E. R. PETTIT.

ATOMIZER.

APPLICATION FILED DEC. 1, 1911.

1,103,684. Patented July 14, 1914.

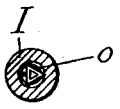


Fig. 3

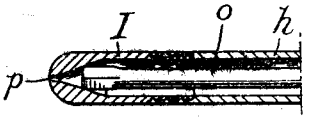


Fig. 4

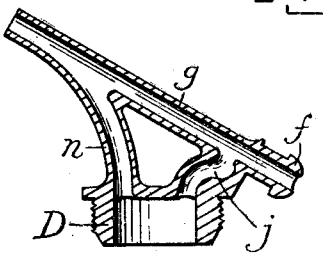


Fig. 2

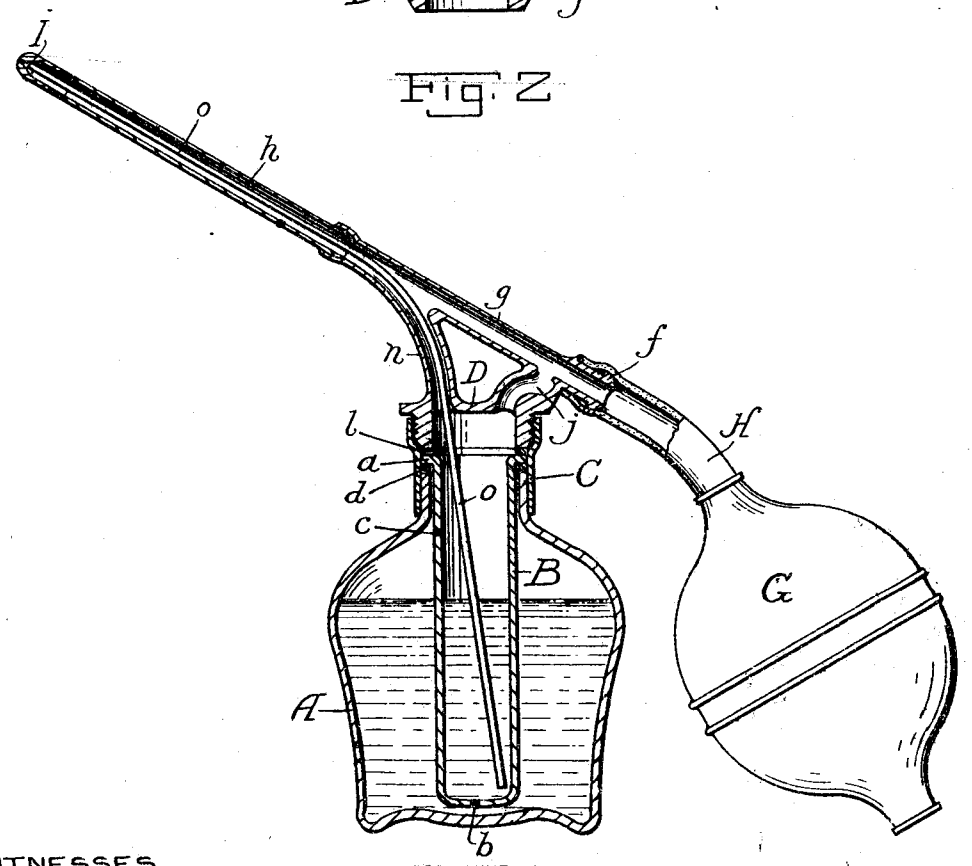


Fig. 1

WITNESSES

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ATOMIZER.

1,103,684. Specification of Letters Patent. Patented July 14, 1914.

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To all whom it may concern:

Be it known that I, ELIHU R. PETTIT, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Atomizers, of which the following is a specification.

One object of my invention is to produce a continuous spray from an atomizer when in operation, not only when the elastic bulb is being compressed, but also during the period when the pressure is removed and the bulb is being refilled with air, and to continue the spray so long as the elastic force of the compressed air continues after the bulb is no longer operated.

A further object of my invention is to reduce the inconvenience and cost of continuous spray atomizers by the use of only one bulb instead of two.

A yet further object of my invention is to effect diversion of the excess of air forced from the bulb, into the combined air and liquid receivers, in such manner, by the arrangement of the air tubes in relation to each other, as not to interfere with the force of the air propelled in a straight direction to the nozzle, the air so diverted, being compressed in the receptacles, to be utilized automatically as needed to produce a continuous spray. By this arrangement also, in connection with the other improvements as hereinafter specified, the particles of liquid are broken up into a fine spray.

In the description of my invention reference is made to the accompanying drawings, in which corresponding parts in the several figures are designated by corresponding characters.

Figure 1 is a vertical sectional view of the atomizer, with parts in position for operating; Fig. 2 is a vertical sectional view of the air tubes and top or cap of the atomizer; Fig. 3 is a transverse sectional view of the nozzle and liquid tube, and Fig. 4 is a vertical sectional view of the same, both enlarged.

A is a wide-mouthed bottle or receptacle into which any desired liquid may be placed to be utilized in the form of spray, B is a wide-mouthed bottle or vessel, preferably made of glass but which may be of metal, generally cylindrical in shape, having a flange *a* at its mouth, a small opening *b* at or near its lower end, and another small opening *c* at its side near the top. This bottle B is made to fit very loosely inside the mouth of the bottle A, and when so placed it is a little short of being in contact with the bottom of the bottle A, and is supported by its flange *a* resting upon the rim of said bottle A, but preferably with a suitable intervening washer *d* both to prevent breakage and also so that when clamped moderately firmly in proper position no air can escape from the bottle A except through the small vent *c*, (the object of which is hereinafter described) so long as there shall be sufficient liquid in the bottles to produce a spray. The opening *b* while small, must be sufficiently large to permit the free escape of the liquid from the bottle B into the bottle A, by pressure of the air above it when compressed, and vice versa, so that when the atomizer is in operation the height of the columns of liquid in the two vessels will be varying constantly.

C is a metallic band or collar surrounding and securely fastened to the neck of the bottle A, and having a projecting portion above the mouth of the bottle with a thread on its inner side corresponding to the screw thread of the cap.

D represents the air tubes and cap or top of the atomizer shown as cast in one piece, *f* being the portion suitably formed to retain the elastic tube H, when stretched over it, and G is the bulb attached to the tube H and containing a valve at each end of the bulb as commonly used in atomizers, *g* is a tube continuation of the outlet for the air from the bulb in a straight line or direction, to which tube *g* the tube *h* is securely fastened. The nozzle I is removable, and attached to the tube *h* by thread and screw.

j is the air tube through which the excess of air from the bulb G passes to the inner bottle B through the cap D in such manner or relationship as not to interfere with the force of the direct current of air from the bulb to the emerging point in the nozzle.

l is a washer of suitable material between the upper surface of the flange *a* and the lower part of the cap D and *n* is the air tube from the inner bottle B to the straight air tube *g*.

c is a vent in the side of the bottle B

near the top, through which air communication is had between the air chamber portions of the bottles A and B.

o is a small tube extending from near the bottom of the bottle B through the tubes *n*, *g*, *h* to the opening of the nozzle to carry the liquid to that point.

I represents the nozzle, having the forward portion of its inner surface tapered toward the central opening *p* to act as a guide for the triangular end of the liquid tube *o*, so as to bring the latter always to a central position in the nozzle.

To operate the atomizer the liquid required is poured into the outer bottle A until it is very nearly full, if so much be desired, but never above a short distance below the vent *c* of the bottle B when the latter is in position. The inner bottle B is then placed within the bottle A, its flange *a* resting upon the washer *d* at the mouth of the latter. The liquid will pass through the opening *b* and rise until the two columns of liquid in the outer and inner bottles are at the same level. The combined air tubes and cap D with the nozzle I in position are then screwed or fastened in place so as to press moderately firmly upon the flange of the inner bottle B, with or without the second washer *l* between, so that no air can escape except through the outlet or channel provided for the purpose. The bulb G is then compressed, and, as the construction of the apparatus provides, the air is forced in a straight line or direction, and therefore with the least resistance, to the nozzle I and through the outlet *p*, passing on all sides of the liquid tube *o*, and tending to produce a vacuum as it escapes through the opening *p*. By this means the liquid is drawn through the inner tube *o*, and meeting the air being forcibly expelled from the nozzle it is converted into a fine spray as it emerges. The excess of air from the bulb, by means of the second tube so connected as not to interfere with the force of the current in the first tube is diverted to the inner bottle B with the least possible resistance, as described, From the bottle B there is provided a free escape for the air through the tubes *n*, *h*, where the current may combine with the direct current of air in tube *g*, to the extent that the force of the current will permit: but it escapes through this means principally when the bulb is released from pressure to permit it to become refilled. During the compression of the bulb the air cannot escape from the nozzle as rapidly as it is forced from the bulb G. The excess is therefore diverted through the tube *j* into the inner bottle B within which it becomes compressed by the force exerted upon the bulb G, and consequently will press upon the column of liquid in the bottle B tending to force it downward and through the opening *b*, into the outer bottle A. The column of liquid in the outer bottle A thus becomes greater as that in the inner bottle B becomes less. The air above this liquid having no means of escape except through the small vent *c* is also compressed. The bulb being released from pressure, the compressed air in the outer bottle acts upon the column of liquid beneath it, and forces it down and into the inner bottle through the opening *b*, and as the liquid rises in the inner bottle it tends to keep up the compression or increased elasticity of the air above it while it forces the current through the tube *n*, *h*, and through the outlet *p* of the nozzle, thus continuing to produce the spray in the interval while the bulb is refilling. Thus the inner and outer columns of liquid act and react upon each other alternately as the bulb is compressed and released as described, and by this constant action and reaction the spray is made continuous without the use and expense of a second elastic bulb.

The more nearly full of liquid the bottles are, the less the air space above them, hence, when nearly full, the air in these spaces must become more compressed to produce the desired action upon the inner and outer columns of liquid, as there is greater weight of liquid to be displaced to produce the action and reaction of these columns of liquid upon each other. Conversely, the less the amount or quantity of liquid in the bottles, the larger the air spaces above them, and a less amount of compression of this air will cause the columns of liquid to act and react upon each other, there being less weight of liquid to be displaced. When the bottles are nearly full very little movement of the columns of liquid is noticeable; while, when they are nearly empty, the movement is rapid and the height of the two columns will vary greatly, but when the bulb is released from pressure for refilling, and the compressed air within the two chambers is thus permitted to act fully, as the action and reaction of the two columns of liquid upon each other are equal, the amount of force upon the air passing through the nozzle during the interval of refilling is practically uniform whether the bottles are nearly full or nearly empty, therefore the continuity and fineness of the spray produced are maintained equally whether the bottles are nearly full or nearly empty, and at all the varying degrees between.

It is not improbable that while the bulb is being compressed, and by this means the excess of air in the inner bottle is also compressed and acting upon the column of liquid so as to tend to compress the air in the outer bottle as described, that this compression is aided somewhat by the forcible entrance of air through the vent *c* into the outer bottle, but as this vent is small, this aid, if any,

can be but slight. It is manifest, however, that if there were no air vent between the two bottles and the whole force of the compressed air acted upon the column of liquid in the inner bottle, the result would be practically the same. Actual tests have shown this to be true, and therefore this vent seems to be unnecessary, but practical tests have also shown this is true while the atomizer is continued in action but that when the spray is no longer desired, and the compression of the bulb is no longer continued, the pressure of the compressed air in the outer bottle is so great, (the continued supply of air being cut off) that the liquid escapes from the nozzle in a stream instead of a spray. The vent *c* permits the equalization of the pressure in the two bottles to take place more rapidly so that the liquid continues to escape as spray so long as there is sufficient force in the elasticity of the confined air to produce it. The sole object of this vent is, therefore, to prevent the liquid from escaping in a stream when the bulb is no longer being compressed.

In the single bulb atomizers in common use, when the bulb is released from pressure for refilling, the force of the compressed air in the bottle is very rapidly diminished, so that the spray rapidly becomes more coarse, and the liquid often falls from the nozzle in drops, before the compression of the bulb is resumed, thus causing both inconvenience and waste, while the coarse spray is less effective. By the atomizer herein described there is the largest quantity of air utilized (with greater compression because confined within a smaller space) upon the smallest quantity of liquid, thus producing a very fine as well as continuous spray, which is much more likely to be carried by inhalation to remote parts of the bronchial tubes or lungs, and to penetrate the cavities of the nose, instead of being immediately deposited upon the proximate tissues, as with the ordinary single bulb atomizers.

It is obvious that the principle of my invention may be applied to other spray-producing apparatus than such as indicated in the drawing, as, for example, for spraying trees, for disinfecting rooms, etc., but in such cases it would be advisable to have a main reservoir attached from which an additional supply of liquid could be admitted into the outer vessel as required, without taking the apparatus apart.

It is also obvious that the said invention is capable of various modifications without departing from the spirit of the invention.

I claim:

1. In an atomizer, the combination of a wide mouthed bottle for the liquid with an inner wide mouthed bottle supported by an air-tight joint and of such capacity as to contain a considerable body of liquid, the two bottles affording air chambers at their upper ends, said inner bottle having a small opening at its lower end through which there is free communication and circulation of the liquid from either bottle to the other, a bulb for forcing air into the air chamber of the inner bottle, and a discharge nozzle in communication with the liquid contents of the inner bottle, said inner bottle having a small opening in its side near the top through which there is communication between the air chambers of the two bottles to permit the rapid escape of the air from the outer bottle when the bulb is not being compressed, said liquid acting as a piston to compress the air in the outer bottle when the air in the inner bottle is being compressed by compression of the bulb.

2. In an atomizer, the combination of the inner and outer bottles whose lower portions are in communication with each other, with a cap having air tubes, one extending in a straight line between the air inlet and the nozzle, and two others diverted downwardly from said straigh tube to the inner bottle, one from a point adjacent to the air inlet opening and the other from a point farther along in the straight tube.

3. In an atomizer, the combination of the nozzle having a tapered bore, an air supplying tube communicating therewith, and a liquid-supplying tube having a forward portion of polygonal cross section which tube, at its forward end, contacts with the tapered bore of the nozzle.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ELIHU R. PETTIT.

Witnesses:

KATE A. BEADLE,

HAMILTON D. TURNER.