July 20, 1948. C. E. WHITE 2,445,653

NASAL APPLICATOR

Filed Feb. 22, 1945

Fig. 1

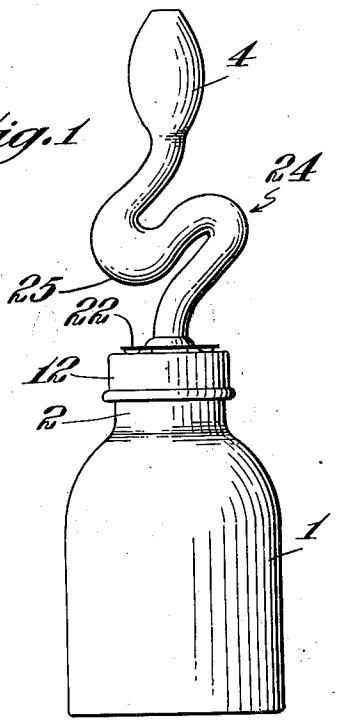


Fig. 2

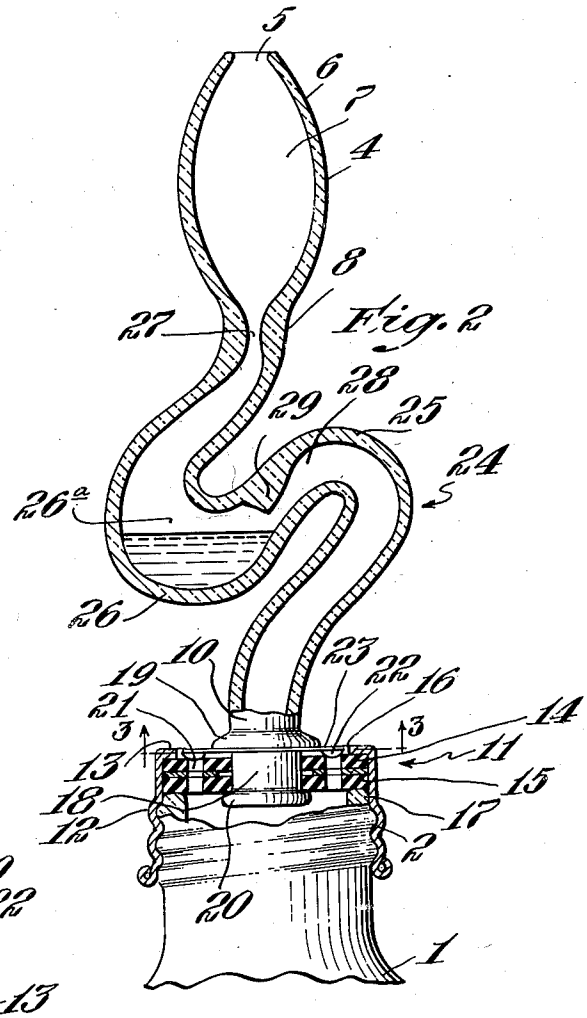


Fig. 3

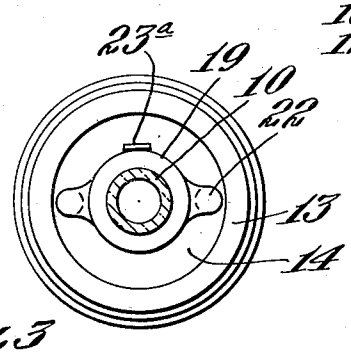


Fig. 4

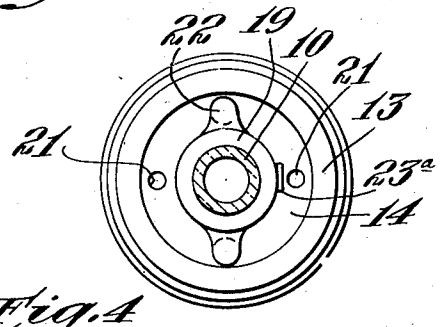


Fig. 5



Fig. 6

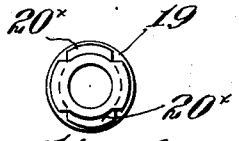
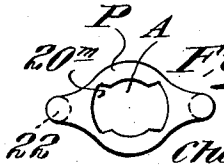


Fig. 7



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NASAL APPLICATOR

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4 Claims. (Cl. 128—173)

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This invention pertains to an applicator device for the introduction of fluid, for example medicaments, disinfectants, or the like into the nasal cavity. Heretofore applicators employed for this purpose have been of two general types, to wit, droppers and atomizers. The usual dropper is a simple appliance into which the liquid is drawn and which is then introduced into the nostril, the liquid being ejected in fluid form or in drops of relatively large size. On the other hand, atomizers are designed to break up the liquid into very fine droplets or mist, the atomizing action being attained by the use of a jet of air produced mechanically, for example by the compression of a bulb, or a piston operating in a cylinder.

The usual dropper type of applicator is subject to various disadvantages. For instance, when this type of dropper is used, unless the patient's head be tilted far back, the contents of the dropper flow down into its lower end so that it is difficult to eject the liquid into the nose. Moreover, the usual dropper has a rather pointed delivery end, making it difficult to use when administering the liquid to a child, since there is danger that the child may be injured by the point of the dropper. The quantity delivered by such a dropper is difficult to gauge; there is danger that the liquid may be ejected so forcibly as to cause injury, and quite commonly the contents of the dropper pass directly into the throat without contacting or coating the upper nasal passages. On the other hand, the usual atomizer, depending as it does upon the compression of a bulb or the like for its atomizing action, may deliver the spray with such force as to cause injury to the sinus passages or the inner ear. The bulb, usually of rubber, tends to become hard and to crack after a relatively short period of use, especially when the fluid used is of an oily nature, and such devices are of somewhat complicated character and expensive to manufacture.

An object of the present invention is to provide an applicator device which, in a single instrument, combines the functions of dropper and atomizer, but which is free from the defects of either of such devices, as heretofore constructed; to provide an applicator for the introduction of a predetermined quantity of liquid in fluid form into the nasal cavity in so gentle a manner as to avoid all possibility of injury to the nasal membranes or to communicating cavities; to provide an applicator for introducing liquid in fluid form such that there is no danger of

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mechanical injury to the patient, thus making it especially desirable for the treatment of children; to provide an applicator for administering liquid in the form of a mist or spray, but without necessitating the use of a collapsible bulb or other source of air or gas under pressure; to provide a device of the atomizer type such that all danger of delivering a high pressure jet into the nasal cavity is avoided; to provide a combined dropper and atomizer device devoid of any metal parts which contact the fluid so as to be corroded by the latter; and to provide a combined dropper and atomizer so low in cost that it may be supplied to the user, at a very nominal price.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings in which

Fig. 1 is a side elevation showing the combined dropper and atomizer complete and in association with a suitable container for liquid;

Fig. 2 is a vertical section, to larger scale, showing the interior construction of the applicator and also showing the neck portion of a bottle for holding the liquid;

Fig. 3 is a horizontal section on the line 3—3 of Fig. 2, showing the air inlet ports closed;

Fig. 4 is a similar section showing the air inlet ports open;

Fig. 5 is a fragmentary view of the lower end of the conduit element, illustrating a modification;

Fig. 6 is a bottom view of the part shown in Fig. 5; and

Fig. 7 is a plan view of a valve-supporting plate useful with the construction shown in Figs. 5 and 6.

The numeral 1 designates a suitable container for the fluid which is to be delivered by the dropper or atomizer, this container here being illustrated as a bottle having an externally screw-threaded neck portion 2. However, it is to be understood that the particular type of container for the liquid constitutes no essential part of the present invention except that the container chosen should be of an appropriate material to hold the selected liquid; should be of convenient size for handling; and capable of making air-tight connection with the attaching element of the applicator.

As here illustrated, the applicator comprises a hollow nozzle portion 4, here shown as elongate and substantially elliptical in longitudinal section and having a delivery opening 5 at its

upper or free end. The upper portion 6 of this nozzle is externally contoured to fit snugly and substantially leak-tight in the nostril of the patient, its curvature being such that it can not be projected into the nostril to an injurious extent. This nozzle preferably has thin walls and provides a chamber 7 of substantial capacity whose horizontal section increases from its lower or entrance end and then gradually decreases toward the delivery opening 5. This chamber affords sufficient space for a thorough mingling of atomized liquid with the current of air in which the mist or liquid droplets are suspended.

The lower end of the nozzle 4 is united to the upper end 8 of a rigid conduit. This conduit and the nozzle 4 are preferably integrally joined and may be of the same or different materials, as desired. Preferably the conduit at least should be of transparent or translucent material, for instance glass or a synthetic resin, and it is contemplated that the nozzle and conduit may be moulded in a single operation or that they may be moulded in complemental half sections and joined to form the complete structure in any appropriate manner. Preferably, and as here illustrated, the axis of the part 8 of this conduit which joins the nozzle 4 is substantially vertical and parallel to or aligned with the axis of the lower part 10 of the conduit. This lower part 10 is secured to an attaching device 11 by means of which the conduit is removably secured to the neck of the bottle 1.

This attaching device is here shown as a cap comprising the substantially cylindrical screw-threaded shell portion 12, for example of metal or moulded plastic, designed to have threaded engagement with the threads on the bottle neck 2 and having a radial flange 13 at its upper end. This cap also comprises a lamellar top member, here shown as consisting of three annuli 14, 15 and 16, of substantially like external and internal diameter, the annuli 14 and 15 being of a relatively resilient material, for example, rubber or rubber substitute, while the annulus 16 is of a stiff and relatively rigid material, for example sheet metal. These annuli are assembled in coaxial relation and introduced into the upper part of the member 12 so that the annulus 14 engages the inner surface of flange 13 of the member 12. Preferably this lamellar top member is secured to the shell 12 by appropriate means, for example adhesive, and the several annuli composing this top are likewise united, as for example, by an adhesive. When the cap is screwed down onto the bottle neck, the lower annulus 15 engages the upper edge 17 of the bottle neck, thus providing a tight, leakproof seal.

The lower end portion 18 of the rigid conduit fits within the central aperture in the assembled annuli 14, 15 and 16, the conduit preferably having an integral flange 19, which is located just above the upper surface of the annulus 14, and an inner flange 20 which bears against the lower surface of the annulus 15, the flanges 19 and 20 being so spaced as to confine the top member between them with sufficient pressure to insure a leak-tight joint.

The top member of the cap is provided with one or more air inlet ports 21 operative, when unobstructed, to permit free entrance of air to the interior of the container. For closing each of these ports there is provided a valve member 22, the valve member or members preferably being secured to or integral with a thin resilient ring 23 coaxial with the part 18 of the conduit.

Preferably this ring has an upstanding lug 23^a (Figs. 3 and 4). If the ring 23 be so arranged as to be capable of turning relatively to the part 18 of the conduit, then by manipulation of the lug 23^a the ring may be turned relatively to the cap so as, at will, to move the valve or valves 22 toward or away from the corresponding inlet port or ports 21.

On the other hand, it is contemplated that the part 18 of the conduit may be arranged for rotation within the top member of the cap. In that event, an arrangement such as illustrated in Figs. 5 to 7 may be used. In Figs. 5 and 6, the lower surface of the flange 19 is shown as provided with two segmental lugs. The resilient valve supporting plate P (Fig. 7) has a central aperture A for the reception of the part 18, the aperture having segmental recesses 20^m which receive the lugs 20^x and thus constrain the plate P to turn with the part 18. Thus, upon rotation of the conduit relatively to the cap, the valve or valves 22 will be correspondingly moved to cover or uncover the port or ports 21. Alternatively, the part P, or its equivalent, may be integral with flange 19, the resiliency of the valve seat ring 14 being sufficient to permit the valves 22 to be moved to and from operative position by relative rotation of the part 24 and the cap 11.

Between its end portions 8 and 10 the conduit comprises a sinuous, preferably S-shaped portion 24, including the upwardly convex bend 25, and the downwardly convex bend 26, the latter being of increased diameter as respects the main portion of the conduit so as to form the trap or reservoir chamber 26^a. That part of the passage within the conduit which leads upwardly from this reservoir or trap to the nozzle 4 is provided with a constriction 27 of capillary diameter, for example a diameter of ½ mm. That part 28 of the passage in the conduit which leads into the reservoir or trap chamber 26^a inclines downwardly so as to direct the incoming current of air in a downwardly inclined direction. Preferably a baffle 29 is arranged within this part of the passage so as further to deflect the incoming air current and to cause it to impinge upon the surface of liquid contained in the trap at a very acute angle. Thus this entering jet of air tends to sweep up particles from the surface of the liquid with an atomizing action, these particles being carried on and up through the very narrow constriction 27 where they are subjected to compression. As the air current, with these entrained droplets, enters the chamber 7, there is a sudden expansion of the air with a resultant tendency to break up the droplets of moisture still further, so that before the current of air reaches the outlet 5, the liquid has been reduced to an extremely fine atomized or vaporous condition thoroughly and uniformly mingled with the conveying air current.

When the device is to be used as a dropper, the valves 22 are closed and the user inverts the device so that liquid from the container 1 gravitates through the conduit into the region 28 where it reaches a condition of equilibrium. As the liquid gravitates down the conduit, the air trapped in the container increases in volume and decreases in pressure while the air in the vicinity of baffle 29 remains at atmospheric pressure whereby the negative pressure created in the container tends to reverse the direction of flow of the liquid. A condition of equilibrium is established between the weight of the liquid column and the aforesaid negative pressure when

the region 28 is filled and the outward flow ceases before the reservoir 26a is reached. The container is then returned to upright position, as shown in Fig. 2, which allows the liquid collected in the region 28 to flow into the reservoir 26a, the remainder of the liquid in the conduit returning to the container and atmospheric pressure being restored to the container. If more than the desired amount of liquid is present in the reservoir 26a, the device may be gently tipped in the direction of region 28 which allows the excess to flow back into the container 1. It is thus very easy for the user to deliver substantially as small a quantity of liquid as may be desired into the trap chamber 26a. The device is now restored to its normal position as shown in Fig. 1, and the end 6 of the nozzle is inserted in the nostril. The user may now tip the head backwardly again inverting the device, permitting the determined quantity of liquid in the trap chamber slowly to escape through the constriction 27 and through the nozzle 4 into the nostril. At the moment the device is inverted for the second time and before any liquid has run out of the container or trap chamber, the pressure throughout the conduit is atmospheric. A moment later the determined quantity of liquid in the trap chamber flows by gravity to the constriction 27 thereby temporarily to seal the constriction. Concomitantly the liquid in the container also flows by gravity down the conduit as aforesaid displacing the air therein into the trap chamber and, because the constriction is temporarily sealed, compressing said displaced air to a slightly positive pressure. While the liquid flowing from the container into the conduit will again reach a condition of equilibrium as described above and the outward flow will cease before the reservoir 26a is reached, the determined quantity of liquid will flow through the constriction 27 by means of gravity together with the force of the positive pressure of the air behind it, the pressure on the outer side of the constriction being atmospheric. The determined quantity of liquid will then flow downwardly along the inner walls of nozzle 4 to the opening 5. At this moment all of the determined quantity of liquid will have passed through the constriction 27 and although the air trapped behind said liquid will have expended some of its positive pressure through expansion of volume, its pressure will still be slightly positive. The determined quantity of liquid remaining at the opening 5 will then continue to escape in drops due to the weight of the column of the determined quantity of liquid together with the force of the slightly positive pressure of the air trapped behind it, which together slightly overbalance the atmospheric pressure existing at the outside of opening 5. It will be understood that in use, if the sides of the nostril are brought in contact with the edges of the nozzle 4 at the opening 5, the surface tension of the drop formed at the opening 5 will be broken and the determined quantity of liquid will flow into the nostril. It is evident that the remaining liquid in the container has flowed no further than the region 28 and has again assumed the equilibrium above described, thereby ensuring that no more than the determined quantity of liquid received in the reservoir flows to the nostril of the user. This arrangement permits the user to determine substantially the exact quantity of fluid to be delivered into the nostril and the delivery of this fluid into the nostril is so gradual that no possible harm can come to the nasal membranes or cavities. Furthermore the shape of the nozzle is such that its insertion in the nostril can not cause mechanical injury.

If the device is to be used as an atomizer, the operator may in the way above described, cause a certain portion of the liquid to enter the trap chamber 26a. He then opens the valves 22 so as to permit air freely to enter the container and by placing the nozzle in the nostril and inhaling (while the other nostril is closed by the finger) a current of air is caused to enter the port 21 and thence to pass up through the conduit. In entering the trap chamber through the passage 28 this air is caused to impinge forcibly upon the liquid so as to pick up liquid particles, vaporize them and carry them up into the nasal passage in a very finely divided condition. This arrangement for atomizing the liquid avoids the use of mechanical pumps of any type to produce the vaporizing current, thus avoiding dangerous pressures in the nasal cavity and at the same time making it unnecessary to provide such pump devices.

It may be appreciated that the device thus provided is of extremely simple form, comprises no moving parts other than the valve for closing or opening the air inlet port, its use can not injure the patient, and it may be made very cheaply and occupy but little space and has nothing that will rapidly deteriorate regardless of the fluid which is used for treatment.

While a desirable embodiment of the invention has been illustrated by way of example, it is to be understood that the invention is not necessarily limited to this precise embodiment, but is broadly inclusive of any and all modifications falling within the scope of the appended claims.

I claim:

1. A combined dropper and atomizer for nasal use designed to be attached to the neck of a liquid cointainer and comprising a hollow nozzle designed to enter and plug the nostril, a cap for removable leak-tight engagement with the container neck, and connecting means constituting a liquid path from the container to the nozzle and comprising a rigid S-shaped conduit, said conduit comprising an enlarged concave bend, the enlargement extending downwardly in the direction of the container, said enlarged bend defining a reservoir in said liquid path adapted for receiving and holding a determined quantity of liquid passed thereto from the container upon inversion of the container, and a part of the conduit beyond the reservoir in the direction of the nozzle being formed to provide a delivery passage of capillary dimensions.

2. A combined dropper and atomizer for nasal use designed to be attached to the neck of a liquid container and comprising a hollow nozzle designed to enter and plug the nostril, a cap for removable leak-tight engagement with the container neck, and connecting means constituting a liquid path from the container to the nozzle and comprising a rigid S-shaped conduit, said conduit comprising an enlarged concave bend, the enlargement extending downwardly in the direction of the container, said enlarged bend defining a reservoir in said liquid path adapted for receiving and holding a determined quantity of liquid passed thereto from the container upon inversion of the container, and a part of the conduit beyond the reservoir and in advance of the hollow nozzle being formed to provide a delivery passage of capillary dimensions.

3. A combined dropper and atomizer for nasal use designed to be attached to the neck of a liquid container and comprising a hollow nozzle designed to enter and plug the nostril, a cap for removable leak-tight engagement with the container neck, and connecting means constituting a liquid path from the container to the nozzle and comprising a rigid S-shaped conduit, said conduit comprising an enlarged concave bend in the upper curve of the S-shaped conduit, the enlargement extending downwardly in the direction of the container, said enlarged bend defining a reservoir in said liquid path adapted for receiving and holding a determined quantity of liquid which is passed into the lower curve of the S-shaped conduit from the container upon inversion of the container, and a part of the conduit beyond the reservoir in the direction of the nozzle being formed to provide a delivery passage of capillary dimensions.

4. A combined dropper and atomizer for nasal use designed to be attached to the neck of a liquid container and comprising a hollow nozzle designed to enter and plug the nostril, a cap for removable leak-tight engagement with the container neck, and connecting means constituting a liquid path from the container to the nozzle and comprising a rigid S-shaped conduit, said conduit comprising an enlarged concave bend in the upper curve of the S-shaped conduit, the enlargement extending downwardly in the direction of the container, said enlarged bend defining a reservoir in said liquid path adapted for receiving and holding a determined quantity of liquid which is passed into the lower curve of

the S-shaped conduit from the container upon inversion of the container, and a part of the conduit beyond the reservoir in the direction of the nozzle being formed to provide a delivery passage of capillary dimensions, said connecting means, when the container is restored to upright position, presenting a continuous air passage from the container to the nozzle and passing over the surface of the liquid in the reservoir.

CHARLES E. WHITE.

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