

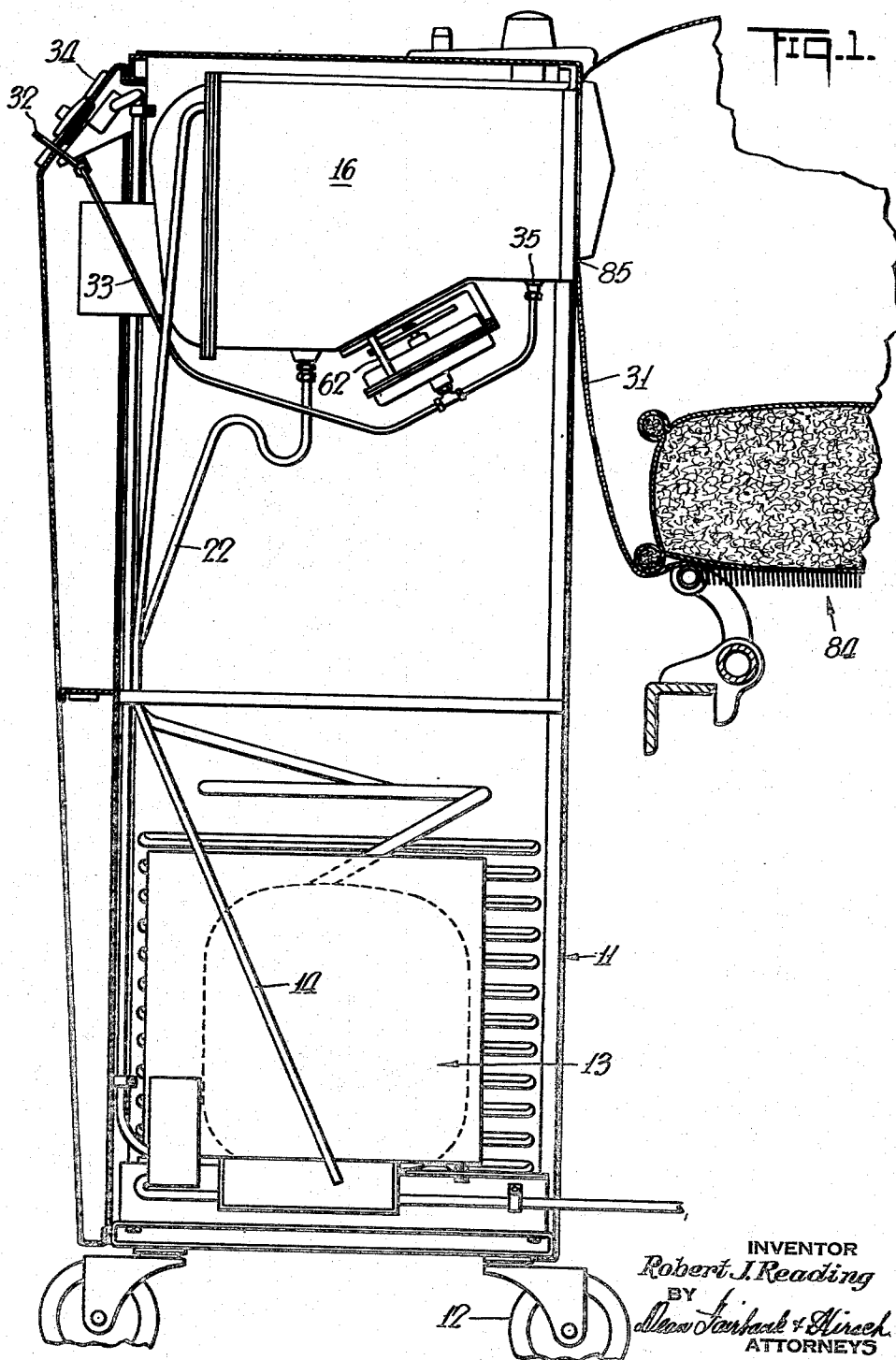
Aug. 31, 1954

R. J. READING
RESPIRATOR UNIT

2,687,741

Filed Dec. 28, 1951

2 Sheets-Sheet 1



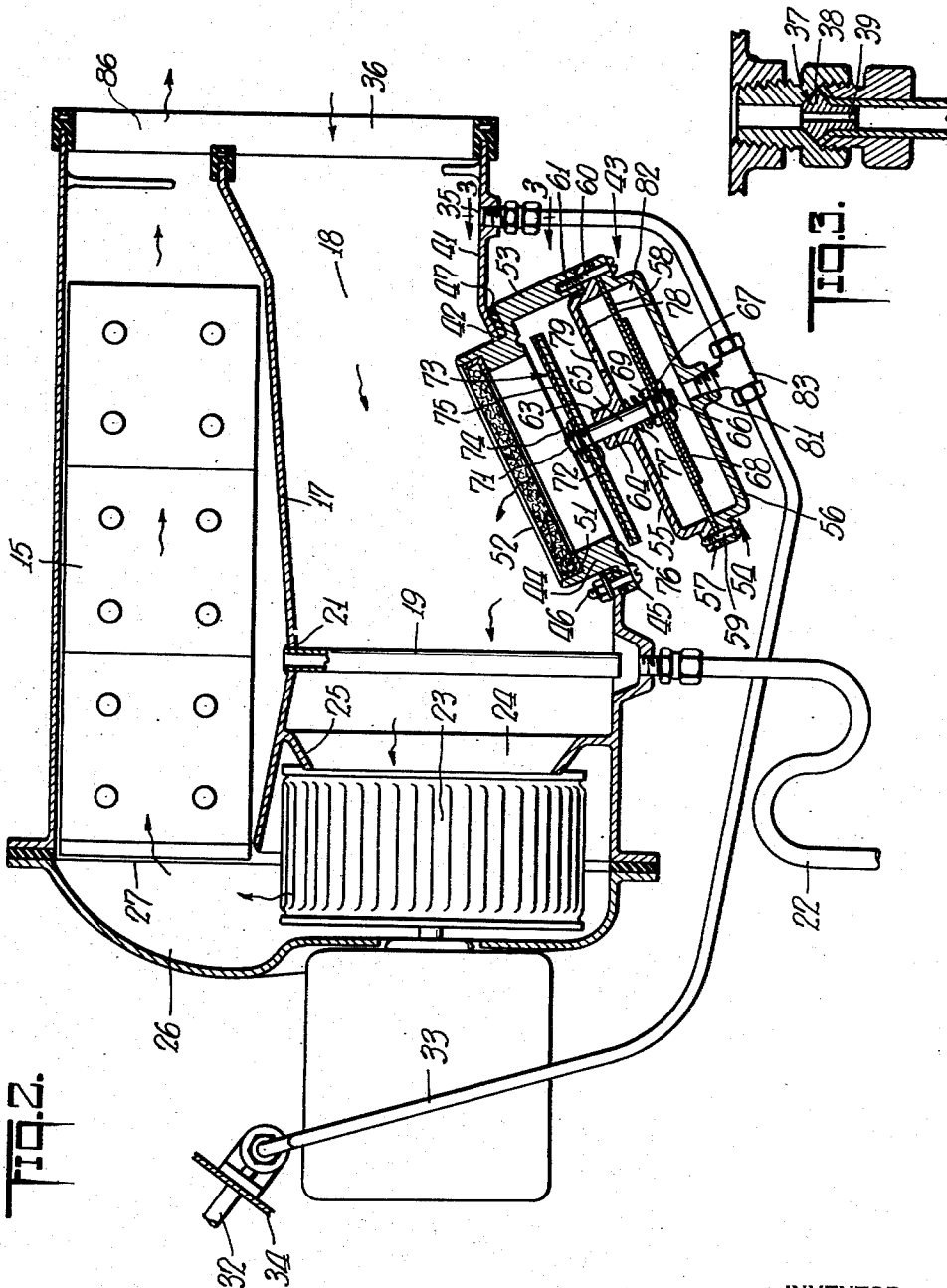
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2,687,741

RESPIRATOR UNIT

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5 Claims. (Cl. 137-113)

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This invention relates to the art of respirator units and more particularly to a respirator unit having means automatically to provide an air inlet on failure of the oxygen supply.

As conducive to an understanding of the invention, it is noted that where oxygen is fed from a source of supply through a respirator unit which recirculates the air from the conventional canopy generally used with such unit so that it may be mixed with oxygen and cooled before delivery into such canopy placed over a patient lying in bed, in the event the supply of oxygen should be cut off, only the stale air from the canopy would be recirculated and the patient would rebreathe such stale air with resultant building up of the carbon dioxide content in the canopy and consequent harm to the patient, which may be especially serious if the patient is in such weakened condition, that any excess carbon dioxide might be fatal.

Where, in order to cut off the oxygen supply and feed only air to the patient in the canopy, numerous valves must be closed and opened for this purpose, such procedure is cumbersome and time consuming.

It is accordingly among the objects of the invention to provide a respirator unit which is relatively simple in construction having but few parts that are not likely to become deranged and requires but a minimum of maintenance and which, upon failure of the oxygen supply or upon decrease in the flow of oxygen below a predetermined minimum will automatically provide an air supply for discharge into the canopy, thereby eliminating any possibility of the building up of a high carbon dioxide content in the canopy which might be harmful to the patient.

According to the invention, a pressure valve is interposed between the intake or suction chamber of the respirator unit and the outside air, said valve being controlled by the flow of oxygen from any suitable source into said intake chamber. The intake chamber desirably has a suction fan associated therewith to draw the exhaled or stale air from the canopy and discharge such air together with oxygen fed into the intake chamber through a suitable cooling chamber and thence through the outlet of the cooling chamber of the respirator unit which leads into the canopy.

More specifically an oxygen supply line is connected at its outlet end to said intake chamber and the pressure valve is connected to said supply line between the inlet and outlet ends thereof. The supply line desirably has a restricted portion between said valve and the oxygen outlet, so

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that upon flow of oxygen through said line a back pressure will be developed therein which will maintain the pressure valve in closed position. The valve is so set that upon decrease in the oxygen supply below a predetermined amount, the valve will open to provide communication between said intake chamber and the outside air.

In the accompanying drawings in which is shown one of various possible embodiments of the invention,

Fig. 1 is a vertical sectional view of the respirator unit showing the latter applied to a canopy.

Fig. 2 is a fragmentary vertical sectional view on a larger scale with parts broken away, showing the pressure valve, and

Fig. 3 is a sectional view taken along line 3-3 of Fig. 2.

Referring now to the drawings, the respirator unit shown in Fig. 1 desirably comprises an upright casing 11, which may be mounted on suitable casters 12 so that it may readily be moved about.

A refrigerator unit 13, desirably positioned in the lower portion of the casing 11 is connected by suitable conduits 14 to a cooling chamber 15 in the upper portion of the casing. As shown in Fig. 2, the cooling chamber 15 is desirably positioned in the upper portion of a housing 16, the lower portion of the latter, which is separated from the cooling chamber 15 by means of a substantially horizontal partition 17, defining an intake chamber 18. Desirably a discharge pipe 19 extends through a suitable opening 21 in partition 17 so that liquid forming in the cooling chamber by reason of condensation therein may flow back into the refrigerator unit through a suitable discharge line 22.

The intake chamber 18 desirably has a suction fan 23 preferably of the drum type, at the outlet end 24 thereof, the latter preferably having an annular flange 25 in juxtaposition to said suction fan for optimum suction action. The fan is so positioned that it will discharge upwardly into a chamber 26 which is in communication with the inlet end 27 of the cooling chamber 15, the lower portion of said chamber 15 being defined by a portion of partition 17 which extends over the fan 23 beyond the annular flange 25.

In order to supply oxygen to the canopy 31 shown in Fig. 1, the inlet end 32 of an oxygen supply line 33 may be positioned in the front face of the control panel 34 of the respirator unit and the outlet end 35 of said line 32 is positioned in the intake chamber 18 desirably near its inlet end 36. As shown in Figs. 2 and 3, a restrictor

member 37 is positioned in oxygen line 32 near the outlet end 35 thereof. Although the restrictor member 37 may be of any suitable type, in the embodiment herein shown it desirably comprises a plug 38 having a bore 39 of diameter substantially less than the diameter of the oxygen supply line so that upon flow of oxygen through said line into the intake chamber 18, a back pressure will be built up in said line.

The floor 41 of the intake chamber 18 desirably has an opening 42 therein of relatively large diameter which is controlled by means of a pressure valve 43. As shown in Fig. 2, valve 43 may comprise a casting having an annular portion 44 extending through said opening 42. The casting desirably has an annular flange 45 which is clamped against the periphery of opening 42 by means of bolts 46, a washer 47 intervening between said periphery and flange 45 to provide a dependable seal. Desirably the annular portion 44 has an internal annular shoulder 51 at its upper end on which may be seated a suitable filter 52.

Preferably formed integral with annular flange 45 is a depending bracket 53 which serves as a support for a pressure chamber 54. As shown in Fig. 2 chamber 54 desirably comprises a pair of substantially cup-shaped members 55 and 56 each having an outwardly extending annular flange 57 between which is interposed the periphery of a flexible diaphragm 58, which divides the pressure chamber into two portions, the cup-shaped members and the diaphragm being securely clamped together by means of screws 59 extending through said flanges. The chamber 54 is securely affixed to bracket 53 by means of a screw 60 which extends through flanges 57 into a threaded opening 61 in said bracket. Desirably, supporting rods 62 may also be interposed between the annular member 47 and the flanges 57 more securely to retain chamber 54 in fixed position.

As shown in Fig. 2, a cup-shaped member 55 desirably has an external axial hub 63 with a bore 64 through which extends a valve stem 65. The inner end 66 of the valve stem 65 desirably extends through axially aligned openings 67 in diaphragm 58 and in a reinforcing disc 68 affixed to said diaphragm, said inner end 66 being rigidly affixed to the diaphragm 58 and to the disc 68 as by means of nuts 69 screwed on the threaded end thereof. The outer end 71 of said valve stem 65 desirably has an annular shoulder 72 on which is seated a valve head 73, the latter being retained on shoulder 72 by nut 74. The valve head 73 desirably comprises a circular disc having a resilient facing 75 preferably of rubber, on its outer surface, which, when moved into engagement with the adjacent periphery 76 of the annular member 44 which serves as a valve seat, will seal the opening 42 into the intake chamber 18.

Desirably the valve head is normally retained in valve open position as shown in Fig. 2 by means of a coil spring 77 encompassing the portion of the valve stem 65 in the chamber 54 between the diaphragm 69 and the cup-shaped member 55, the wall 78 of the latter having an opening 79 to vent the air therein.

In order to actuate the valve stem 65 to move the valve head 73 to close opening 42, the cup-shaped member 55 desirably has an axial bore 81 leading into the lower portion 82 of chamber 54, said bore 81 being threaded to receive a suitable fitting, preferably a T fitting 83 which

is interposed in the oxygen supply line 33 between the inlet and outlet ends 32 and 35 thereof.

In the operation of the respirator unit, it is generally positioned adjacent a bed 84 as shown in Fig. 1 and the oxygen canopy 31 which encompasses the bed, has its inlet 85 affixed to the outlet and inlet ports 86, 36 of the respirator unit in conventional manner. The oxygen supply connected to inlet 32 is then turned on so that oxygen will flow through inlet 32, line 33, through restrictor member 37 and outlet 35, into the intake chamber 18. The refrigerator unit 13 and the suction fan 23 are then started.

By reason of the back pressure created in oxygen line 33, due to restrictor member 37, a pressure will be created in the lower portion of pressure chamber 54 which is in communication with line 33 through fitting 83. The pressure is such as to move the diaphragm 58 upwardly against the tension of coil spring 77 so that the valve head 73 will move against its seat 76 to seal opening 42, the vent 79 in wall 78 of member 55 permitting escape of air from the upper portion of chamber 54 so as not to impede the free movement of diaphragm 58.

By reason of the rotation of suction fan 23, the exhaled air of the patient will be drawn through inlet 36 of the intake chamber. This exhaled air together with the oxygen forced into the intake chamber 18 through inlet 35 will be drawn by the suction fan 23 into chamber 26 and thence through cooling chamber 15 to be discharged through outlet 86 into the canopy 31. As a result, there will be a continuous circulation of cooled oxygen through the canopy.

In the event that the supply of oxygen should be exhausted or the pressure of the oxygen supply should fall below the predetermined minimum amount which is required to deliver the necessary amount of oxygen to the patient, the pressure in the oxygen supply line 33 will also fall. Consequently, the pressure developed in the lower portion of chamber 54 will be insufficient to overcome the tension of coil spring 77 and the latter will move the diaphragm downwardly, thereby also moving the valve head 73 off its seat 76 to provide communication through opening 42 between the interior of the intake chamber 18 and the outside air.

As a result, the suction fan 23 in addition to sucking the exhaled air from the canopy through inlet 36 will also suck air from the outside through opening 42. It is apparent, therefore that in the event of failure of the oxygen supply, a supply of fresh air will immediately be made available and will be cooled and delivered to the patient. Consequently, there is no likelihood of the building up of carbon dioxide in the oxygen canopy which might have serious if not fatal results to the patient.

With the equipment above described, if the attendant should desire to cut off the oxygen supply and feed only cooled fresh air to the patient, he need merely turn off the oxygen supply valve. As a result, due to the decrease in pressure in the oxygen supply line, the pressure valve 43 will open as previously described.

With the relatively simple pressure valve 43 above described and restrictor member 37 in the oxygen supply line 33, complete and automatic protection is afforded to the patient in the event of failure of the oxygen supply regardless of whether or not an attendant is present.

As many changes could be made in the above

construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A respirator unit comprising an intake chamber having an inlet and an outlet and having an opening therein providing communication with the outside air, a discharge chamber having an inlet in communication with the outlet of the said intake chamber and an outlet, a suction fan in said unit positioned between the outlet of said intake chamber and the inlet of said discharge chamber to force gas from said intake chamber into said discharge chamber, an oxygen supply line having an inlet end and outlet end leading into said intake chamber, a pressure valve controlling said opening in said intake chamber, said valve having a valve head normally spaced from said opening, means connecting said oxygen supply line between its ends to said pressure valve to control the latter, and means in said line to create a back pressure therein upon flow of oxygen therethrough to actuate said pressure valve to move said valve head to seal said opening.

2. The combination set forth in claim 1 in which the means in said line to create a back pressure therein comprises a restrictor member having a bore diameter smaller than the bore diameter of said oxygen line.

3. The combination set forth in claim 1 in which said valve comprises a pressure chamber rigidly supported with respect to said intake chamber and having a flexible diaphragm therein dividing said chamber into two portions, a valve stem affixed at one end to said diaphragm extends through one portion of said chamber and mounts said valve head at its free end, and the other portion of said chamber has an inlet to which said oxygen supply line is connected.

4. A respirator unit comprising an intake chamber having an inlet and an outlet and having an opening in the bottom wall thereof, providing communication with the outside air, a discharge chamber having an inlet in communication with the outlet of said intake chamber and an outlet, a suction fan in said unit positioned between the outlet of said intake chamber and the inlet of said discharge chamber to force gas from said intake chamber into said discharge chamber, an oxygen supply line having an inlet and outlet end, said outlet end leading into said

intake chamber, an annular member affixed in said opening in said intake chamber and defining a valve seat, a pressure chamber suspended from said annular member, said chamber comprising a pair of cup-shaped members each having an outwardly extending annular flange, a flexible diaphragm positioned between said flanges, means securely clamping said flanges and said diaphragm together, said diaphragm dividing said chamber into two portions, a valve stem affixed at one end to said diaphragm and extending through one of said portions and one of said cup-shaped members, a valve head affixed at the outer end of said stem, resilient means normally spacing said valve head from said seat, means connecting said oxygen supply line between its ends to the other cup-shaped member, and providing a passage into the other of said portions of said chamber, and means in said line to create a back pressure therein upon flow of oxygen therethrough to deform said diaphragm and move said valve head onto said seat to close said opening.

5. A respirator unit comprising an intake chamber having an inlet and an outlet, a discharge chamber having an inlet in communication with the outlet of said intake chamber and an outlet, a suction fan adjacent the outlet of said intake chamber and the inlet of said discharge chamber to force the contents of said intake chamber through its outlet into the inlet of said discharge chamber for discharge from the outlet end thereof, an oxygen supply line having an inlet and outlet end, said outlet end leading into said intake chamber near the inlet end thereof, said inlet chamber having an opening therein providing communication to the outside air, a pressure valve controlling said opening and normally retaining the latter open, means connecting said oxygen supply line between its inlet and outlet ends to said pressure valve, and means in said line to create a back pressure therein upon flow of oxygen therethrough to actuate said pressure valve to close said opening.

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