

Dec. 4, 1962

F. A. DE MELFY

3,066,669

NEBULIZER

Filed June 8, 1959

2 Sheets-Sheet 1

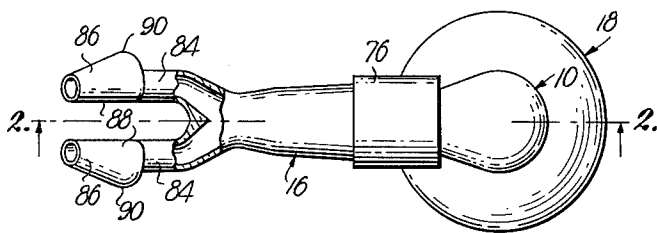


Fig. 1.

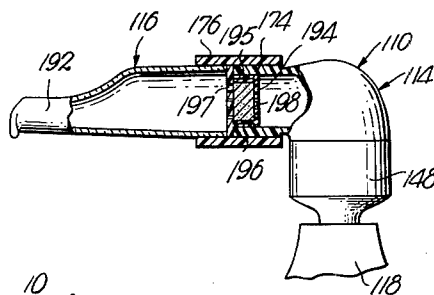


Fig. 3.

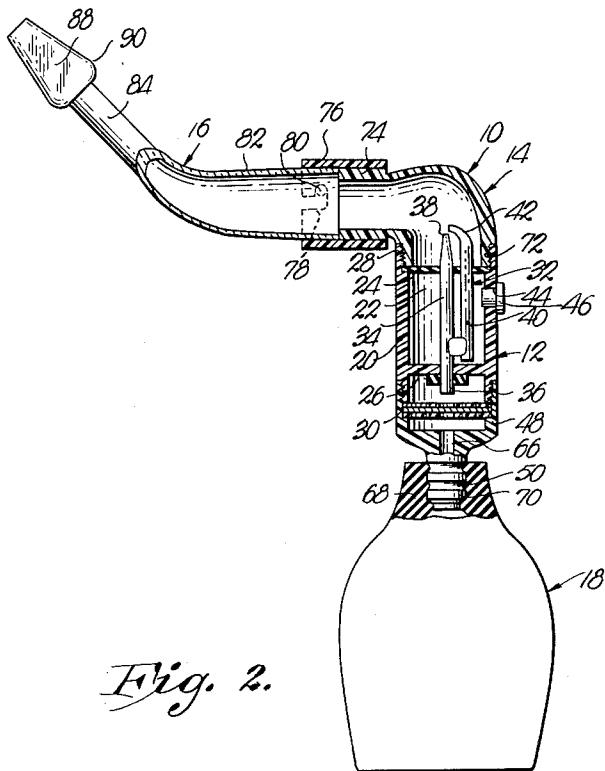


Fig. 2.

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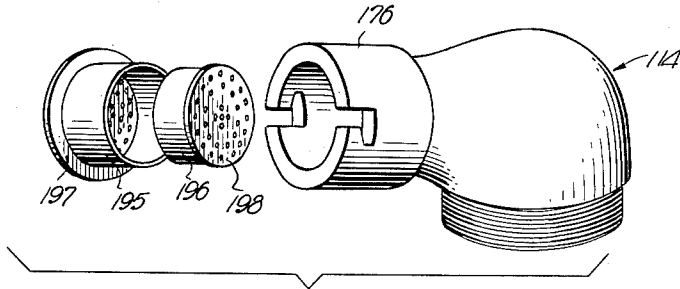


Fig. 4.

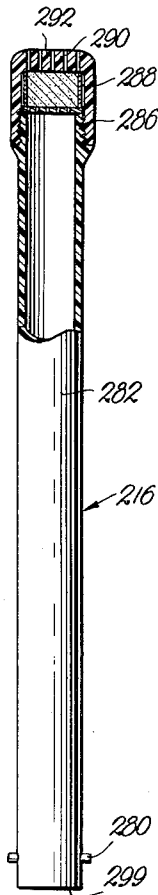


Fig. 6.

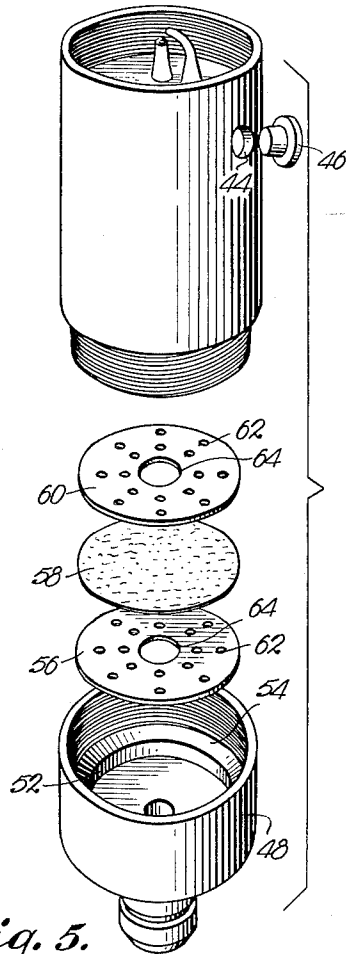


Fig. 5.

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3,066,669
NEBULIZER

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1 Claim. (Cl. 128—194)

This invention relates to improvements in medical appliances and particularly to a combination nebulizer and insufflator, the primary object being to provide an instrument which is constructed to assure positive and faultless operation over long periods of time and without substantial contamination of the medicaments contained therein.

Treatment of many types of illnesses requires the use of an appliance for the inhalation or inward application of vaporized medicaments in either powdered or liquid form. In many instances, such as in the case of certain asthmatic and bronchial conditions, it is imperative that the instrument used to provide relief be completely free of all defects and not subject to breakdown, for it is conceivable that in the event of clogging of the appliance, or because of other defects, the patient could suffocate or at least become violently ill before repair of the instrument could be made. Furthermore, because of the frequency of use of the appliance, it is a requisite that the medicament contained therein be maintained in a sterile condition notwithstanding the patient's frequently breathing into the apparatus.

One type of substantially trouble-free combination nebulizer and insufflator is shown in my U.S. Letters Patent No. 2,829,642, but this appliance cannot be readily converted for use in application or inhaling of both powders and liquids nor does the same provide complete protection from contamination of the medicaments as the person breathes into the delivery nozzle during exhalation.

It is, therefore, another important object of the invention to provide a combination nebulizer and insufflator having more universal application than my prior appliance and which is thus adapted to be used for the inhaling or inward application of medicaments of the particular type required by the patient and which conversion may be accomplished within a short period of time negating the probability of the patient becoming violently ill or suffocating before he can properly employ the instrument.

It is also an important object of the invention to provide a medical appliance of the character defined wherein the removable nebulizer portion thereof includes a hollow body adapted to contain a liquid medicament and substantially sealed against contamination by virtue of the fact that the exhalation products of the user are not directed onto the medicament. In this respect, an additional important object is to provide a nebulizer as set forth above, wherein the hollow body may be sealed during production of the appliance and it is only necessary for the patient to replace the hollow body when the medicament is depleted from the same, or in the alternative, provided with a filler opening permitting the patient to refill the hollow body as required.

A still further important object of the invention is to provide a medical appliance which may also be used as an insufflator by the simple expedient of removing the hollow body adapted to receive the liquid medicament and contained atomization means, and in lieu thereof, inserting a perforated, hollow body in the conduit means of the appliance and which is adapted to receive a quantity of finely comminuted medicament so that when the currents of air are forced through the appliance, the powdered medicament is forced into the oral or nasal passages of the patient.

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Other important objects of the invention include the provision of a novel, L-shaped, tubular conduit forming a part of the delivery means whereby the direction of movement of the dispersed medicament is changed to permit more convenient use of the appliance; to the provision of conduit means of the type referred to above, wherein is included a relatively long tube permitting the administrator of the medicament to remain in spaced relationship to the patient to whom the medicament is being administered; to an appliance including filter means disposed between the air pressure source and the nebulizer or insufflator portions of the appliance to prevent contamination of the medicament with materials in the air; to a combination nebulizer and insufflator including novel nozzle means for efficiently directing the dispersed medicament into either the oral cavity or the nasal passages, as is desired; to a medical appliance as described, which is simple in construction, not subject to breakdown, and may be distributed at a relatively low unit cost; and to other important objects and details of construction of the present device which will become obvious or be explained in greater detail as the following specification progresses.

In the drawings:

FIG. 1 is a plan view of a combination nebulizer and insufflator embodying certain of the concepts of the present invention and having one type of delivery nozzle connected thereto, portions of the latter being in section to reveal details of construction;

FIG. 2 is a side elevational view of the medical appliance shown in FIG. 1, with portions thereof being in vertical section to show the construction of the same;

FIG. 3 is a fragmentary, side elevational view of the appliance of FIGS. 1 and 2, and disclosing a different type of delivery nozzle as well as a powdered medicament container disposed therein, with portions of the components being in section;

FIG. 4 is an enlarged, perspective, exploded view of the L-shaped conduit forming a part of the delivery means and also illustrating in greater detail, the perforated container adapted to receive the powdered medicament;

FIG. 5 is an enlarged, perspective, exploded view of the nebulizer section of the appliance as well as the coupling adapted to receive filter means and thereby removably secured to a source of compressed air and most usually a bulb or the like; and

FIG. 6 is a side elevational view of an elongated adaptor tube permitting application of the medicament from a position spaced from the patient, with the upper portion of the tube being in section.

The medical appliance broadly enumerated 10 in the drawings, is illustrated in FIGS. 1 and 2 as a nebulizer and includes as major components thereof, nebulizer section 12, L-shaped conduit 14, connected to the outlet end of section 12, a delivery nozzle 16 coupled to the outlet of conduit 14, and a source of air pressure such as bulb 18.

Nebulizer section 12 includes an outer cylindrical body 20 which is preferably of transparent material, such as a synthetic resin of the relatively rigid type, to thereby permit viewing of the quantity of medicament contained within the inner chamber 22 in part defined by opposed, circular end walls 24 and 26 closing opposite ends of cylindrical body 20, although it is to be noted from FIG. 2, that both of the end walls 24 and 26 are located inwardly from respective outer circular margins 28 and 30 of body 20.

Cylindrical body 20 carries liquid atomizing means broadly designated 32 and including an elongated air tube 34 extending longitudinally of body 20 substantially along the axis thereof and having an air inlet end 36

and an air outlet end 38 disposed externally of respective end walls 24 and 26. The air outlet end 38 of tube 34 gradually decreases in diameter as the outer extremity thereof is approached to present a nozzle to provide maximum air velocity from air tube 34 in respect to the diameter thereof. Tubular pipette 40 extending through end wall 24 and communicating with chamber 22 adjacent end wall 26, has a curved outer end segment 42 terminating within the path of travel of air emanating from nozzle end 38 of tube 34. It is likewise to be noted that the curved segment 42 of pipette 40 also decreases in diameter as the outer end is approached.

An important feature of nebulizer section 12 is the fact that the openings in end walls 24 and 26 receiving tube 34 and pipette 40 are sealed around the respective peripheral surfaces of the latter to prevent entrance of air into chamber 22 except for the slight opening provided by the outer open end of pipette 40.

Although it is contemplated that the chamber 22 of body 20 may be filled with a liquid medicament at the time of manufacture of nebulizer section 12, it is particularly contemplated that the side wall of body 20 be provided with a filler opening 44 normally closed by a resilient, removable stopper 46.

The cylindrical marginal portion 30 of body 20 is externally threaded and adapted to complementally engage the internal threads of tubular coupling 48 having an integral tubular boss 50 in alignment with the axis of the main body of coupling 48 and also body 20 when coupling 48 and section 12 are threadably interconnected. An integral, inwardly extending flange 52 within coupling 48 presents an upwardly facing shoulder 54 adapted to support a perforated disc 56, a circular sheet of filter paper 58 and a second perforated circular disc 60 in that order, it being observed in FIG. 2 that the lower marginal edge 30 of body 20 engages the normally uppermost surface of disc 60 and thereby forces the latter into tight engagement with filter 58 which is in turn pressed against the proximal surface of shoulder 54. Discs 56 and 60 which have a number of radially disposed perforations 62 therethrough also have central, normally aligned, relatively large openings 64 which are normally in alignment with the bore 66 of boss 50 as well as the air inlet end 36 of tube 34.

Bulb 18 is of conventional construction and will not be described in detail although it can be seen in FIG. 2 that the upper tubular end 68 is telescoped over boss 50 and is maintained in substantially tight frictional engagement therewith by virtue of the longitudinally spaced, circumferentially extending, outwardly projecting flanges 70 integral with boss 50 of coupling 48.

The circular marginal portion 72 of elbow 14 is externally threaded to complementally engage the internal threads of margin 28 of cylindrical body 20 while the opposite cylindrical portion of elbow 14 has a sleeve 76 telescoped thereover and maintained in proper disposition by friction or a suitable adhesive, if desired. The outer edge of sleeve 76 is provided with a pair of opposed, substantially J-shaped, oppositely directed notches 78 which are adapted to receive respective coaxial pins 80 projecting outwardly from the outer surface of main tubular portion 82 of nozzle 16. As best shown in FIG. 1, nozzle 16 is of substantially Y-shaped configuration and thereby includes a pair of tubular branches 84 each having tubular nostril adaptors 86 on the outer ends thereof. It can be seen that adaptors 86 are substantially larger in diameter than respective branches 84 at the zone of juncture thereof, but decrease in effective diameter as the outer ends of each adaptor 86 is approached. Of particular significance is the fact that the inner opposed surfaces 88 of adaptors 86 are in substantial alignment with proximal wall portions of branches 84 while the opposed outer segments 90 of adaptors 86 flare outwardly at the zones where adaptors 86 join corresponding branches 84 to thereby permit nozzle 16 to be employed by persons

regardless of the size of their nasal passages. Nozzle 16 may be employed to direct dispersed medicament into the nostrils of babies as well as children of all ages and adults.

In the operation of appliance 10 as a nebulizer and in the form illustrated in FIG. 2, bulb 18 is squeezed to cause a blast of air to be directed through bore 66 of boss 50 into the chamber presented by tubular coupling 48, thence through filter discs 56 and 60 and paper 58, and finally, into tube 34 extending through chamber 22. As the blast of air emanates from nozzle end 38, a zone of reduced pressure is produced within pipette 40 and thereby chamber 22 whereby a quantity of the liquid medicament contained within nebulizer section 12 is vaporized and forced outwardly through the open discharge segment of pipette 40. Elbow 14 changes the direction of the vaporized medicament and the same is forced into the nasal passages of the user through nozzle 16 and simultaneously through respective branches 84 and nostril adaptors 86.

A modified medical appliance denominated 110 constitutes an insufflator and is illustrated in FIG. 3. Coupling 148, and identical with coupling 48 of appliance 10, is adapted to receive a flexible bulb 118 of conventional character, while elbow 114, also identical with elbow 14, is threadably connected directly to coupling 148. The nozzle 116 adapted for oral administration of a medicament and removably connected to sleeve 176 of elbow 114, in the same manner that nozzle 16 is coupled with sleeve 76 of elbow 14, has an outer portion 192 of reduced dimensions and of greater width than height to permit the user to place mouthpiece 192 within his mouth for most efficient inhalation or inward application of a medicament.

Powder container 194 and adapted to receive a quantity of finely comminuted medicament, includes a pair of cup-shaped members 195 and 196 disposed in telescoped relationship and having opposed, spaced, perforated, circular end walls 197 and 198 respectively. End wall 197 is of a diameter substantially equal to the internal diameter of sleeve 176 whereby the outer peripheral margin of end wall 196 is normally engaged by opposed circular margins of circular portion 174 of elbow 114 and nozzle 116 respectively.

It is to be understood that nozzle 16 may be substituted for nozzle 116, if it is desired, to inhale or inwardly apply a powdered medicament into the nasal passages. By the same token, nozzle 116 may be substituted for nozzle 16 when the patient desires to direct atomized medicament into the oral cavity.

A third type of nozzle 216 is illustrated in FIG. 6 and comprises a relatively long tube 282 having a pair of opposed, coaxial pins 280 projecting from the outer surface thereof at the end 299 of tube 282 whereby tube 282 may be releasably connected to sleeve 76 or sleeve 176 of appliances 10 or 110 respectively, if desired. Normally outermost end 286 of tube 282 is externally threaded to complementally receive an internally threaded cap 288 having a number of perforations 290 in the normally outermost transverse wall 292 thereof.

If desired, cup-shaped member 195 may be inserted in cap 288, as illustrated in FIG. 6, with the upper circular margin of end 286 of tube 282 bearing against the outer peripheral margin of end wall 197 to thereby force member 195 into engagement with the inner surface of end wall 292.

It is apparent that with tube 282 connected to elbow 14 or 114, the physician or other person may administer the medicament either in liquid or powdered form and into the oral or nasal passages from a position in safely spaced relationship to the patient.

It is further to be pointed out that in certain circumstances, it may be desirable to use the powder receiving members 197 and 198 in conjunction with nebulizer section 12. The perforated end walls 197 and 198 serve to

maintain the atomized liquid in a dispersed condition notwithstanding the relatively long passage from the outlet of pipette 40 to the outer openings of nozzles 16, 116 or 216.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

In a medical appliance for inhaling or inwardly applying medicaments, a cylindrical body having a pair of opposed end walls whereby to define a medicament receiving chamber, said end walls being spaced inwardly from corresponding end margins of the body; air supply means coupled to said body at one end thereof and in communication therewith; a coupling joining said air supply means to said body, said coupling being connected to one end margin of the body in such a manner as to define a space between the end wall of the body corresponding to said one end margin and a wall of the coupling; filter means disposed within said space and in the path of travel of air from said supply means to said body; a delivery conduit secured to the other end margin of said body and in communication with the interior of the body; a nozzle carried by said conduit and in communication

therewith; and atomization means carried by the body and including an elongated air tube extending through the body and having air inlet and air outlet ends disposed externally of respective end walls of the body, with the air inlet end extending into said space, said air outlet end extending into the conduit, and a delivery pipette extending through the end wall of the body adjacent the outlet end of the air tube, communicating with the interior of the chamber and disposed with the outlet end thereof terminating within the path of air emanating from the outlet end of the air tube.

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