Nov. 22, 1949 J. B. SCHMITT 2,488,988

NEBULIZER

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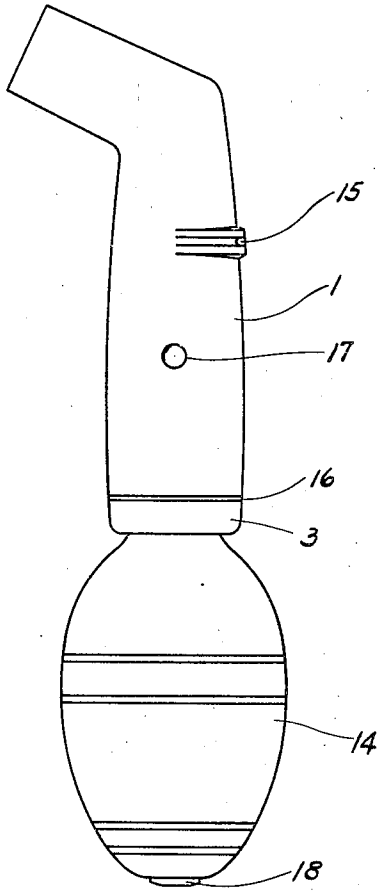


Fig. 1

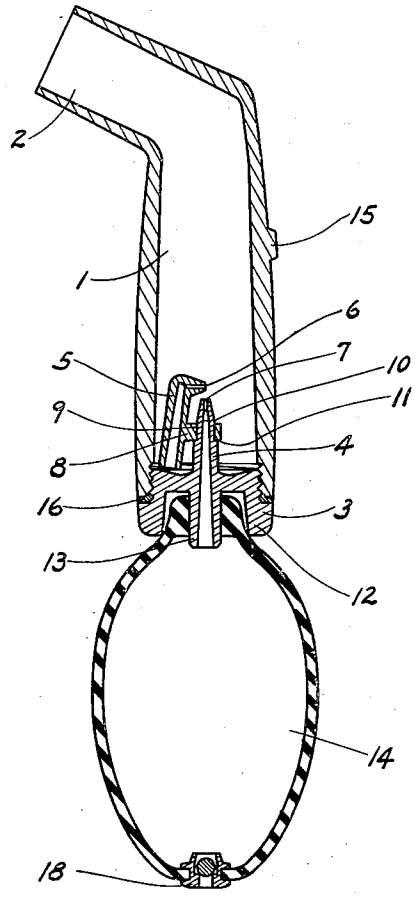


Fig. 2

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NEBULIZER

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1 Claim. (Cl. 299—88.5)

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This invention relates to improvements in nebulizers of the type used primarily for applying minute liquid particles of therapeutic and preventive substances, through inhalation, to the bronchi, smaller bronchial tubes and air cells of the lungs.

An object of the invention is the provision of a nebulizer capable of producing a fine vapor of any suitable liquid medicament in sufficient volume and dispersion to be readily inhaled without any deposit of an excessive amount.

A further object is to provide apparatus of this character which will be formed of a minimum number of simple and strong parts, inexpensive to produce, and which will not easily get out of order.

Another object of the invention is to provide a device of this kind which is not only advantageous for the treatment of asthma, hay fever, and other respiratory ailments but may also be used to introduce into the blood stream by absorption through the lungs of therapeutic substances such as penicillin to combat serious infections in other regions of the body. Tests have shown that the air action of a nebulizer does not reduce the potency of this medicament. It has also been shown that penicillin aerosols created by such an instrument penetrate the lungs and diffuse into the blood stream. As penicillin has been established as the best therapeutic agent presently available for numerous micrococci and other virulent infections, substantial importance may be attributed to this method of application.

With penicillin, with other medicaments in common use and no doubt with many yet to be discovered, certain dosage limits produce the most satisfactory results.

It is therefore essential, in order to comply with medical treatment prescribed, that nebulizers be made to deliver material at a uniform rate and the comparative capacity of individual nebulizers vary only within a slight range.

For certain conditions a discharge of .240 gram per minute has been set as a standard of performance for a nebulizer for respiratory application. Great difficulty has been encountered in satisfying this specification. Size of orifices are necessarily small and are therefore not easly controlled. Further, the relative positions of the nozzle parts must be closely maintained in order to avoid inconsistent performance.

In the manufacture of glass nebulizers the most unfavorable results have been met. These articles are hand blown and formed. The minutely-sized nozzles are drawn from tubes originally

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much larger in diameter. The final size is far from exact as diameters usually range $1/64$ inch or more from that specified. This occurs even in a production run in which special emphasis has been placed upon uniformity.

Then again the angle of inflection of one nozzle toward the other will not regularly conform to recommended practice. In glass nebulizers the bottom is usually fused closed. The accompanying heat will frequently affect the angle or relative horizontal or vertical positions of the nozzle parts. With these conditions in mind, it may be understood why glass nebulizers are not alike in capacity and their performance is unreliable.

A principal object of this invention is to circumvent the deficiencies of nebulizers previously used through the provision of a nebulizer which may be depended upon to deliver medicament at a definite rate and which may be produced accurately, uniformly and without varying capacity.

In order to attain the desired objects the nozzle parts are produced as precisely as possible. This is accomplished by pressure molding. One of the orifices is formed in the mold operation by a mandrel supported at both ends. The other orifice is drilled, as practical means for furnishing support for a mandrel is not available. The nozzle parts are designed and assembled so that they fit together with a definite positioning and spacing. One nozzle part is rotatably mounted on the axis of the other so that its relative position will remain the same however it is turned.

Nebulizers made according to my invention will differ less than 5% in amount of medicament discharged. This compares with a variation of 25% to 30% found in other such instruments.

Other objects and advantages of the invention will be apparent upon reading the following specification in connection with the drawing, in which:

Figure 1 is a side elevation of a nebulizer embodying my invention; and

Figure 2 is a vertical section thereof.

As illustrated, the embodiment of my invention has a cylindrical body 1 forming a receptacle for the medicament. At the top of the body 1 is a discharge nozzle 2 directing the atomized particles laterally. The angle of discharge permits the device to be held either upright for self-treatment in a standing position or inclined at only a slight angle from horizontal to treat a person in a reclining position. Fastened to the bottom of body 1 is a base 3. Integral with this member is an air discharge tip 4 extending centrally into the medicine container. Mounted up-

on and supported by the tip 4 is a liquid tube 5. This has an outlet 6 terminating directly above the outlet 7 of the tip 4. Liquid tube 5 has a supporting collar 8 integral therewith. The cylindrical bore 9 of the collar fits over cylindrical section 10 of the tip 4 and the bottom of the collar rests upon a shoulder 11 terminating the cylindrical section 10. In whatever position the liquid tube 5 is swung around air tip 4 the outlet 6 remains in the same relative position above the outlet 7 of the air tip. This insures proper atomizing cooperation of these parts regardless of the circumferential position of the tube 5. The section 10 of the tip may be made slightly out of round in order that the friction fit between the nozzle parts be more positive. In case the nozzle parts become clogged with dried medicament the nebulizer may be easily disassembled for cleaning. It is particularly advantageous to have the liquid tip removable for this purpose.

Beneath the base 3 the outer annular flange 12 surrounds the centrally located air nipple 13. An air bulb 14 is fastened over this nipple. The outer surface of the attaching end of the bulb meets the inner wall surface of the flange 12. This contact assists in holding the bulb in position and may provide rigidity to the bulb when it serves to support the nebulizer. From one side of the body 1, projects a flattened flange 15. When not in use the nebulizer is laid horizontally upon this flange. It is on the opposite side from that toward which discharge nozzle 2 is directed and the medicament in the body member 1 will therefore not leak out when the nebulizer is so positioned. Only sufficient liquid is ordinarily put in the receptacle to bring the level in the vicinity of collar 8. In order to provide a tight seal between the base 3 and receptable 1 a gasket 16 is placed between them.

A vent opening 17 in the side of receptacle 1 permits the entry of air to compensate for the partial vacuum established by the action of the atomizing air jet from the air tip. A conventional check valve assembly 18 is located in the end of bulb 14. This allows air to enter the bulb at this point while it is expanding but prevents

any outward flow except into the nebulizer during compression of the bulb.

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

I claim:

In an instrument of the type described, a body forming a main portion of a receptacle for medicament, a base forming the bottom of the receptacle, an atomizing air supply nipple extending exteriorly and centrally from the base, there being an annular recess in the base around said nipple, an air supplying bulb and a ported attaching neck of reduced diameter on the bulb, said neck being dimensioned to fit over said nipple and to occupy said recess, the expanding diameter of the bulb adjacent said neck being in contact with the outer edge of the recess, the fitting of the neck into the recess and the contact of the adjacent portion of the bulb with the edge of the recess providing a substantially rigid connection between the bulb and the base, whereby the instrument may be firmly supported in operation by the user's hand on the bulb.

JOY B. SCHMITT.

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