other end of said air-passage communicating with said air space, said sleeve being longitudinally movable to-and-fro relative to said stem to respective blocking and unblocking positions of said sleeve, said sleeve being shaped to block said outlet port when said sleeve is in block-

ing position, said sleeve being shaped to unblock said outlet port when said sleeve is in unblocking position, means to prevent substantial leakage of air out of said air space when said sleeve is moved from blocking position to unblocking position in order to compress the air in said air space when said sleeve is thus moved.

10. An atomizer device according to claim 9 in which said aspiration passage has another port at the other end of said aspiration passage, said other port being also in the wall of said stem inwardly of its closed outer end, said sleeve being shaped to block and to unblock said other port when said sleeve blocks and unblocks said outlet port.

11. A closure device according to claim 1, in which said internal body-member also has an air passage which has an air-inlet-port and an air-outlet-port, said air-outlet-port being located to deliver air from said passage to the receptacle, said air-inlet-port being also located between the inner end and the outer end of said internal body member and being located to be blocked by said external body member in its blocking position and to be unblocked by said external body member in its unblocking position, said internal body member also having a one-way valve which permits the flow of air from said air-inlet-port to said air-outlet-port and which blocks the reverse flow of air through said air passage.

12. A closure device for a receptacle, said device comprising an internal body member and an external body member, each said body member having an inner end and an outer end, said body members having a common longitudinal axis, said internal body member having a delivery passage which has an inlet port and an outlet port, said outlet port being located intermediate the inner end and the outer end of said internal body member, the proximate longitudinal walls of said body members being spaced laterally from each other to provide an intermediate air space, said external body member being longitudinally movable relative to said internal body member to a blocking position and an unblocking position, said internal body member also having an air passage which has an air-inlet-port and an air-outlet-port, said air-inlet-port being located between the inner end and the outer end of said internal body member, said air-inlet-port being also located to communicate with said air space in said blocking and unblocking positions and while said external member is moved from said blocking position to said unblocking position, said body members having blocking means to block said outlet port in said blocking position and to unblock said outlet port in said unblocking position, and air-confining means providing a close sliding fit between said body members during the movement of said external body member from said blocking position to said unblocking position to then force air from said air space through said air-outlet-port, said air-outlet-port being located to deliver the air to the receptacle.

13. A closure device according to claim 12, said device having a spring located in said air space, said spring biasing said external body member to said blocking position and yieldingly maintaining said external body member in said blocking position.

14. A closure device according to claim 12, in which said internal member has a one-way valve which permits air to flow from said air space through said air-outlet-port and which blocks said air passage while said external member is moved from its unblocking position to its blocking position.

15. An atomizer device according to claim 8, in which said internal body member has an additional delivery passage which has an additional inlet port and an additional outlet port, said additional outlet port being located between the inner and outer ends of said internal body member to be blocked by said external body member in its blocking position and to be unblocked by said external member in its unblocking position.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
84,384	Sherwood	Nov. 24, 1868
245,401	Raynor et al.	Aug. 9, 1881
1,182,452	Bucklin	May 9, 1916
1,742,605	Lemoine	Jan. 7, 1930
1,948,070	Hasse et al.	Feb. 20, 1934
2,162,092	Lundgren	June 13, 1939
2,197,352	Terkel	Apr. 16, 1940
2,296,773	Daggett	Sept. 22, 1942