

[54] **NEBULIZER**

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 [58] Field of Search **239/338, 370, 590, 590.3**

[56] **References Cited**

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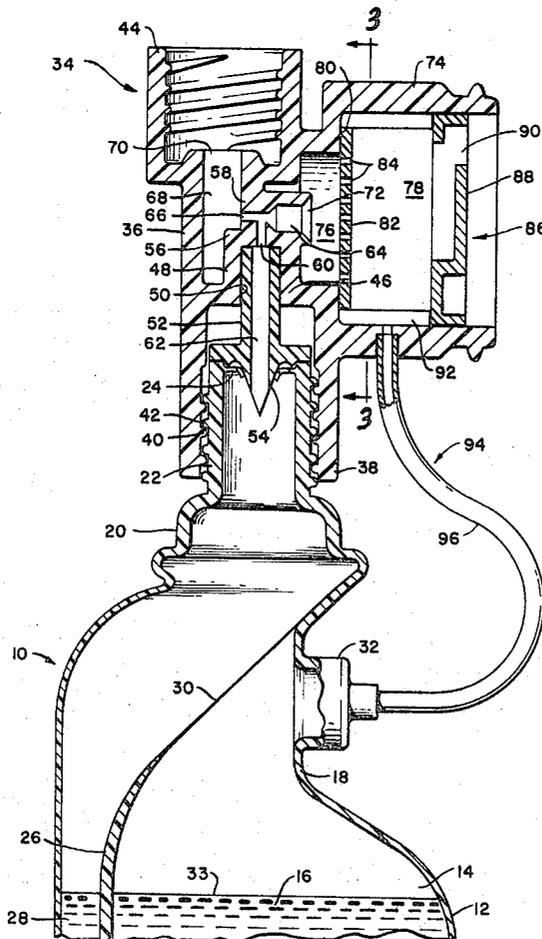
[57] **ABSTRACT**

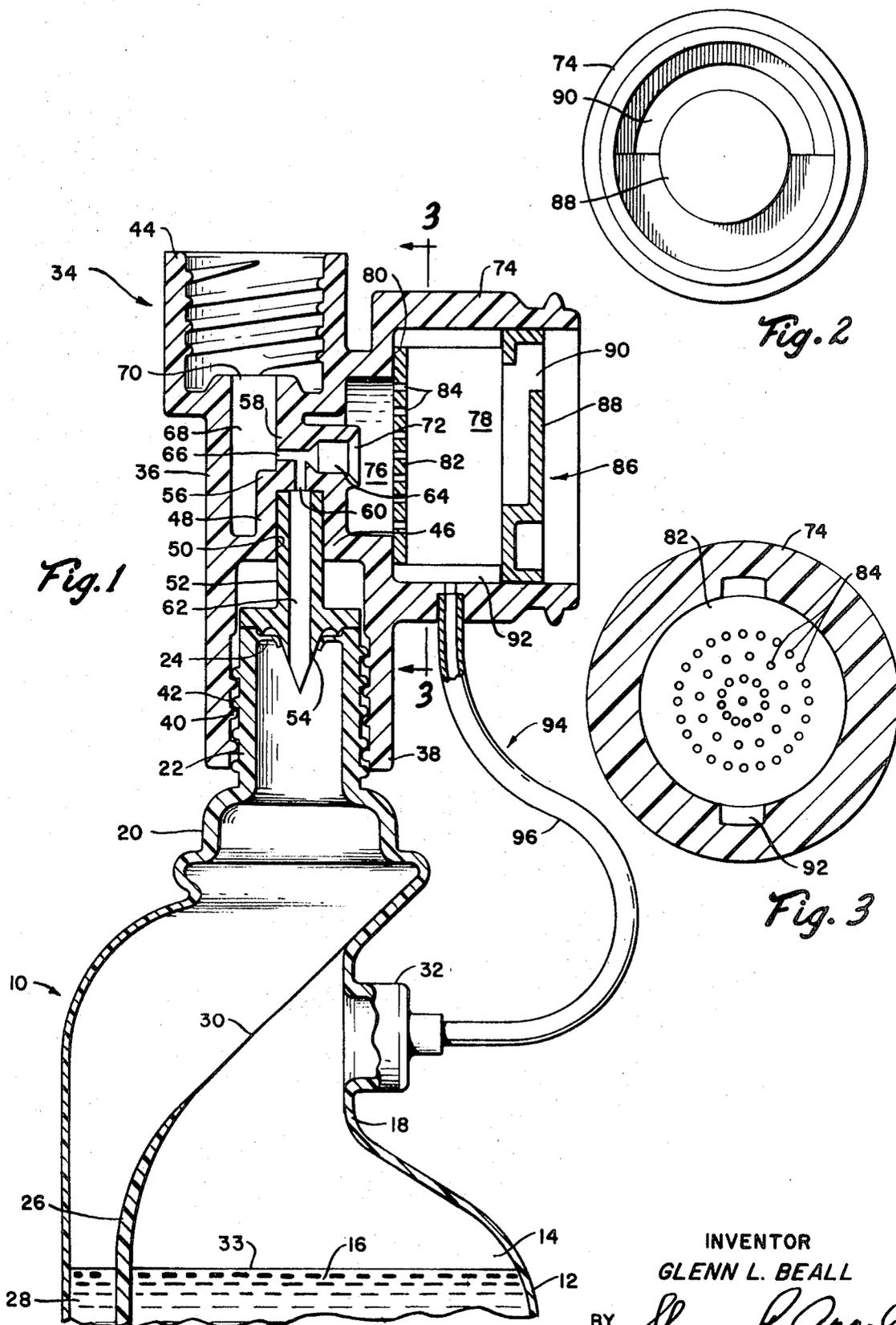
A water supply is adapted as a source for nebulized liquid through the agency of an adapter which couples oxygen pressure to a container for the water. A venturi within the adapter draws from the water supply and directs atomized water and oxygen through an outlet pipe on the adapter.

A perforated plate is disposed in the path of flow downstream of the venturi and divides the outlet pipe into inner and outer chambers. It traps water particles which are too large to pass through the plate perforations and passes the remainder. Water which collects upstream of and against the perforated plate in the inner chamber drains into the outer chamber through lowermost perforations.

A baffle plate is disposed in the outlet end portion of the outlet pipe; and it intercepts water condensed in the outer chamber and has an arcuate upper opening for passage of nebulized water from the fitting. A duct which is fluidally connected to the outer chamber returns condensed water therefrom to the container and stabilizes pressure therein by providing gas replacement for water removed from the system.

7 Claims, 3 Drawing Figures





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NEBULIZER

FIELD OF THE INVENTION

The present disclosure relates to inhalation therapy. Particularly it relates to nebulizers. Specifically it concerns a nebulizer adapter for a liquid container.

BACKGROUND OF THE INVENTION

Inhalation therapy is the medical art of treating with oxygen having a high moisture content. Several classes of devices, one of which comprises atomizers or nebulizers, are adapted for such treating. A heretofore known system for inhalation therapy comprises a container for water which has means enabling operation of the container in selected of several modes. A fitting, comprised of a venturi, when associated with said enabling means, adapts the container as nebulizer reservoir and itself is adapted for providing nebulized water. However, in that device, some of the water which has been removed from the container either fails to break into a mist, or condenses at or about the fitting after atomization. Absent from the prior device is special provision for managing such unatomized water.

It is an object of the present invention to provide an improved nebulizer.

It is a further object of the invention to provide an improved fitting for adapting a water container as a nebulizer.

It is another object of the invention to remove condensate from a mist produced by a nebulizer, particularly a nebulizer comprised of a venturi.

It is an additional object of the invention to improve the quality of a nebulized mist.

Moreover, it is an object of the invention to return condensate in a nebulizer to its liquid supply.

SUMMARY OF THE INVENTION

To effect the foregoing, and other objects of the invention which will be apparent from ensuing description, a nebulizer, has a venturi for mist forming means disposed within a body having chamber means with a mist outlet opening. Provided are means for removing from said body a stream of fluid collected in said chamber means. More particularly, the nebulizer has a delivery pipe disposed in fluid receiving association with said venturi. A wall section of said pipe has a channel arranged for draining said chamber means; and an opening in said wall is adapted to drain said channel.

BRIEF DESCRIPTION OF THE DRAWINGS

In the ensuing detailed description, reference is made to the accompanying drawings in which:

FIG. 1 is a vertical sectional view through a nebulizer embodying the invention, only an upper portion of an associated container with a nebulizer adapter being shown;

FIG. 2 is an elevational view of the outlet end portion of said fitting looking toward said nebulizer from the right of FIG. 1; and

FIG. 3 is a view according to the line 3—3 on FIG. 1, a perforated plate being shown in elevation.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

Referring now more particularly to the drawings, shown is one end portion of a container generally designated 10, which may be of semirigid fabrication and has a general vertical orientation. It is comprised of a body 12 having therein a chamber 14 which defines a reservoir for water 16. A neck 18, being an upper restricted end portion of body 12 serves as a transition component atop of which is fashioned an integral head 20. Inlet means comprised of a duct 22 is integrally fashioned with head 20 and projects vertically upwardly, its inlet end portion having mounted therein a flexible sealing disc, membrane or diaphragm 24 which is shown ruptured for fluidally connecting the container with an oxygen supply source (not shown).

A septum 26 which is formed integrally with and is disposed within body 12, with the wall of said body, defines a duct 28 with a generally vertical aspect. The septum separates chamber 14 from duct 28; but at its lower end (not shown) terminates short of the container bottom, whereat the chamber 14 and said duct are fluidally connected. The upper portion of the septum extends obliquely across said chamber the neck 18, being fashioned such that a path for gas is formed between the duct 22 and the duct 28. An opening 30 through the upper end portion of the septum fluidally connects the upper end portion of chamber 14 with duct 22. Were it not for opening 30 the septum would isolate the upper end of said chamber from said last duct.

The foregoing construction enables use of container 10 as a humidifier reservoir (such use not being illustrated herein) as well as nebulizer reservoir, as illustrated herein. This dual feature is disclosed and described in detail in a copending application, Ser. No. 856,756, filed Sept. 10, 1969.

A liquid return nipple 32 is fashioned integrally with neck 18 and preferably is disposed above the highest liquid level 33 in chamber 14. In addition, nipple 32 comprises venting means through which gas is supplied to compensate for fluid withdrawn from said chamber in a manner which will be appreciated from ensuing description.

A nebulizer fitting or adapter generally designated 34 has a body 36 preferably of rigid plastic fabrication. A vertically orientable lower socket 38 is formed in said body with an internal spiral thread 40. The latter operably matches external thread 42 formed on duct 22, whereby the adapter may be mounted on container 10. An internally threaded upper socket 44 formed above socket 38 in body 36 for receiving the male component of oxygen supply means (not shown) adapts fitting 34 for connection to an oxygen pressure source.

Socket 38 is defined by an upper wall 46 which has an upwardly projecting cylindrical section 48 with a pocket 50. A breaching tool 52 has an upper end snugly seated in pocket 50. It has a lower breaching element 54 which is adapted for rupturing diaphragm 24 and projects into duct 22 when fitting 34 is operably associated with container 10. An axial vertical conduit 62 for water 16 projects through breaching tool 52.

The upper wall 56 of cylindrical section 48 defines the lower wall of a venturi 58 fashioned integrally with adapter 34 in a medial portion of body 36 between sockets 38 and 44. A vertical venturi passage 60 through wall 56 fluidally connects reservoir 16 through conduit 62 with an intersecting venturi passage 64 which extends horizontally through the venturi.

The gas inlet port 66 of passage 64 opens into a chamber 68 within body 36 which is fluidally connected to socket 44 through an opening 70 in the socket floor. The venturi outlet port 72 is fluidally connected to an outlet element, nose or pipe 74, integrally fashioned as a substantially cylindrical section of adapter 34.

The axis of pipe 74 is orthogonal to the axis of body 36 and, when operatively disposed, is horizontal with reference to FIG. 1, relative which all terms of orientation herein are made.

In consequence of the foregoing construction, oxygen introduced into adapter 34 under pressure will be directed by the venturi through passage 64. Suction thereby generated in venturi 58 draws water from chamber 14 into the gas stream with which the water, as a spray, is expelled through orifice 72 into pipe 74.

Pipe 74 has a stepped cylindrical cavernous interior comprised of an inner lesser chamber 76 and an outer greater chamber 78 formed from an integral annular shoulder 80. The chambers are in horizontal alignment and preferably are concentric with the longitudinal axis of horizontal venturi passage 64 whose outlet orifice opens into chamber 76. Perforated means, herein shown as a circular disc 82 has a plurality of circularly arranged pores 84 (only some of which are numbered). It is disposed in chamber 78 being rigidly secured against shoulder 80 orthogonally of the axis of pipe 74 and separates the chambers, each from the other, though fluidal connection is maintained therebetween through said pores.

A baffle generally designated 86 which is axially spaced from disc 82 partially plugs the outlet end portion of pipe 74. It has an outlet closure 88 and an upper arcuate outlet slot or opening 90 through which chamber 78 is fluidally connected to the exterior of adapter 34.

The wall of pipe 74 has an upwardly opening axially extending lower channel or trough 92 which extends between shoulder 80 and baffle 86 and opens into chamber 78. Duct means 94 including a length of flexible tubing 96, at its upper end portion fluidally communicates with the trough through the wall of said pipe. At its lower end portion said duct means is fluidally connected to nipple 32 for returning water from chamber 78 to reservoir 14.

Water particles which are not blocked by disc 82 will be forced by the pressure in the system, when operating, through pores 84 into chamber 78 from chamber 76. Water which is in a condensed phase upstream of disc 82 collects in the bottom of chamber 76. When the level of such collected water reaches the lowermost pores 84, it will flow by gravity therethrough into chamber 78 and then into channel 92. In chamber 78, particles too heavy to rise for passage through outlet opening 90, will be trapped against the upstream surface of closure 88, and, with other water which condenses in said chamber will fall or flow to the bottom thereof and into channel 92.

It is appreciated that duct means 94, in addition to returning water from chamber 78 to container 10, restores pressure balance within the container enabling continuous removal of water.

As many changes in the described construction could be conceived, and as many changes could be made therein without departing from the spirit and scope of the claims, it is intended that all matter contained in the specification shall be considered as illustrative only and not in a limiting sense.

I claim:

- 1. In a nebulizer wherein the mist forming means comprises a venturi disposed within a body having chamber means with a mist outlet opening, an improvement characterized by:
 - said chamber means having a first chamber disposed downstream of said venturi;
 - said chamber means having a second chamber disposed downstream of said first chamber;
 - an element disposed with one of said first and said second chambers for intercepting fluid upstream of said second chamber and having perforations for passing a mist and intercepted fluid from said first chamber to said second chamber and means for removing fluid collected in said second chamber from said body.
- 2. In a nebulizer wherein the mist forming means comprises a venturi disposed within a body having chamber means with a mist outlet opening, an improvement characterized by:
 - means for removing fluid collected in said chamber means from said body;
 - said chamber means having a first chamber disposed downstream of said venturi;
 - said chamber means having a second chamber disposed

- downstream of said first chamber;
 - an element disposed with one of said first and said second chambers for intercepting fluid upstream of said second chamber and having perforations for passing a mist and intercepted fluid from said first chamber to said second chamber;
 - and baffle means for preventing a portion of the fluid in said second chamber from passing through said outlet opening.
- 3. In a nebulizer wherein the mist forming means comprises a venturi disposed within a body having chamber means with a mist outlet opening, an improvement characterized by:
 - means for removing fluid collected in said chamber means in a stream from said body;
 - said chamber means having a delivery pipe disposed in mist receiving association with said venturi;
 - said removing means having a wall section of said pipe with a channel for draining said chamber means and a drain opening through said wall fluidally connected to said channel;
 - said first and said second chambers disposed in coaxial alignment in said pipe;
 - the first chamber disposed in mist receiving association with said venturi;
 - the second chamber having said outlet opening and being adapted to drain said first chamber;
 - an inner baffle arranged medially of said chamber means and for intercepting fluid movement between said first and said second chambers, said inner baffle being perforated for enabling passage of mist and flow of fluid between said chambers.

4. A combination according to claim 3 further characterized by second baffle means arranged in said pipe for partially diverting liquid from said outlet opening toward said channel.

5. In a nebulizer wherein the mist forming means comprises a venturi disposed within a body having chamber means with a mist outlet opening, an improvement characterized by:
 means for removing fluid collected in said chamber means in a stream from said body;
 said chamber means having a delivery pipe disposed in mist receiving association with said venturi;
 said removing means having a wall section of said pipe with a channel for draining said chamber means and a drain opening through said wall fluidally connected to said channel;
 said pipe having a horizontal axis, and said channel extends parallel to said axis.

6. A combination according to claim 5 characterized by duct means for fluidally connecting said body to a nebulizer reservoir.

7. A combination according to claim 5 wherein said connecting means comprise a pair of sockets with vertically oriented axes and having means for connecting said body to an oxygen supply fitting and a water container.

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