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T. J. HOLMES

NEBULIZER

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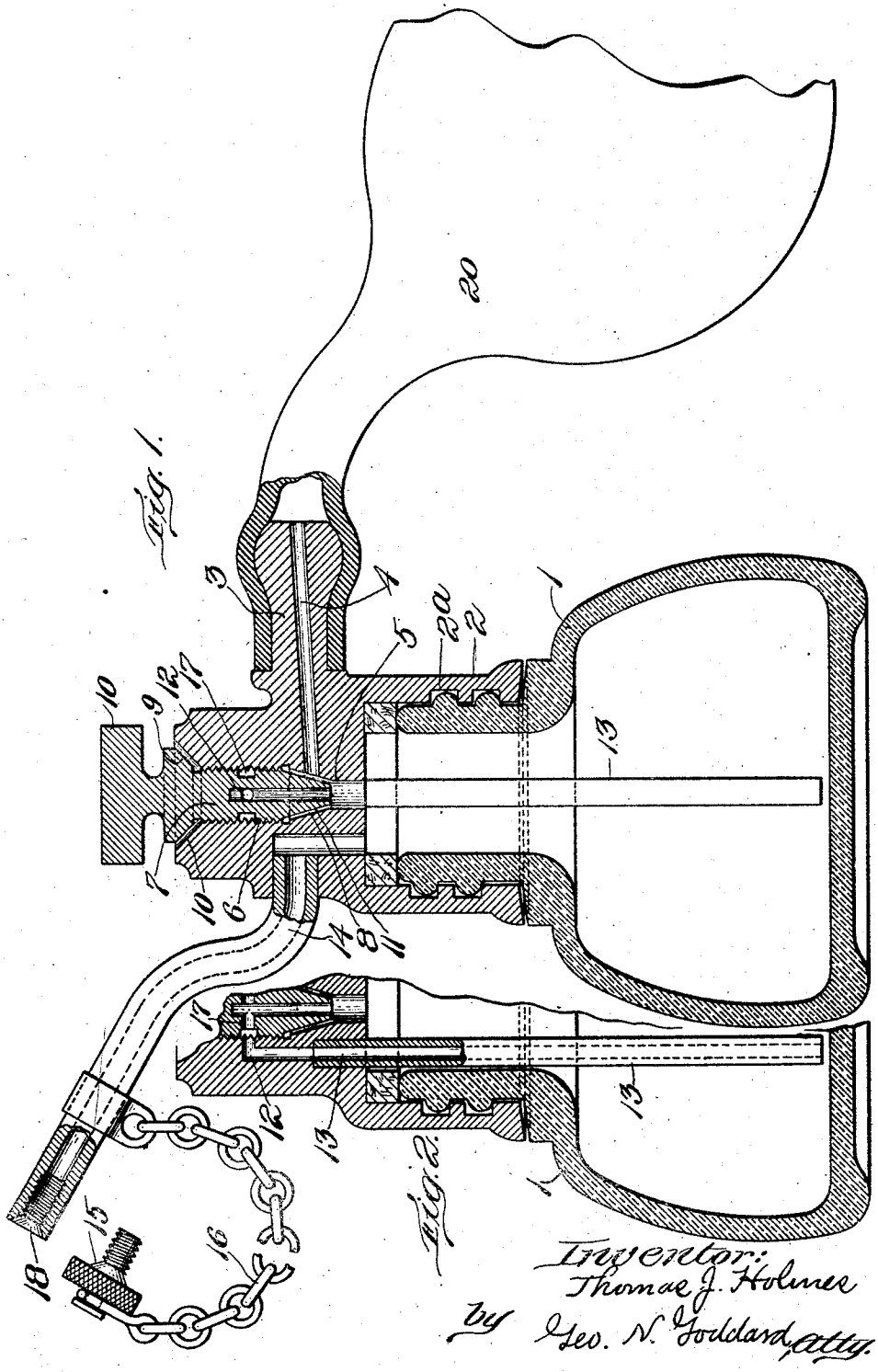


Fig. 1.

Fig. 2.

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NEBULIZER.

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To all whom it may concern:

Be it known that I, THOMAS J. HOLMES, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Nebulizers, of which the following is a specification.

This invention relates to nebulizers and is intended to provide a simple and effective device for the purpose of delivering a copious supply of vapor-laden air with a minimum expenditure of effort, the construction being such as to permit of easy manipulation and cleaning. Provision is also made for effectually sealing the openings in the stopper or closure to prevent leakage of the liquid contents from the container and for conveniently regulating the delivery of vapor.

It will be understood that a nebulizer of this type is not intended to act like an ordinary atomizer such as is used to deliver liquid in a finely divided spray, but is constructed and arranged to deliver a jet or stream of air which is saturated or charged with the vapor of the liquid used in the container.

Generally speaking the invention is characterized by a compressed air duct arranged in operative atomizing relation to a liquid-supply passage so as to draw a supply of liquid from the body of liquid in the container and discharge it in a finely atomized condition into the interior of the container above the liquid level, in combination with a discharge or delivery tube whose intake is above the liquid level and is adapted to discharge the vapor-laden air outside of the bottle in any direction that may be desired. Further features include the arrangement for regulating the spray and for tightly sealing the device against leakage when not in use.

In the accompanying drawings I have illustrated a simple and convenient form of construction and arrangement illustrating the principles of this invention, in which:

Figure 1 is a vertical central section of the complete assembled device ready for use.

Figure 2 is a similar section of one side of the device in a plane at right angles to that of Figure 1 to illustrate the course of the liquid to the atomizing orifice.

In the practice of this invention, according to the form illustrated in the drawings, I provide a liquid container of any suitable construction such as a bottle or flask 1, which may be provided with screw threads for firmly but detachably securing thereto the closure or stopper member 2, which carries the working elements by which the desired result is effected, the stopper 2, being provided with internal screw threads, is in this case shown at 2^a, for tightly drawing it against the open neck of the bottle.

On one side the stopper body 2, is provided with a projecting nipple 3, adapted to form a connection with an air-compressing bulb or equivalent source of compressed air supply. This nipple is provided with an interior bore shown at 4, which communicates with a vertical passage 5, through which the liquid is discharged into the upper portion of the device. The stopper body 2, is provided with a central bore which is internally screw threaded as shown at 6 to form interlocking engagement with externally threaded valve plug 7, and is formed with two tapered or frustro-conical valve seats 8 and 10 against which simultaneously tapered surfaces 9 and 11 of the valve plug abut when the valve is screwed tightly to the valve seats. The liquid supply tube 13 is inserted in the stopper body so as to allow its lower or intake end to extend fairly close to the bottom of the container and consequently below the level of the liquid body therein. It communicates with the central bore 6, of the valve plug through a lateral passage or port 12, which is in communication with an annular channel 17, formed by externally grooving the valve plug opposite the exhaust opening of the duct or liquid supply passage 13. The annular groove 17, is formed in order that the port 12, may always be in communication with the liquid supply pipe whatever the position of adjustment for use the valve plug may assume. The extreme lower end of the valve plug forms a nozzle for the discharge of liquid which acts as an inspirator by reason of the column of air discharging around its exterior and, therefore, acts to draw or suck the liquid through the supply pipe 13, and break it up into a fine spray mingled with the air as it discharges from the nozzle.

In consequence of this arrangement there is discharged into the upper end of the bottle a stream of compressed air highly charged with vapor which finds its exit through the outlet or discharge tube 14, whose intake

end is above the body of the liquid and whose outer end is also preferably screw threaded and provided with a tapered valve seat 18 which can be tightly sealed by the tapered valve plug 15 which, for convenience, is permanently connected with the device by a flexible connection such as a chain 16, which does not interfere with the screwing and unscrewing of the sealing plug.

The valve seats 8 and 10, and their corresponding tapered valve surfaces 11 and 9, are so arranged and proportioned that both valve surfaces seat simultaneously when the valve plug is tightened with the result that no liquid can escape through the air passage 4, or through the central bore containing the valve plug even if the bottle be inverted. The discharge nozzle 18 is, of course, closed by its sealing plug 15, to prevent leakage through the discharge tube. With this arrangement it is possible to throw the device containing a suitable supply of liquid into a bag without danger of leakage of the contents, and yet the device is ready for instant use and by its construction and arrangement is not only easy to keep clean but affords a strong and copious discharge of thoroughly saturated or charged air.

What I claim is:

1. A liquid nebulizer embracing in its construction a stopper forming a closure for a liquid container provided with a downwardly dischargeing liquid-atomizing chamber having a conical wall affording a valve seat, and having a compressed air duct discharging through said conical wall, a rotatably axially adjustable valve plug having a tapered surface adapted to tightly engage said wall and seal the air-discharging passage, a liquid supply tube whose intake end is submerged in the liquid in the container and which communicates at its other end with the atomizing chamber through said valve plug, substantially as described.

2. A nebulizer for liquids embracing an atomizing stopper body adapted to form a closure for a liquid container, said body being formed with an atomizing chamber and being provided with a duct for leading compressed air to said chamber, a liquid supply tube whose intake end is submerged in the liquid in the container and whose discharge end communicates with said atomizing chamber, and an externally projecting regulating and sealing plug axially adjustable by rotation to seal said air passage against communication with the atomizing chamber and to seal the stopper against leakage of the liquid around said plug, and a sealable vapor discharging tube secured to said stopper, substantially as described.

3. A nebulizer for liquids embracing in its construction a centrally bored stopper body adapted to form a closure for a liquid container, the inner end of said bored passage forming an atomizing chamber, said stopper being also provided with a compressed air passage leading into said atomizing chamber and with a liquid supply tube whose lower end is submerged in the liquid in the container and whose upper end communicates with said atomizing chamber, a rotatable axially adjustable valve plug provided with two conical valve surfaces adapted to seat against corresponding conical seats formed in the stopper body to seal, respectively, the compressed air passage and the centrally bored passage when the nebulizer is not in use, said stopper being provided with a vapor-discharge pasasge whose intake end is located above the level of the liquid in the container, substantially as described.

4. A nebulizer embracing in its construction, a liquid container, a stopper body formed with an air inlet and vapor discharge ducts communicating with the exterior of the container, and having an internal liquid supply duct coordinated with the air duct to form an internal atomizer, an externally projecting valve plug arranged to regulate the atomizing action in order to control the vaporizing action and the delivery of vapor-charged air through the discharge duct, substantially as described.

5. A nebulizer embracing in its construction, a liquid container, a vaporizing stopper body formed with an opening for a valve plug, a compressed air duct discharging into the inner end of said opening, a vapor discharge tube, a valve plug adjustably mounted in said opening to control and shut off the discharge of air through the inner end of the opening said plug being provided with an internal liquid duct communicating with a liquid supply pipe, substantially as described.

6. A nebulizer embracing in its construction, a liquid container, a vaporizing stopper body formed with an opening for a valve plug, a compressed air duct discharging into the inner end of said opening, a vapor discharge tube, a valve plug adjustably mounted in said opening to control and shut off the discharge of air through the inner end of the opening, said plug being provided with an internal liquid duct communicating with a liquid supply pipe, and having valve surfaces disposed to seat against cooperating surfaces of the stopper body to tightly seal the air duct and the valve plug opening against the escape of liquid, substantially as described.

7. A nebulizer embracing in its construction, a liquid container and its stopper body, a discharge tube for discharging vapor-charged air from the container, said stopper body being provided with air and liquid supply passages coordinated to form an

atomizer for delivering a fine spray into the interior of the container, a valve plug having axial adjustment in an opening formed through the stopper body to regulate the atomizing action, said plug being formed and arranged to tightly seal its receiving opening and the air duct against the escape of liquid from the container, substantially as described.

8. A nebulizer embracing in its construction, a liquid container and a stopper body therefor, a vapor discharge tube, and an axially adjustable valve plug mounted in an opening through said stopper body and having inner and outer conical valve faces, said stopper body being provided with an air supply passage and with a liquid supply passage having discharge outlets adjacent to the inner end of the valve plug respectively to form an atomizing nozzle discharging into the container, and being also provided with conical valve seats arranged to cooperate with said conical valve faces to seal the stopper against escape of the liquid and a sealing device for closing the outer end of the vapor discharge tube, substantially as described.

In witness whereof, I have subscribed the above specification.

THOMAS J. HOLMES.