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Freeman

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[54] **AUTOVENT FIELD VENTILATOR**

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[58] **Field of Search**..... 128/145.8, 145.6, 145.7, 128/145.5, 142.2, 142.3, 146.5, 188, 202

[56] **References Cited**

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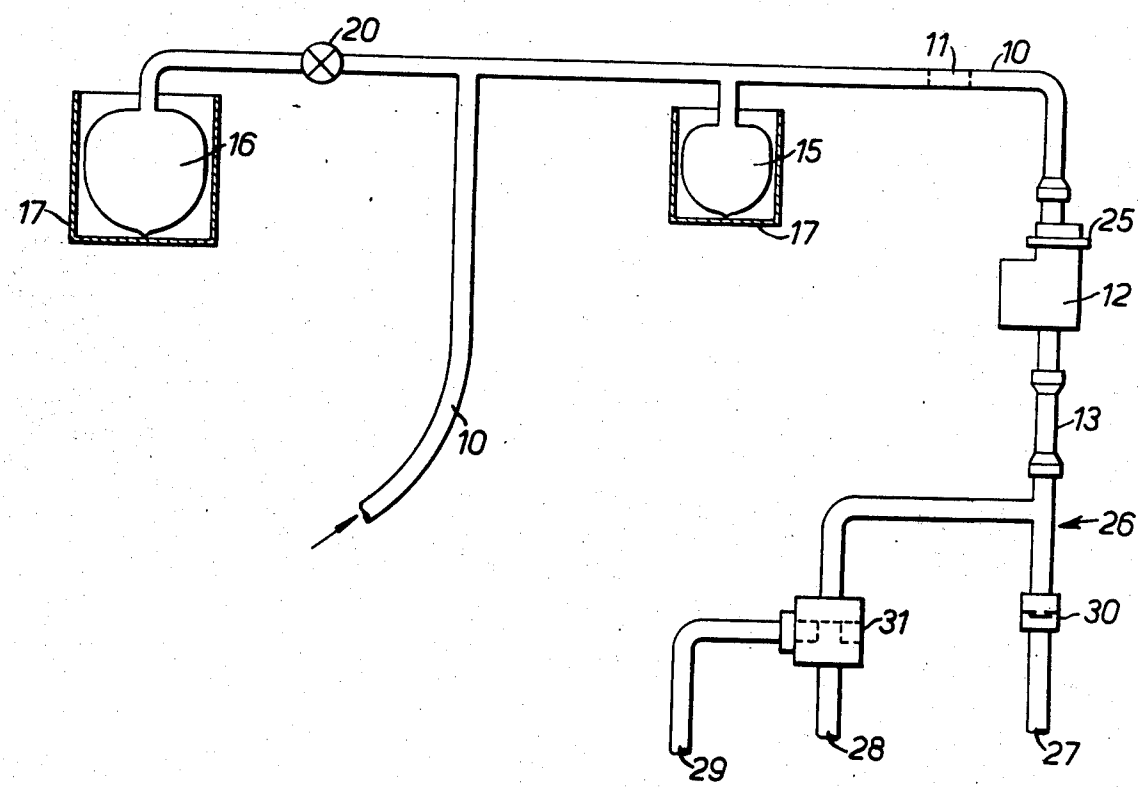
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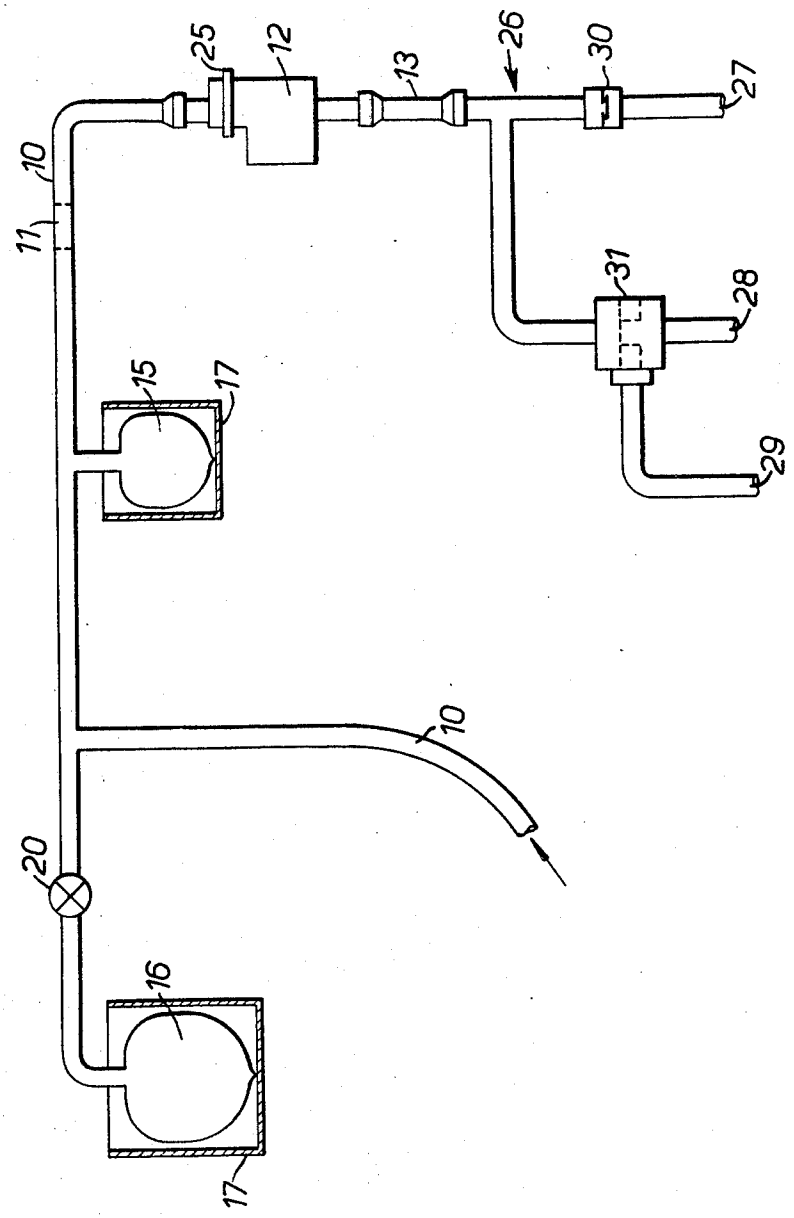
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[57] **ABSTRACT**

An automatic ventilator includes a gas input line, a compliant volume means communicating with the input line, a constraint limiting the expansion of the volume means, and a gas output line. A pressure responsive valve is provided which interconnects the lines, the pressure responsive valve being responsive to the pressure in the input line to open to pass gas to the output line, and being responsive to the gas pressure in the input and output lines to close to permit exhalation by a patient. A one way valve is further provided between an inspiration port and the output line so as to allow gas to flow from the output line to the inspiration port in order to periodically deliver a predetermined volume of gas at a predetermined pressure to the inspiration port.

4 Claims, 1 Drawing Figure




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AUTOVENT FIELD VENTILATOR

This invention relates to an automatic ventilator for inducing respiration in a patient.

Automatic ventilators generally fall into two classes, namely those that are pressure limited, i.e., will deliver gas to a patient until a pre-set back pressure is attained, and those that are volume limited, i.e., will deliver to the patient a pre-set volume of gas. Both classes of ventilators have uses in dealing with particular respiratory disorders but can be dangerous if used in an unsuitable case.

It is an object of the present invention to provide a simple ventilator incorporating volume control and capable also of providing pressure control.

The present invention is an automatic ventilator including a gas input line, compliant volume means communicating with said input line, a constraint limiting the expansion of said volume means, a gas output line, and a pressure responsive valve interconnecting said lines and responsive to the gas pressures therein to open to pass gas to the output line and to close to permit exhalation by a patient.

The compliant volume means may comprise an expandable bag. Two such expandable bags may be provided the second also having a constraint associated therewith and communicating with the input line through a flow control valve.

A valve device may be provided at the other end of the gas output line to pass gas to an inspiration port and to pass gas from an expiration port to the atmosphere.

An embodiment of the present invention will now be described, by way of example, with reference to the drawing, the single FIGURE of which diagrammatically illustrates an automatic ventilator according to the present invention.

Referring now to the drawing, a gas inlet line **10,** intended to be supplied from a constant flow gas source, is connected through a filter **11** and a pressure responsive valve **12** to an output line **13.**

In communication with the gas inlet line are compliant volume means, in this embodiment two expandable bags **15** and **16,** each of which is located in a container **17** which acts as a restraint to limit the expanded volume of the bags. The bag **15** has a capacity of half a litre and the bag **16** has a capacity of 1 litre and communicates with the line **10** through an adjustable flow control valve **20.**

The pressure responsive valve **12** which is preferably of the type disclosed in our British Patent Specification No. **1,208,775** operates to remain closed during which time the line **13** vents to the atmosphere until the pressure in the input line **10** reaches a specified value and remains open until the pressures in the input and output lines **10** and **13,** respectively are substantially equal. The specified pressure at which the valve opens is adjustable by means of a collar **25** on the valve body.

Connected with the free end of the output line **13** is a valve device **26** having an inspiration port **27,** an expiration port **28** and a vent port **29.** The inspiration and expiration ports are coupled to a face mask (not illustrated) (or other patient connection) for a patient while the vent port **29** is open to the atmosphere. The inspiration port **27** is coupled to the output line **13** through a one way valve **30** which permits flow from the line **13** to the port **27.** A diaphragm valve **31** uses the pressure in the output line **13** to control communication between the expiration port **28** and the vent port **29.**

The cycle of operation of the automatic ventilator commences with the valve **12** closed, the patient then breathing out. The constant flow of gas **10** into the ventilator expands the bag **15** and, at a rate determined by the setting of the flow control valve **20,** the bag **16.** The pressure in the line **10** rises sharply when the bag **15** has expanded against its restraint, and the valve **12** opens when its preset pressure is reached. Gas then flows from the bags **15** and **16** and the line **10** through the valve **12,** the output line **13** and the one way valve **30** through the inspiration port **27** to the patient. The diaphragm valve **31** closes across the expiration port when the pressure in the line **13** increases upon opening of the pressure responsive valve.

When the pressures in the input and output lines **10** and **13** respectively, are equal or substantially so, depending upon the precise characteristics of the valve **12,** the valve **12** closes, venting the ouput line **13** to atmosphere and thus closing the valve **30** and opening the diaphragm valve **31** to permit the patient to breathe out through the expiration port and the vent port. The cycle of operation of the automatic ventilator then recommences.

It should be noted that the automatic ventilator described is both pressure and volume limited. The pressure limit is set by adjustment of the pressure responsive valve **12.** The volume limit is set by the volume of the bag **15,** which is the minimum volume that the ventilator can deliver per cycle, plus the volume of the bag **16** at the moment the valve **12** opens. This latter volume depends on the setting of the flow control valve **20,** as the less it constricts flow to the bag **16** the greater is the volume of the bag **16** when the bag **15** is full and the valve **12** is triggered.

While the valve device **26** is not strictly necessary as the valve **12** is capable of exhausting the patient to the atmosphere, it is desired to have the device **26** to avoid inspiratory and expiratory flow in a common line to mitigate risk of cross infection between succesive patients, and to prevent the re-breathing of exhaled gases.

Modifications may be made to the embodiments described. Both bags **15** and **16** may be included in a common restraint chamber, or alternatively other volumetric chambers may be used, and other arrangements for the valve device **26** may be readily devised by those familiar with the art.

I claim:

1. An automatic ventilator for automatically supplying inspiration gas to a patient and for automatically permitting exhalation by a patient without any breathing effort by the patient, including:

a gas input line,

first compliant volume means,

transfer conduit means for continuously communicating said first compliant volume means directly with said input line at all times and without interruption during operation of the automatic ventilator,

a first constraint limiting the expansion of said first compliant volume means,

a gas output line,

a pressure responsive valve interconnecting said input line and said first compliant volume means with said output line, said pressure responsive valve being responsive to the gas pressure in the input

line to open to pass gas to the output line, and responsive to the gas pressure in the input and output lines, to close,

an inspiration port, and

a one way valve between the output line and said inspiration port to allow gas to flow from the output line to the inspiration port whereby a predetermined volume of gas at a predetermined pressure is periodically delivered automatically to the inspiration port, independent of breathing effort by the patient.

2. An automatic ventilator as claimed in claim **1**, in which said first compliant volume means comprises a first expandable bag.

3. An automatic ventilator as claimed in claim **2**, comprising a second compliant volume means which includes a second expandable bag and a second constraint associated therewith for limiting the expansion thereof and a flow control valve communicating the second compliant volume means with the input line.

4. An automatic ventilator as claimed in claim **1**, in which said one way valve and said inspiration port form part of a valve device which further includes an expiration port, an exhaust port and a diaphragm valve controlling the passage of gas between the expiration and exhaust ports, the diaphragm valve being connected to the output line such that the diaphragm valve is closed when the pressure responsive valve is open.

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