

[54] **MEDICAMENT INJECTOR FOR
NEBULIZER**

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[58] **Field of Search**.....128/194, 193, 185, 186, 187, 128/188, 190, 195, 196, 197; 261/78, 115

[56] **References Cited**

UNITED STATES PATENTS

3,473,530 10/1969 Urbanowicz.....128/194

3,221,737 12/1965 Felts.....128/188

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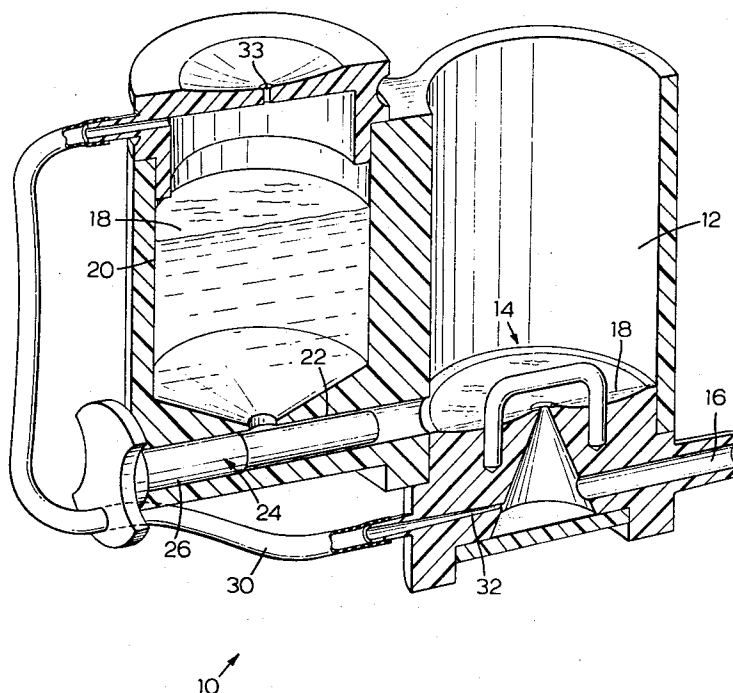
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[57] **ABSTRACT**

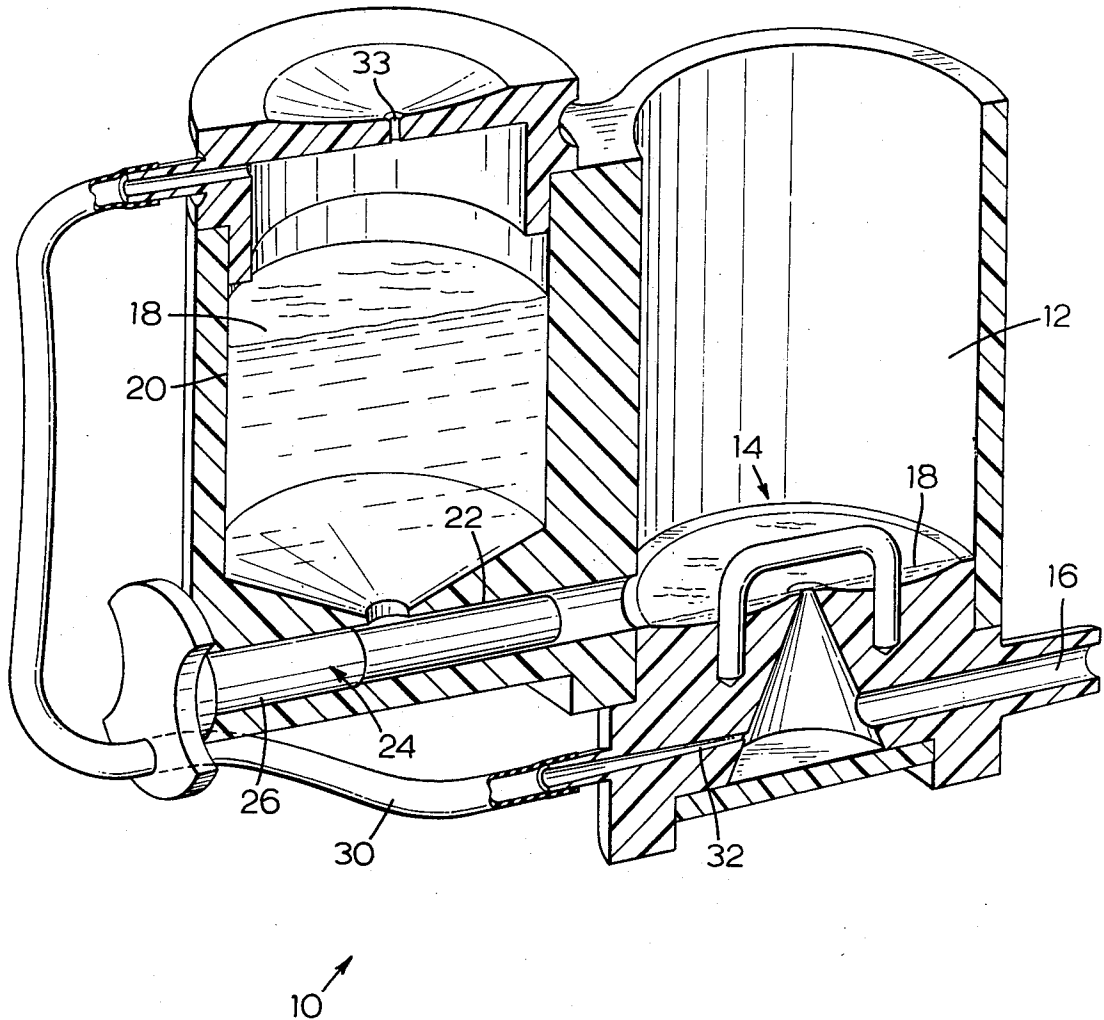
This invention is a device for supplying medicament to a nebulizer at the rate of consumption of the medicament by the nebulizer for the purpose of avoiding the objections of contamination of the medicament as it is nebulized and of insuring that the concentration of the medicament remains constant as it is nebulized. The invention achieves its objective by providing a medicament chamber that communicates with the nebulizer through a metering passage and pneumatic means for forcing medicament from the medicament chamber through the metering passage that is responsive to the demand of the nebulizer.

4 Claims, 1 Drawing Figure



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MEDICAMENT INJECTOR FOR NEBULIZER

This invention relates to an injector for a medicant to a nebulizer.

Nebulizers are used extensively for atomizing liquid medicants as a means for creating beneficial atmospheres in sick rooms. In this way, drugs are administered through inhalation.

A common complaint with nebulizers is that the concentration of the drug being nebulized changes with time because of the tendency of light molecules to be nebulized first, and heavy molecules nebulized last.

A further difficulty with existing nebulizers where a large charge of drug is put in the nebulizer is that the drug often becomes contaminated as it is used up.

It is an object of this invention to provide a device for simply metering the supply of medicant to the nebulizer at the rate it is nebulized by the nebulizer as the nebulizer operates to avoid the variations of drug concentration and to avoid contamination during use.

Generally speaking, a medicament injector for a nebulizer, according to this invention, comprises a medicament chamber, a medicament metering passage extending from said medicament chamber and adapted to communicate with a nebulizer, a gas supply means for admitting gas under pressure to said medicament chamber, said medicament chamber being formed with a gas vent at its upper portion that has a cross-section small enough to cause pressure build-up from said gas supply means in said medicament chamber to force medicament from said medicament chamber and out said medicament metering passage, said medicament metering passage having a cross-section adapted to restrict flow of medicament from said medicament chamber under conditions of no supply of gas from said gas supply means to said medicament chamber.

This invention will be clearly understood after reference to the following detailed specification read in conjunction with the drawings.

In the drawings:

FIG. 1 is a perspective view of the generator of a nebulizer and an injector according to this invention.

In the drawings, the numeral 10 generally indicates a combined nebulizer and medicament injector, the medicament injector being constructed according to this invention. The nebulizer will not be referred to in detail. Generally speaking, it is in accordance with the disclosure of U.S. Pat. No. 3,473,530 issued Oct. 21, 1969. The nebulizer consists of a generator chamber 12, a mist generator 14, to which pressurized operating gas is supplied by means of the gas supply conduit 16.

FIG. 1 shows the nebulizer and the medicament injector in perspective but broken away along a vertical plane along the longitudinal center line to show construction. The medicament injector has been formed integrally with the nebulizer, but it will be appreciated that it could be separately formed and mounted thereon. It will also be appreciated that the injector can be applied to nebulizers that are of a different design to the one illustrated.

In use, it is desired to deposit medicament into the generator chamber 12 of the nebulizer at the rate that it is used by the nebulizer. It is, therefore, important that the supply of medicament only continue as long as the nebulizer is in use and that it be metered at the rate of use.

The medicament 18 in liquid form is maintained in the medicament chamber 20 and, in use, flows therefrom through the metering passage 22. Metering passage 22 has a metering valve 24 therein, the shoulder 26 of which is a press-fit in the rear portion of the through opening of the passage 22. The forward portion of the metering valve 24 is of a reduced diameter and it defines an annular space in the passage 22 from the opening in the bottom of chamber 20 that communicates with the passage 22. The annular space defined by the metering valve and the passage 22 is adapted to prevent the flow of medicant from the chamber 20 to the generator 14 under conditions of gravity and when there is no pressure build-up in the medicament chamber 20 above the medicament 18. It has been found that a radially extending space of about 0.0025 inches between the valve 24 and the wall of the passage 22 is sufficient for most medicaments of an aqueous nature. This, however, will vary with the medicament and a more viscous medicament might require a greater spacing. It is a matter of skill in the art to adjust the spacing for the particular type of medicament being used to achieve a delivery of medicament at the rate of consumption.

It will be noted that the metering valve 24 can be withdrawn from the passage 22 for the purpose of cleaning. This may be frequently necessary in use, where the unit has been standing and medicament becomes crystallized in the annular space between the valve 24 and the passage 22.

A gas supply conduit 30 communicates with the medicament chamber at one end and with the pressurized gas supply 16 to the nebulizer through a gas flow reducer 32. The gas flow reducer 32 is adapted to lead off a portion of the gas supply to the nebulizer and supply it to the medicament chamber 20 through the conduit 30. A vent 33 is formed in the upper portion of the medicament chamber and it has a cross-section small enough to cause pressure build-up under conditions of pressure supply through the conduit 30 in the medicament chamber to force medicament through the opening in the bottom of the medicament chamber and through the medicament metering passage that is constituted by the metering valve 24 and the passage 22 and into the generator chamber 12 of the nebulizer where it is nebulized as it is delivered. Vent 33 for an aqueous medicant and an annular medicament passage of a radial dimension of about 0.0025 inches should be about 0.035 inches in diameter.

The pressure in the medicament chamber 20 is adapted to supply medicament to the generator chamber at a rate that it will be used by the nebulizer under conditions of use and the opening 33 is adjusted to achieve this pressure. The pressure in the supply chamber 20 can be increased by reducing the size of vent 33 to increase supply rate or drive a more viscous medicament.

It will be apparent that, with an increase in gas inlet pressure to the nebulizer, the capacity for the nebulizer to nebulizer medicament in increased. At the same time, the gas flow is proportionately increased to the medicament chamber and the pressure on the medicament is increased. This results in a greater flow of medicament to the generator chamber. A reduction in gas inlet pressure to the nebulizer has the opposite ef-

fect. Following are readings taken of variations in pressure on the medicament with variations in gas inlet pressure, i.e. nebulizer generator pressure.

DATA ON FLUID INJECTOR

Generator Pressure PSIG	Injector Pressure Cm. of H ₂ O
50	48
45	41
40	34
35	28
30	23.5
25	18.2
20	13.5
15	10
10	6.2
5	3
2	1

Embodiments and uses of the invention other than the one illustrated will be apparent to those skilled in the art. For example, the injector could be used on a venturi-type of nebulizer or any other type nebulizer for the purpose of supplying medicament to the throat of the venturi at the rate that it was being nebulized by the venturi-type nebulizer.

The embodiment illustrated is used by placing medicament in the medicament chamber and connecting an air supply to the nebulizer gas pressure inlet. A portion of the air supply is conducted to the medicament chamber to build up the pressure therein and force medicament through the medicament metering passage to the nebulizer generator from which it is nebulized at the rate of deposit therein.

The nebulizer illustrated is illustrated only by way of example and it is intended that the injector be used on any nebulizer having a gas pressure associated therewith that requires medicament to be supplied at the rate that it is nebulized. The embodiment of the invention other than the one illustrated will be apparent

to those skilled in the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In combination with a nebulizer a medicament injector comprising a medicament chamber, a medicament metering passage of constrained cross-section extending from said chamber to the base of the nebulizer, (a) parallel flowing gas supply means for admitting gas under pressure to said medicament chamber and the base of the nebulizer, said medicament chamber being formed with a gas vent of small cross-section in the chamber upper portion venting to the (outside) atmosphere such that gas from the gas supply means is adapted to build up a pressure within the chamber to force medicament from the chamber through said medicament metering passage into the nebulizer with excess gas venting through the gas vent to the outside, said medicament metering passage of stepped and constrained cross-section adapted to restrict the flow of medicament from said chamber to the nebulizer under condition of no supply of gas to the said gas supply means and to cause medicament to accumulate in the base such that the gas may be vented therethrough to nebulize the same.
2. A medicament injector as claimed in claim 1, in which said medicament metering passage is defined by a tubular section and a metering valve within said tubular section, said metering valve having a lesser cross-section than said tubular section and defining with said tubular section an annular space that constitutes said metering passage, said metering valve being removable from said passage.
3. A medicament injector as claimed in claim 1, in which said gas supply means is connectible to a gas inlet supply for said nebulizer.
4. A medicament injector as claimed in claim 2, in which said gas supply means is connectible to a gas inlet supply for said nebulizer.

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