United States Patent

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[54] **DEVICE FOR ADMINISTERING A GAS TO A PATIENT**
2 Claims, 1 Drawing Fig.

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[50] **Field of Search** ..... 128/140, 141, 142, 145, 145.5—145.8

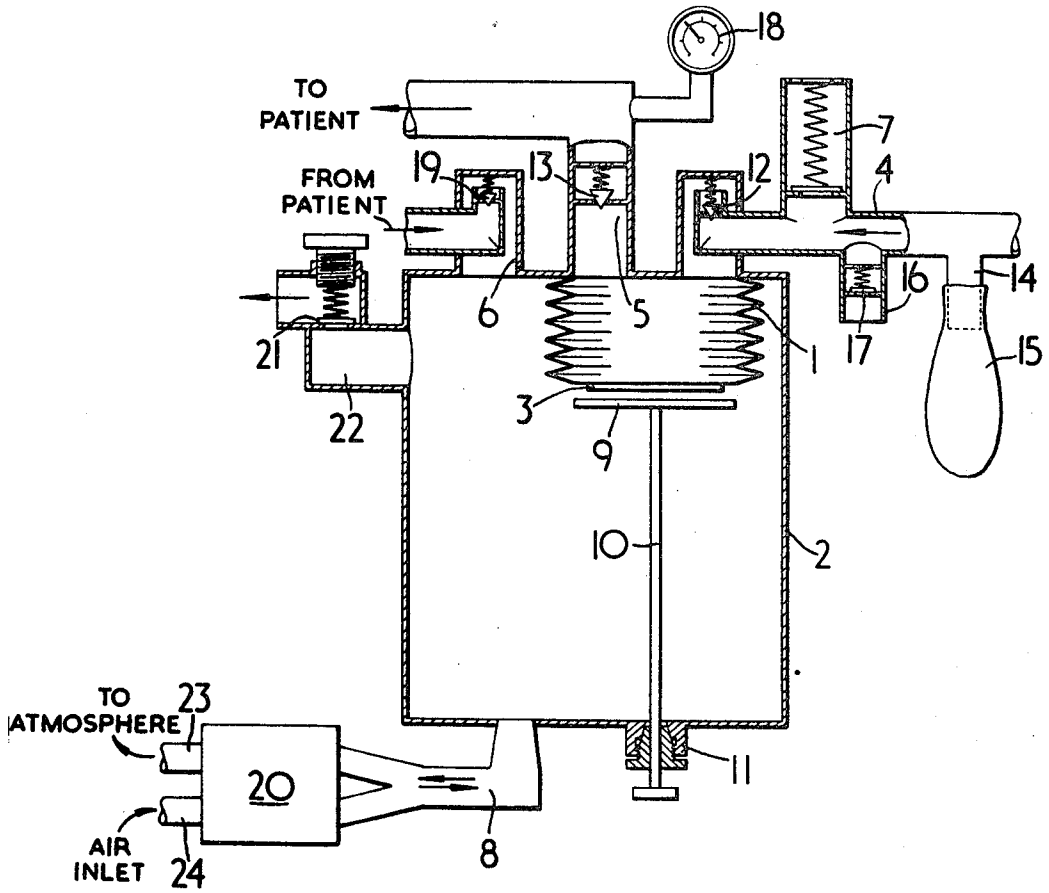
[56] **References Cited**

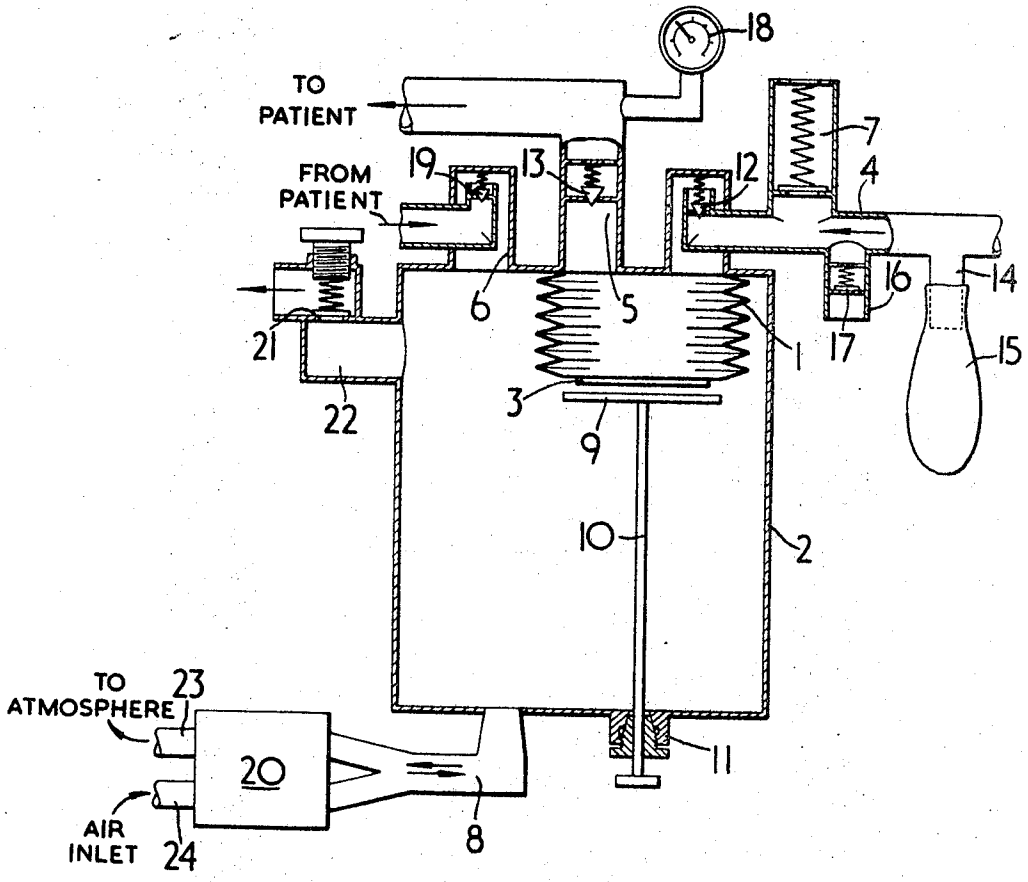
UNITED STATES PATENTS

2,918,917	12/1959	Emerson	128/145.6
2,969,789	1/1961	Morch	128/145.8
3,045,668	7/1962	Lee	128/145.5
3,068,857	12/1962	Black	128/145.8

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ABSTRACT: Device for administering a gas to a patient by deflating a self-inflatable bellows mounted in a chamber to which a pressurised fluid is alternately introduced and extracted to effect alternate deflation and reinflation of the bellows. The interior of the bellows is connected to a source of gas and, through a nonreturn valve, to the patient and the interior of the chamber, exteriorly of the bellows, is connected through a nonreturn valve to receive gas exhaled by the patient. When the bellows reinflates fresh gas is drawn into the bellows and exhaled gas is drawn from the patient into the chamber. When the bellows is deflated the fresh gas is expelled from the bellows to the patient.





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DEVICE FOR ADMINISTERING A GAS TO A PATIENT

The invention relates to a device for administering a gas to a patient. The term "gas" is used herein to mean air, oxygen, an anaesthetic gas or any mixture thereof. The device is particularly, but not exclusively concerned with the administering of a gas to young children and babies and especially to newly born babies.

According to the invention, the device comprises a chamber containing a deflatable and self reinflatable container, which is closed to the interior of the chamber and has a nonreturn inlet, arranged to communicate with a source of said gas and through which said gas will flow into the container during the reinflation of the latter, and a nonreturn outlet through which said gas will be inhaled by the patient during deflation of said container, the chamber being arranged to communicate with means capable of alternately introducing a fluid under pressure into the chamber and extracting said fluid from the chamber, thereby alternately deflating the container and causing it to reinflate, the chamber having a nonreturn inlet through which during the reinflation of the container, gas exhaled by the patient will be drawn into the chamber.

During normal operation of the device, the container is arranged to be deflated substantially completely, each time it is deflated and so by controlling the extent of reinflation, the volume of gas administered during each deflation of the container can be controlled. Therefore, according to a feature of the invention, an adjustable stop is positioned in the chamber to limit the extent of reinflation of the container, thereby to control the volume of gas inhaled by the patient during each deflation of the container. The stop may be calibrated to indicate the volume of gas which will be held in the container when the latter has been inflated to the full extent permitted by a setting of the stop.

Conveniently the container is a bellows supported at its upper end and weighted at its lower end, whereby on extraction of said fluid from the chamber, the bellows will be reinflated as a result of the falling of the weighted lower end. Alternatively the container, which is preferably a bellows, may be biased by spring means into an inflated condition.

By way of example, one form of device, in accordance with the invention, for administering a gas to a patient will now be described with reference to the accompanying drawing, which is a diagrammatic section through the device and means for operating it.

The device comprises a collapsible bellows **1** which is mounted upright in a chamber **2**. The bottom **3** of the bellows is weighted and is conveniently a metal plate, whereby when the bellows **1** is not collapsed, as will hereinafter be described, the bellows will open under the weight of the metal plate into a position such as that illustrated. Beneath the bottom of the bellows **1** there is an adjustable stop comprising a plate **9** mounted on a shaft **10** which is adjustable to vary the height of the plate **9** above the bottom of the chamber **2**. The shaft **10** passes through a combined gland and locking means **11** by which the stop can be locked in any desired position, the shaft **10** passing through the bottom wall of the chamber **2** in a fluid-tight manner.

The interior of the bellows **1** communicates with an inlet pipe **4** containing a nonreturn valve **12** and also with an outlet pipe **5** communicating via a nonreturn valve **13** with the patient's face mask or an oxygen tent in which the patient is placed. The inlet pipe **4** may communicate with atmosphere, where air is to be administered to the patient, or with a source of any other gas *e.g.*, oxygen, air and oxygen mixture, or an anaesthetic gas, and includes a branch pipe **14** to which a deformable bag **15** for manually introducing gas into the bellows **1** is attached. The inlet pipe also includes a safety air intake **16** controlled by a nonreturn valve **17** and leading from atmosphere to introduce air to the patient in the event of failure of the supply of gas. The inlet pipe **4** is also fitted with a safety valve **7** arranged to open to atmosphere at a predetermined pressure.

The chamber **2** communicates with an inlet pipe **6** including a nonreturn valve **19**. The pipe **6** is arranged to be connected to the patient's face mask or said tent and conveys gas exhaled by the patient to the chamber **2**. The chamber **2** also has a pipe connection **8** arranged to be attached to means **20** (hereinafter described) for introducing and extracting air or other fluid through the pipe **8**.

A pressure gauge **18** is connected in the circuit on the side adjacent the patient of either of the valves **13** (as shown) or **19** in the pipes **5** and **6** respectively. The chamber **2** has an adjustable pressure release valve **21** in a branch pipe **22** leading to atmosphere.

The operation of the device is as follows: on introducing air or other fluid under pressure through the pipe **8** (by the means **20**) into the chamber **2**, the bellows **1** will be collapsed and will discharge gas contained therein through the pipe **5** to the patient, the bellows **1** having previously been filled through the pipe **4**, during inflation of the bellows, with the gas to be administered. Exhaled gas is then drawn from the patient through the pipe **6** into the chamber **2** by removing air or said other fluid through the pipe **8** by the means **20**. This causes a reduction in pressure in the chamber **2** and the bellows **1** will reinflate under the weight of the bottom **3** of the bellows until the latter has engaged the stop plate **9**. The action of reinflating the bellows will cause air or said other fluid to be administered to be drawn in through the pipe **4**. During normal operation of the device, it is arranged that during each inspiration phase, the bellows **1** should deflate substantially completely. Therefore the volume of gas which is introduced to the patient by the bellows **1** each time it is deflated is determined by the extent to which the bellows **1** is permitted to reinflate, in accordance with the setting of the stop plate **9**. The shaft **10** may be calibrated to indicate the volume of gas contained in the bellows when it has reinflated to the full extent permitted by the stop.

The means **20** for introducing and extracting air or said other fluid into the chamber **2** may be of any convenient kind. It may be a controllable pump, a mechanically driven ventilator or a hand-operated collapsible bag, either of the self-inflatable kind or one which requires to be reinflated; in the latter case a source of pressurised air would also be required. By using any of these means the bellows **1** can be deflated and permitted to reinflate at any controlled rate. In the drawing, the means **20** for deflating the bellows **1** is shown diagrammatically and has an inlet **24** open to atmosphere so that on a pumping stroke of the generator, air is drawn through the inlet **24** and discharged through the pipe **8** into the chamber **2** and, on an extraction stroke, air and exhaled gas are removed from the chamber **2** through the pipe **8** and discharged through an outlet **23** to atmosphere. The means **20** may be the machine forming the subject of British Pat. No. 1,008,520. With such a machine, the pressure within the chamber **2** on the expiration phase may be reduced to a subatmospheric value. This will assist the reinflation of the bellows **1** and will also assist in the drawing of exhaled gas through the pipe **6** from the patient. The provision for reducing the pressure in the chamber **2** to a subatmospheric value during the expiration phase is of particular importance when using the device to administer gas to a newly born baby.

It is desirable that the anaesthetist or other user of the device should be able to observe the deflation and reinflation of the bellows **1**. Therefore the chamber **2** is constructed of a transparent material or is provided with a window through which the bellows **1** can be observed.

If desired, more than one bellows **1**, each having its individual inlet and outlet pipes **4** and **5** and independently adjustable stop plate **9** may be provided in a common chamber **2**. In this way two or more patients could be treated simultaneously by using only one means **20** common to all the bellows **1**.

I claim:

1. A device for administering a gas to a patient, said device comprising a chamber, a bellowslike container positioned within said chamber and supported thereby at the upper end of the said container and having a weighted lower end biasing said container to an inflated position, said container being

closed to the interior of said chamber, a nonreturn inlet leading into said container and connectable to a source of said gas, a nonreturn outlet leading from said container to the patient, through which outlet gas will be inhaled by the patient during deflation of said container, connecting means in said chamber for attachment to means for alternately introducing a fluid under pressure into the chamber and extracting fluid from the chamber, thereby alternately effecting deflation of the container and causing it to reinflate under the bias of its weighted lower end, wherein the improvement comprises a nonreturn inlet leading from the patient into said chamber externally of said container, whereby gas exhaled by the patient is drawn into the chamber externally of the container and then extracted from said chamber instead of being reinhaled by the patient.

2. A device as claimed in claim 1 including an adjustable stop positioned in said chamber to limit the extent of reinflation of said container, thereby to control the volume of gas inhaled by the patient during each deflation of said container.