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P. W. FITT
BREATHING APPARATUS
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2,948,292

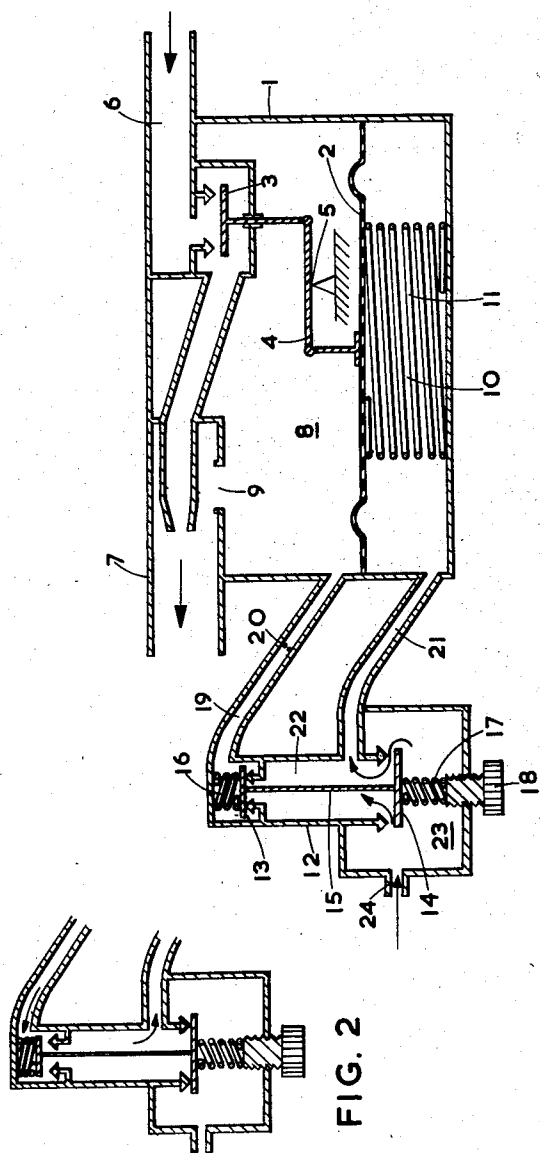


FIG. 1

FIG. 2

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BREATHING APPARATUS

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3 Claims. (Cl. 137—64)

This invention relates to respiratory devices and more particularly to demand oxygen regulators of a type designed for high altitude flight.

In demand oxygen regulators used in flights of over 10,000 ft., in order to supplement the oxygen supply in these rarefied regions, respiratory responsive members are often employed to control the quantity of oxygen delivered to the mask. The actuation of these responsive members will open and close a demand or inlet valve, permitting oxygen to flow into the mask from a pressure source. Up to 40,000 ft. the oxygen or a mixture of oxygen and air is generally delivered at a slight positive pressure to prevent leakage of ambient atmosphere into the mask so that the oxygen delivered by the regulator does not become diluted. At altitudes of 40,000 ft. or over, to prevent anoxaemia, the oxygen delivered at the mask must have sufficient pressure behind it to maintain oxygen tension in the lungs and to enable it to be absorbed by the blood to maintain an acceptable equilibrium level.

Regulators capable of providing these positive or "safety pressures" are generally provided with means whereby a positive pressure is exerted on the respiratory responsive member controlling the demand valve to enable oxygen to be delivered to the wearer at sufficient pressure to maintain lung tension and to prevent air intake due to mask leakage. Such means generally include systems employing aneroids, springs and levers. A disadvantage of this arrangement is that very large loads are experienced by the respiratory responsive member or diaphragm and other working parts when the regulator is working under high outlet pressure conditions.

It is accordingly an object of the present invention to provide a regulator in which such excessive loads are substantially reduced.

Another object of the present invention is to provide a regulator which at extreme high altitudes functions in a way which is comparable to normal function at low altitudes.

A further object of the present invention is to provide a regulator operating on a principle which can be applied to any regulator able to give such positive pressures, and is such that instead of the very large loads experienced by the diaphragm and levers when working under high outlet pressure conditions, works in a way which is comparable to normal function.

The invention consists in a regulator having a respiratory responsive member with one surface subjected to breathing pressure and the other alternatively to ambient pressure or to pressure greater than ambient pressure.

The invention also consists in a regulator as in the preceding paragraph wherein valve means are provided to vary the pressure on the side of the responsive member remote from a breathing chamber, the valve means including a pair of operatively coupled valves.

The invention also consists in a regulator substantially as hereinafter described with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic drawing of a regulator embodying the present invention in one working position.

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Figure 2 is a diagrammatic drawing of the present invention in an alternative working position.

In carrying the invention into effect according to one convenient form by way of example, an oxygen demand regulator generally indicated at 1 is provided having a respiratory responsive member or diaphragm 2 which operates an inlet or demand valve 3 in response to inhalation and exhalation. Diaphragm 2 controls demand valve 3 through a crank and lever arrangement 4, operating about a pivot point 5. Demand valve 3 controls the admission of oxygen from suitable pressure source by way of inlet 6 to outlet 7 which is connected to the wearer's mask (not shown), outlet 7 being in communication with a breathing chamber 8 through communicating port 9. A closed chamber 10 is provided opposite the breathing chamber side of diaphragm 2. Within chamber 10 a spring 11 provides a light loading on diaphragm 2 in such a manner to ensure that the pressure in breathing chamber 8 is maintained slightly higher than that in chamber 10.

At some convenient point which may be remote from regulator 1, a valve body generally indicated at 12 is provided. Body 12 houses a pair of valves 13 and 14 attached to a common spindle 15. Valve 13 is spring loaded by means of a spring 16 and valve 14 likewise by a spring 17. A screwed control knob 18 is provided to control the opening and closing of valves 13 and 14. A duct 19 with a reduced orifice 20 provides communication with breathing chamber 8 and valve body 12 by way of valve 13. A further duct 21 provides unrestricted communication between chamber 10 and a chamber 22 between valves 13 and 14 in valve body 12. Chamber 22 is adjacent a further chamber 23 which is in communication with the ambient atmosphere by way of duct 24. Thus, if valve 14 is open, chambers 22 and 23 are in communication with each other and the ambient atmosphere, at altitudes up to say 10,000 ft.

In operation, at altitudes up to say 10,000 ft., control knob 18 is adjusted so that valve 13 is in the closed position and valve 14 open (Fig. 1). Chamber 10 is then in communication with ambient surroundings by way of duct 21, chambers 22 and 23 and duct 24. The regulator then delivers oxygen to the mask at a pressure related directly to that of ambient pressure in response to movement of diaphragm 2.

At altitudes where a slight safety pressure is automatically obtained from the regulator, or at any altitude where manual "safety" pressure is selected, and when for the aforementioned reasons greater pressures are required to be delivered by the regulator, control knob 18 may be so adjusted as to close valve 14 and open valve 13 (Fig. 2). Chambers 8 and 10 are then placed in communication with one another and due to the slightly higher pressure in chamber 8 relative to that in chamber 10 oxygen flows through reduced orifice 20 in duct 19 to chamber 10 via chamber 22 and duct 21. Pressure in chamber 10 then builds up tending to equalise with the pressure in chamber 8, thus diaphragm 2 is subjected to an increased surface pressure and the regulator operates as though the ambient pressure were increased accordingly, until excess pressure in chamber 10 is released by the opening of valve 14 against spring 17, the opening pressure being determined by the spring loading imposed. The pressure in chamber 8 remains substantially constant thereafter due to the restricting effect of reduced orifice 20 and the constant pressure controlled in chamber 10.

I claim as my invention:

1. A demand regulator for breathable gas having a respiratory responsive member controlling the demand valve thereof, said responsive member having one surface subjected to breathing pressure and the other surface subjected alternatively to ambient pressure or to

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pressure greater than ambient, means providing such alternative pressure comprising first and second operatively coupled valves, said first valve controlling communication between one side of said responsive member and the other, said second valve controlling communication between the side of said responsive member remote from said breathing pressure and ambient atmosphere.

2. A demand regulator for breathable gas as claimed in claim 1 wherein as one of said operatively coupled valves is moved in a closing direction the other of said operatively coupled valves is moved in an opening direction.

3. A demand regulator for breathable gas having a respiratory responsive member controlling the demand valve thereof, said responsive member having one surface subjected to breathing pressure and the other sur-

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face alternatively to ambient pressure or to pressure greater than ambient, means providing such alternative pressure comprising first and second operatively coupled valves, said first valve controlling communication between one side of said responsive member and the other, said second valve controlling communication between the side of said responsive member remote from said breathing pressure and ambient atmosphere and adapted to relieve excessive pressure on the side of said responsive member remote from said breathing pressure.

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