Dec. 16, 1941. S. L. FOX ET AL 2,266,705

COMBINATION BULB AND INHALATION NEBULIZER FOR MEDICAMENTS

Filed Jan. 31, 1938

FIG. 1

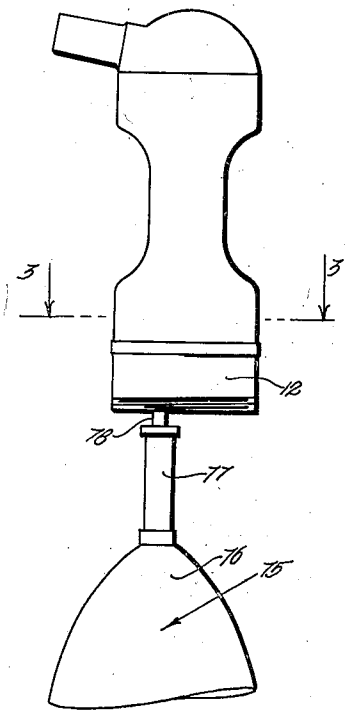


FIG. 2

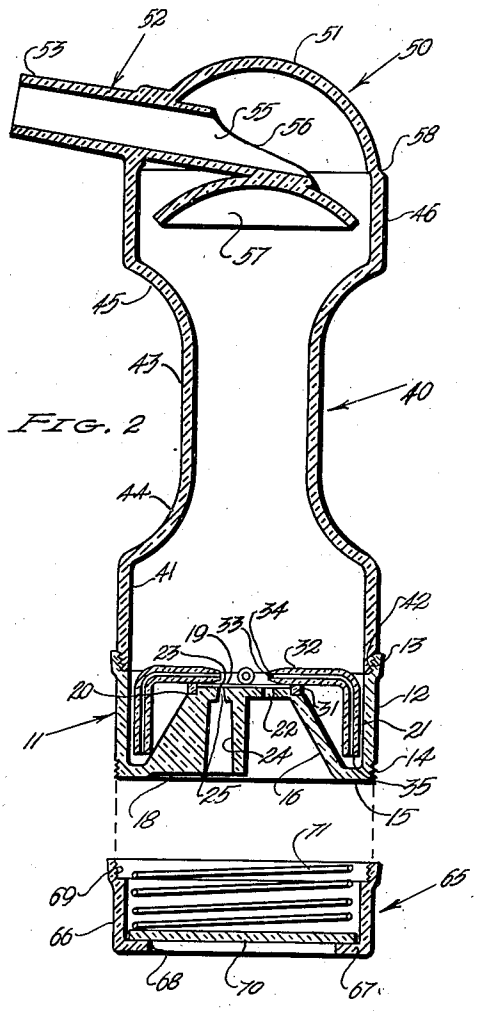
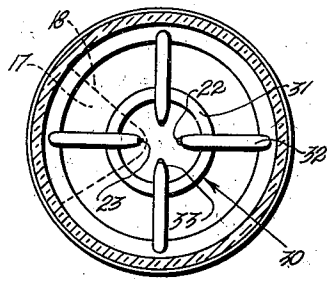


FIG. 3



Inventor
STANLEY L. FOX
CHARLES C COGHLAN
By Hazard and Miller
Attorneys

Patented Dec. 16, 1941 2,266,705

UNITED STATES PATENT OFFICE

2,266,705

COMBINATION BULB AND INHALATION NEBULIZER FOR MEDICAMENTS

Stanley L. Fox and Charles C. Coghlan,
Los Angeles, Calif.

Application January 31, 1938, Serial No. 187,888

4 Claims. (Cl. 128—194)

Our present invention may be considered as a further development or an improvement on our patent application for Nebulizing inhalator for medication, Serial No. 143,511, filed May 19, 1937, in which this case may also be considered as a continuation in part.

The present invention includes the combination of an inhalator for a liquid medicament in which this is partially or completely atomized or vaporized on the inspiration of the breath either through the mouth or nasal passages. In some cases however a person requiring a treatment of the medicament cannot readily develop a sufficient suction by inspiration. This applies especially to persons suffering severely from asthma or similar ailments, also with children it is sometimes difficult to have them develop a sufficient suction in inhaling the breath to properly atomize and vaporize the liquid, therefore an object and feature of this invention is a combination inhalator and bulb atomizer in which the atomizing and vaporization may be effected either solely in the active inspiration or solely by the action of the flow of air by means of the bulb or if desired the action may be combined by the bulb and the inspiration type of atomizer.

A further characteristic of our invention resides in having the medicament reservoir in the form of an annular chamber preferably with the outside walls cylindrical and the inside walls forming a frustum of a cone as by this construction a large space on the inside of the cone at the base is provided for the inflow of air when the device is used by inhalation. The apex of the cone is provided with a plurality of perforations forming inlet air ports and the injector tubes are secured to a ring having the intake ends dipping into the reservoir, the ring being secured to the top of the frustum. This ring therefore aligns the discharge end of the injector tubes in line with the inflow of air through the ports. For the bulb action a cone shaped fitting is provided for the tip end of the bulb tube and in this case the port aligned with one of the tubes is very much smaller than the others.

By this type of construction when the bulb is used practically all the air used for atomizing and nebulizing passes through the small port in alignment with one of the ejector tubes and on account of the greater velocity of air flow over that of the inspiration a greater quantity of the medicament is atomized. However when the operation is entirely by the inhalation most of the air enters through the larger ports in alignment with preferably a plurality of ejector tubes.

Our invention also includes a dome shaped baffle secured to the inner end of the outlet or suction pipe by which the treatment is given by the mouth or nostrils and this baffle is operative to collect the larger globules of the liquid allowing these to drop off the lower edge of the domed or arch shaped baffle. Our invention also comprehends the use of a flutter valve which may be attached or detached to or from the main portion of the appliance, such flutter valve being used only on treatments by inhalation.

Our invention is illustrated in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation with the flutter valve assembly removed illustrating a bulb pump connected at the bottom or base of the nebulizer.

Fig. 2 is a vertical diametrical section through the outlet or suction tube with the bulb pump being disconnected and showing the flutter valve in a removed position.

Fig. 3 is a transverse section on the line 3—3 of Fig. 1 in the direction of the arrows.

In our construction we employ a reservoir assembly unit 11 which has a cylindrical outside wall 12, an internally threaded rim 13, external threads at the lower portion 14, an annular bottom wall 15, a conical inner wall 16 except for the block 17 having radial sides 18. This block is formed solid and integral with the base structure and has its lower edge 18' set upwardly from the plane of the bottom 15. A top wall 19 completes the closure of the reservoir assembly but this has an annular notch 20 on its periphery extending partly downwardly into the conical wall 16. This structure therefore provides an annular reservoir chamber 21. In the top there are a series of inspiration air ports 22, three of these being shown and a small air port 23 to pass the compressed air from the bulb pump. A tapered socket 24 having a cone shaped duct 25 at the top is provided in the block 17 in which the nipple of the bulb pump is inserted.

The ejector tube assembly 30 employs a ring 31 which fits in the annular notch 20, the upper edge being substantially in alignment with the upper surface of the top wall 19. The ejector tubes 32 are preferably molded with the ring on its upper edge. Each tube is provided with a tapered discharge portion 33 having its orifice 34 adapted to be in alignment with the ports 22 and one tube adapted to be in alignment with the small port 23. The lower intake end 35 of each tube extends into the annular reservoir. Three of these are shown aligning with the large inspiration ports 22 and one with the small com-

pressed air port 23. It is preferable to make up the ring with the ejector tubes assembled in the proper positions and then to cement the ring to the reservoir structure. This may be readily done by employing as a cementing medium material which will cause a permanent adherence to the plastic composition of which the instrument is made.

The upper body portion 40 has a lower cylindrical part 41 with external threads 42 engaging the threads of the rim 13. A contracted Venturi throat 43 is connected by a gradual curve 44 to the cylinder 41 and expands by a complementary curve 45 to an upper cylinder 46.

The cap assembly 50 employs a dome 51 with a molded tube 52 extending therethrough. The outer end portion 53 of the tube forms a mouth piece or an end for inserting in a nostril. This is quite short so that the person using the device may place their lips close to the cylindrical wall 46 and the dome 51. The user can also thrust the tube into a nostril a sufficient distance to obtain a good suction on inhaling through one nostril at a time and of course keeping the mouth closed. The inner end 55 of the tube has an upwardly slanting opening 56 facing towards the dome 50 and attached to the underside of the tube there is a deflecting baffle 57. The dome with the assembled tube 52 and the baffle 57 is preferably assembled and secured to the main body portion at the circular line 58.

A flutter valve assembly 65 employs a cup with a cylindrical wall 66, a bottom wall 67 with a large air inlet port or opening 68. A slight outwardly molded rim 69 is internally threaded and engages the threads 14. The flutter valve plate 70 rests on the base 67 forming a complete closure for the large air port 68. A compressor spring 71 has its lower end resting on this valve plate and its upper end engaging the bottom 15 of the reservoir assembly unit 11. This makes the complete installation. In Fig. 1 for sake of clearness of illustration the flutter valve assembly is illustrated as detached.

The manner of using the device with the flutter valve connected is substantially as follows: it will be understood that on disconnecting the body portion from the reservoir assembly which when built up includes the ejector tubes, the reservoir may be filled to the desired depth with the liquid medicament, these being preparations which when atomized or nebulized develop some healing or soothing action when inhaled either through the mouth or nostrils. Presuming the user is inhaling through the mouth, the end 53 of the tube 52 is thrust in the mouth and the person inhales through the mouth holding the nostrils closed. This causes an intake of air by creating a partial vacuum in the body portion and in the large coned intake 16 and also within the flutter valve chamber producing a lifting action of the valve plate 70 allowing inlet of air. The rapid upward flow of air in a straight vertical line through the ports 22 and the smaller port 23 thus developing an ejector action at the discharge end of the tubes 32. These as above mentioned at the intake end 34, immersed in the liquid, their upper ends above the liquid level so that the rapid upward flow of the air on the inspiration atomized and nebulizes the liquid medicament. The velocity of air flow is increased through the contracted Venturi structure 43 and at the upper cylindrical section 46 the air flow again expands. This rapid expansion causes any globules which might be considered too large to deposit and collect on the baffle 57 below the intake. The air must flow upwardly inside of the dome 50 which also collects any large droplets so that the air with the atomized medicament passing outwardly through the tube 52 is in the form of a very fine spray or vapor. The globules collect on the dome, the baffle 57 and on the walls of the main body portion 40, flow downwardly into the reservoir as the proper manner to use the device is with its axis vertical.

It will be understood that when the flutter valve assembly 65 is connected that the inspiration action is intermittent whether the breath is inhaled through the mouth or through a nostril. While this has certain advantages in the atomizing action, this flutter valve may be disconnected and the device used without the same in which case there is a continuous upward flow of air through the large converging opening formed by the cone side 16. On the inspiration action manifestly most of the air enters through the large ports but a certain amount is also drawn upwardly through the small port 23. When it is desired to use the instrument with the bulb pump indicated by the numeral 75, these are constructed in the usual manner, the rubber bulb 76, stem 77 and a nipple 78. The nipple is cone shaped to form a tight closure in the coned socket 24. Therefore by means of the air pump a strong blast of air may be pumped upwardly through the small port 23. When using the device as a bulb atomizer the patient may at the same time inhale the breath through the mouth or nostril or have the atomized medicament projected into the mouth, throat or nostrils without inhaling depending on the particular treatment to be given. When the device is used with the bulb pump entirely without inhalation there is an insufficient flow of air through the ports 22 to draw any liquid through the ejector pipes aligned therewith. It will be manifest that the most complete and thorough treatment may be given by using the bulb and at the same time the user inhaling through the mouth piece 53. Then all of the medicament vaporized by the jet from the pump bulb plus the medicament vaporized by the inspiration through the ports 22 is carried either into the mouth or the nostrils and thence to the various portions of the nose, throat, bronchial tubes or lungs to receive the treatment.

In constructing our vaporizer it is desirable that the ring 31 may be cast or molded with the tubes 32 integral therewith, the tubes being straight and extending outwardly radially and each being formed with a core. The core may then be removed and after removal the tubes bent to the correct curvature to properly dip in the reservoir. The ring 31 as above mentioned may be readily cemented to the top of the coned base structure 16 with the orifice end of the tubes properly aligned with the various ports. The deflecting baffle 57 should be of greater diameter than the contracted portion of the Venturi throat 43. This baffle develops a relatively important function in catching the larger globules of liquid. On account of the use of the Venturi throat construction and this being fairly long, the air travels at a high velocity through the throat, the heavier globules of liquid therefore tend to travel in a straight line and thence will impinge on this baffle 57. They then collect and flow to the edge dripping downwardly on the walls of the upper body portion 40. The lighter particles and vapors are readily deflected around the periphery of the arch to the cap or

dome 50. Our construction gives practically a leak-proof instrument. Even when the reservoir is filled to the desired level the liquid will not run out of the ports 22 and 23 when the device is held in a vertical position. If turned on its side the liquid will occupy part of the reservoir and part of the lower cylindrical section 41. Presuming the instrument is inverted the dome 51 has sufficient capacity to retain the liquid without it flowing out of the tube 53 on account of the opening 56 being spaced from the inside of the dome. The flutter valve not only functions to give an intermittent action of the device when assembled with the rest of the instrument and the bulb is not being used, but it also prevents entrance of dirt and when the instrument is out of use, forms a substantially air tight closure. Then, as it is usual in this type of instrument to fit a rubber cap over the end of the tube 53, there is no circulation of outside air in the interior of the instrument, hence the liquid in the reservoir is not evaporated. This with certain medicaments is an important characteristic as it limits waste of the liquid and in some cases the losing of its strength or its oxidation or chemical change. Then again in using the flutter valve if a person accidentally blows in the tube 53, the flutter valve closes and prevents discharge of the liquid medicament through the ejector tubes and outwardly through the ports 22 and 23. It will be readily appreciated that by our construction and having the body part 40 readily separable from the reservoir that the whole device may be easily cleansed and for instance should the tubes be blocked they can be easily opened by inserting a fine wire through the tubes or by blowing air through the tubes with the bulb pump.

It is important to note that our instrument is designed to be used as a bulb atomizer and an inhalation bulb nebulizer. When using the bulb it has been found that only a small port is necessary to react with the ejector tube, this being on account of the air flowing at higher velocity over the orifice of the ejector tube whereas on inhalation the velocity of air is usually much less and therefore it is necessary to have a larger port to accommodate a greater volume of air to secure the same or equivalent nebulizing of a medicament. In view of the fact that the instrument may be used for inhalation and the bulb action at the same time, the patient receives the benefit of both types of application of the particular treatment. The small port 23 is of such a size that it practically has no function when the device is used simply as an inhaling nebulizer as most of the air enters through the larger ports 22.

Various changes may be made in the details of the construction without departing from the spirit or scope of the invention as defined by the appended claims.

We claim:

1. An inhalator comprising in combination a hollow body having a recessed base with a flat top wall with one or more short ports through said top wall leading to the recess, there being an annular reservoir surrounding the recess base, the upper part of the recessed base having an annular groove, a ring provided with an ejector tube for each port, the ring and the tubes being formed integral, the tubes being adapted to be straight radial tubes and bent downwardly to dip into the recess, the top of the ring being substantially on the level with the flat top of the recessed base, the discharge orifice of each tube being aligned with a port, the hollow body structure having an outlet means spaced from the said ports for flow of nebulized medicament.

2. An inhalator comprising in combination a hollow body having a recessed base with a flat top wall having at least two short air inlet ports therethrough, one port having means for attaching an air pump and such port being much smaller in cross sectional area than the other port, the hollow body having a reservoir for a medicament, an ejector means for each port extending into the reservoir and having an orifice in alignment with the port, the ports and orifices being aligned to direct substantially parallel streams of atomized medicament, a tubular mouth piece connected to the upper end of the hollow body structure and having an inlet substantially in alignment with the jets formed by the ports and the orifices whereby on inspiration air is drawn in through the larger port and by means of an air pump an air stream is forced under pressure through the smaller port thereby directing the atomized liquid from both ports and orifices to the mouth-piece on inhalation.

3. An inhalator comprising in combination a hollow body structure having an upwardly recessed base with a flat top wall and forming an annular reservoir with the side of the body, the recessed base being provided with a relatively large air intake channel with an inspiration air port through the flat portion of the base, the recessed base also having a tapered socket for connection to an air pump and also having a second air port for compressed air, the second port being much smaller in cross sectional area than the first port and both ports being short compared with their area, an ejector means having an inlet end extending into the reservoir and a jet orifice positioned in alignment with each port, the air stream through each port being adapted to develop substantially parallel upwardly directed streams of atomized medicament from the orifice, the hollow body having a Venturi-like contracted section above the ports and orifices and an enlargement above the contracted section, an outlet for medicated vapor at the enlarged section, a baffle positioned in the enlarged section below the outlet, the baffle being of larger diameter than the contracted section, the air stream from the ports and orifices being substantially parallel to the center of the Venturi-like contracted section.

4. An inhalator comprising in combination a hollow body structure having a reservoir for a medicament at the bottom, a first inhalation operated ejector provided with an intake port which is short compared with its cross-sectional area, a second air pump operated ejector having a second air port short compared with its cross-sectional area and being of much less cross-sectional area than the first port, an ejector tube associated with each port having an orifice and an intake end dipping into the reservoir portion of the hollow body, said ejectors being positioned to discharge parallel streams of atomized medicament, the opposite end of the hollow body having a tubular mouthpiece for creating the suction for inhalation and operation of the inhalation operated ejector and to transmit the vaporized medicament generated by both ejectors.

CHAS. C. COGHLAN.
STANLEY L. FOX.