

## [54] GAS EVACUATOR FOR BREATHING APPARATUS

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### [56] References Cited

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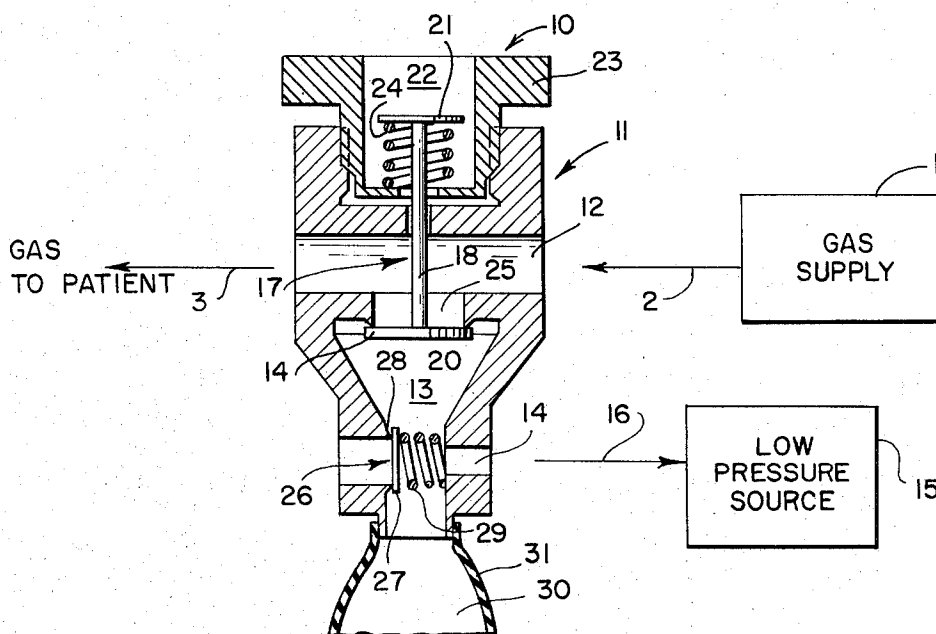
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### ABSTRACT

A gas evacuator for removing excess gas conveyed to a patient through a duct from a gas supply. The device includes a conduit connectable to the gas duct to convey the gas from one portion of the duct to another portion thereof. A chamber is provided with a drain line connectable to a low pressure source, such as a vacuum pump, for maintaining a reduced pressure in the chamber. A first valve is provided for venting excess gas from said conduit to said chamber in response to the differential pressure therebetween. A second valve is provided to introduce gas to said chamber from atmosphere in response to pressure in the chamber. The chamber is kept under low pressure by the vacuum pump. At a desired value of low pressure, the second valve opens to maintain that pressure in the chamber. If excess gas is present in the duct, the first valve opens venting that excess gas to the chamber until the excess gas is removed. The vented gas is removed through the drain line. In the event of a temporary increase in pressure in the chamber above the mentioned desired value, the second valve closes thus ensuring that the excess gas removed from the duct is not vented to atmosphere in the area adjacent the device.

7 Claims, 2 Drawing Figures



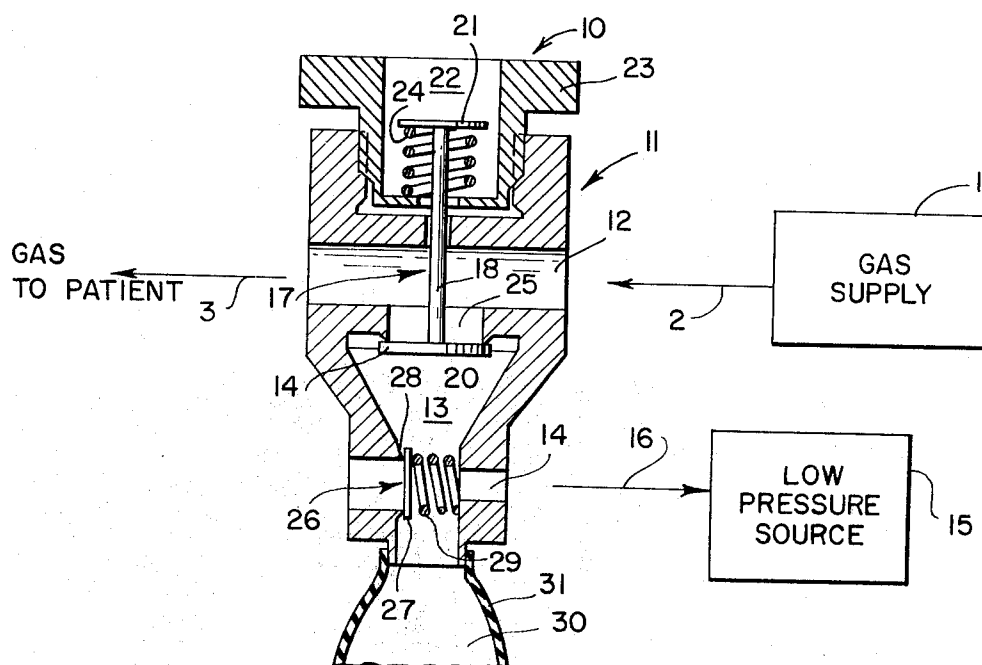


FIG. 1

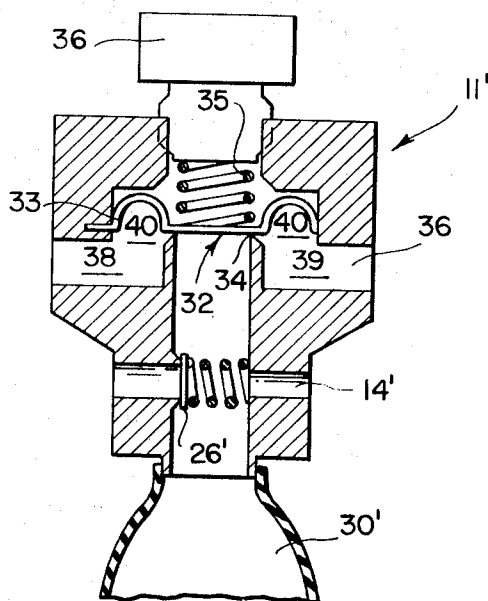


FIG. 2

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## GAS EVACUATOR FOR BREATHING APPARATUS

## BACKGROUND OF THE INVENTION

The present invention relates to apparatus for removing excess gas from a duct in which the gas is flowing. More particularly, the invention relates to a breathing apparatus such as a narcosis apparatus. Still more particularly, the invention relates to such apparatus wherein gas from a gas supply source is conveyed to a patient through a gas duct.

In known apparatus for breathing gas, such as described in Swedish Pat. No. 212,054, gas is introduced to a patient through a conduit from a gas supply source. The patient intermittently breathes the gas and, accordingly, the gas pressure in the gas duct will vary. The gas is supplied at a rate to permit free breathing. This usually results in temporary overpressures in the gas conduit and, in the past, this excess gas has been permitted to leak out in the room in the vicinity of the breathing apparatus. When narcotics are added to the gas, the said leakage causes considerable trouble to personnel present in the room.

It is an object of the present invention to provide a device which obviates the above-mentioned disadvantage in connection with gas breathing apparatus. It is a further object of the invention to provide such a device which is simple in construction.

## BRIEF SUMMARY OF THE INVENTION

The foregoing and other objects which will be apparent to those having ordinary skill in the art are achieved according to the present invention by providing gas evacuating apparatus for removing excess gas from a duct in which said gas is flowing comprising: a conduit connectable to said duct to convey said gas from one portion of said duct to another portion thereof; a chamber; a drain line from said chamber connectable to a low pressure source for maintaining a reduced pressure in said chamber; first valve means responsive to differential pressure between said conduit and said chamber for venting excess gas from said conduit to said chamber; second valve means responsive to pressure in said chamber for introducing gas from atmosphere into said chamber to maintain a desired pressure therein.

## DETAILED DESCRIPTION OF THE INVENTION

There follows a detailed description of a preferred embodiment of the invention, together with accompanying drawings. However, it is to be understood that the detailed description and accompanying drawings are provided solely for the purpose of illustrating a preferred embodiment and that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

FIG. 1 is a diagrammatic view, partially in section, of a gas evacuating apparatus according to the present invention; and

FIG. 2 is a diagrammatic elevation of an alternative device according to the present invention.

A gas breathing apparatus comprises a gas supply source 1, and a gas duct indicated generally as arrows 2 and 3 for conveying gas from the gas supply source to a patient. Gas breathing devices of this type are conventional and a typical example is described in Swedish Pat. No. 212,054. FIG. 1 illustrates a gas evacuating apparatus 10 for removing excess gas from duct 2, 3 in which the gas is flowing. The device comprises a housing 11 in which is provided a conduit 12 connectable to duct 2, 3 to convey gas from portion 2 of the duct to portion 3 of the duct. Housing 11 also defines a chamber 13. The chamber 13 is provided with a drain line 14 connected to a low pressure source 15 by a suitable conduit indicated generally as arrow 16 for maintaining a reduced pressure in the chamber. The chamber includes a first valve 17 for venting any excess gas from said conduit to said chamber in response to differential pressure between said conduit and said chamber. Valve 17 comprises a valve stem 18 carrying valve disc 19 which seats on valve seat 20. The opposite end of stem

18 is provided with a disc 21. Disc 21 is arranged in a recess 22 formed in a member 23 which is threaded into housing 11. A spring 24 acting between the bottom of recess 22 and disc 21 biases the valve disc 19 against valve seat 20 thus closing passageway 25 between conduit 12 and chamber 13. Member 10 is adjustably located in housing 11 by means of screw threads to adjust the compression of spring 24. A second valve 26 is provided for introducing gas from the atmosphere into the chamber in response to pressure therein. The valve includes a valve disc 27 seating on valve seat 28 under the influence of spring 29. The valve may include a conventional valve stem of the like not shown for purposes of simplicity.

The device also includes a reservoir 30 in gas communication with chamber 13. By providing the device with a reservoir which is in gas communication with the chamber and the drain line 14, it is possible to compensate for any gas volumes which may be introduced into chamber 13 and which cannot immediately be removed by the suction in the evacuating line due to the limited capacity of the vacuum pump. It is alternatively possible to provide the device with a large volume such that a reservoir is not required. However, the large dimensions of a device of this type involve several disadvantages such as increased cost and excessive noise. Accordingly, it is preferred to provide a reservoir member such as member 30. The reservoir may be a closed member in the form of a flexible bag 31 made of rubber of the like. Alternatively, the reservoir may comprise an elongated tube of considerable length having one end in gas communication with the chamber 13 and having the other end remote from the gas chamber open as described in Swedish Pat. No. 302,660.

Operation of the device is as follows. Low pressure source 15, such as a vacuum pump, is actuated to bring the pressure in chamber 13 to a desired value. Spring member 29 is adjusted such that valve 26 will open in the event that pressure in chamber 13 is reduced below this desired value. Spring member 24 is adjusted such that valve 17 will open in the event that the differential pressure between chamber 13 and conduit 12 exceeds a certain desired value. Thus, if there is excess gas in conduit 12, valve 17 is opened and the excess gas is vented to chamber 13. The gas vented into chamber 13 is removed therefrom through drain line 14. In the event that the introduction of gas from conduit 12 into chamber 13 causes an increase in the pressure of chamber 13 above the desired value mentioned above, valve 26 will close. Thus, excess gas removed from the conduit 12 will not be vented to atmosphere in the vicinity of the device. On the contrary, this excess gas is removed through drain line 14 via conduit 16 to a low pressure source 15 located remote from the device and from the patient. Thus, the disadvantage of venting excess gas in the vicinity of the gas evacuating device has been obviated by the present invention. It will be apparent that the problem solved by the present invention is rather complex in that while the excess gas is removed from conduit 12, only the excess gas is removed to ensure that the patient receives the proper gas volume and the proper gas mixture. In accordance with the present invention, the drain line 14 is provided with an evacuating line 16 and a suction valve 26 for the compensation of low pressure in the drain line and in chamber 13. The equipment thus operates with a certain underpressure or suction in the evacuating line which is vented in an area remote from the breathing apparatus and from the patient. The underpressure in the drain line must not become too low since, in such a case, valve 17 would open and the breathing gas would be removed from the breathing apparatus. The device has therefore been provided with suction valve 26 which compensates for any such underpressure in chamber 13.

An alternative device according to the present invention is shown in FIG. 2. The device is similar to that of FIG. 1 except in the configuration of conduit 12 and valve 17. In the device of FIG. 2, valve 17 is replaced by valve 32 comprising a diaphragm 33 biased against a valve seat 34 by means of spring 35 the compression of which is adjustable by means of member 36 threadably secured in housing 11'. The gas con-

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duit 37 described a tortuous path through the housing defined by openings 38, 39 therein connected by an annular passage 40 defined by diaphragm 33.

What is claimed is:

1. Gas evacuating apparatus for removing excess gas from a duct in which said gas is flowing comprising: a conduit connectable to said duct to convey said gas from one portion of said duct to another portion thereof; a chamber; a drain line from said chamber connectable to a low pressure source for maintaining a reduced pressure in said chamber; first valve means responsive to differential pressure between said conduit and said chamber for venting excess gas from said conduit to said chamber; second valve means responsive to pressure in said chamber for introducing gas from atmosphere into said chamber to maintain a desired pressure therein.

4

2. Apparatus according to claim 1 including a gas reservoir in gas communication with said chamber.

3. Apparatus according to claim 2 wherein said reservoir comprises a flexible container.

4. Apparatus according to claim 3 wherein said reservoir comprises an elongate tube open at an end remote from said chamber.

5. Apparatus according to claim 1 further including means to maintain a low pressure in said chamber.

6. Apparatus according to claim 1 including gas supply means for supplying a flow of gas through said duct.

7. Apparatus according to claim 1 including conduit means for conveying gas flowing through said duct to a patient.

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