June 29, 1943. W. A. REICHEL 2,322,883

OXYGEN REGULATOR

Filed Oct. 7, 1939

Fig. 1.

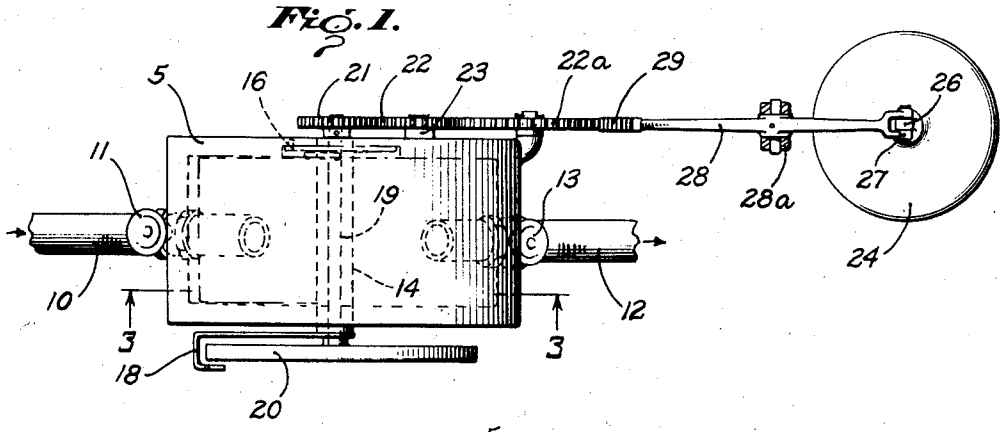
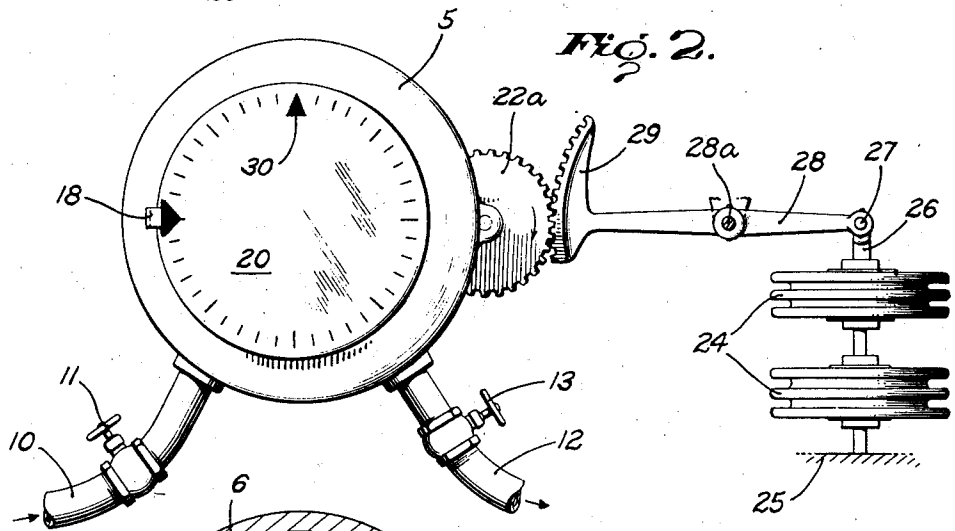


Fig. 2.



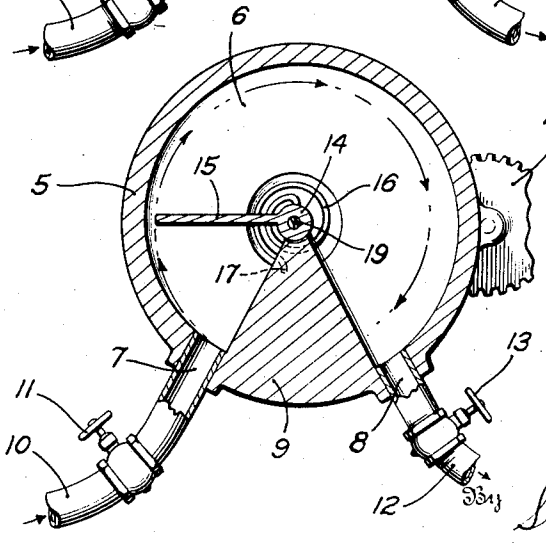


Fig. 3.

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OXYGEN REGULATOR

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3 Claims. (Cl. 137—153)

This invention relates to fluid regulators and more particularly to oxygen regulators for use in aviation for supplying oxygen to a mask worn by the pilot or to the cabin of an airplane.

A problem confronted in aeronautics during stratosphere flights is the lack of oxygen at the extremely high altitudes. This deficiency must be compensated for, and it is obvious that the rate at which the oxygen is supplied to the pilot or to the cabin of the plane should be varied in accordance with changes in altitude. The rate of change should be such that the regulator will pass greater amounts of oxygen with progressive increase in altitude because the higher the altitude the rarer is the air and, therefore, less natural oxygen is available. This consideration imports another factor, namely, when the pilot uses an oxygen mask, it is essential that he obtain more oxygen with an increase in altitude so as to counteract certain physiological effects that occur with change in altitude. The regulation of the varying supply constitutes an important factor for the reason that a deficient supply or an excessive supply at a given altitude will have injurious effects upon the pilot or the occupants of the cabin.

One of the objects of the present invention is to provide a novel oxygen regulator having means responding to changing altitudes for indicating the proper amount of oxygen needed at the particular altitude.

A further object of the invention is to provide an oxygen regulator comprising a novel combination including means responsive to a change in a condition of the atmosphere so as to indicate the extent of the change, and means defining a spirally adjustable path for the oxygen adapted to be operated so as to vary the rate of supply of oxygen in accordance with the indication of the change in the atmospheric conditions.

Another object of the invention is to provide a novel combination comprising an oxygen regulator which is simple in construction and accurate in operation.

The above and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawing wherein one embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawing is for purposes of illustration and description only, and is not to be construed as defining the limits of the invention, reference being had for this purpose to the appended claims.

In the drawing, wherein like reference characters refer to like parts throughout the several views:

Fig. 1 is a top view illustrating one embodiment of the invention;

Fig. 2 is a front view of the device illustrated in Fig. 1; and

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1.

Referring now more particularly to the drawing, the present invention is shown as embodying a generally cylindrical enclosure or casing 5 having a spirally shaped or cross-sectionally eccentric interior 6, an inlet 7 and an outlet 8 disposed on opposite sides of a sector-like wall portion 9 formed intergrally with and dividing the casing.

A supply pipe 10 is provided with a valve 11 adapted to be controlled manually which communicates with an oxygen supply tank (not shown) on one side and with the inlet 7 of casing 5 on the other side. A second pipe 12 is provided with a manually controlled valve 13 which communicates with the outlet 8 of casing 5 on one side and with the cabin of the airplane or the mask of a pilot on the other side so as to supply oxygen to the latter.

A hollow shaft 14 is mounted for rotation within the casing 5 in any suitable manner and has a vane 15 attached thereto or formed integrally therewith. A spiral coil spring 16 is secured at one end to a stationary portion of the casing, as at 17, and is secured at its other end to the hollow shaft 14 and serves to yieldably urge the vane 15 in a counterclockwise or to a closed position. As the vane travels in a clockwise direction against the tension of the spring 16, the outer end of said vane together with the interior of casing 6 define a spirally or progressively increasing passage, as clearly shown in Fig. 3. The movement of the vane 15 is produced by the pressure of the oxygen communicated by pipe 10 to inlet 7 and controlled by means of the valve 11.

An indicator or pointer 18 is secured to an extending portion of the hollow shaft 14 outside of the casing 5 (Fig. 1) and is actuated upon rotation of the shaft to indicate the position of the vane 15 within the valve casing. The tension of the spiral spring 16 and the arrangement of the vane 15, shaft 14, and indicator 18 are such as to indicate at the various positions of the vane 15, the amount of oxygen passing through the valve.

A shaft 19 is rotatably mounted within the hol-

low shaft 14 and has an extension at its one end carrying a dial 20 (Figs. 1 and 2). The other end of the shaft 19 extends from the opposite side of the casing and has splined thereto a gear member 21 meshing with another gear 22 carried by a support 23 provided on the outside of the casing 5.

Means are now provided for actuating the dial 20 in accordance with changes in barometric pressure or altitude and, in the embodiment illustrated, said means comprise an aneroid device in the form of expansible and contractible bellows 24 mounted upon a fixed support 25. The bellows are provided at the free end thereof with an upwardly extending link 26 pivotally connected at 27 to one end of an arm 28 pivoted at 28a. The arm 28 is provided at its other end with a gear sector 29 which meshes with an intermediate gear 22a, the latter, in turn, meshing with the gear 22 to drive gear 21 and shaft 19.

The dial 20 is provided with an index or indicator 30 thereon, which is moved in a clockwise or counterclockwise direction with the dial in accordance with the expansion or contraction of the bellows 24.

The end of the indicator 18 is bent outwardly and over the dial 20 so as to lie in a plane parallel to said dial 20 in front thereof and is adapted to move about the outward portion of the dial.

In operation, as the aircraft upon which the device is utilized gains altitude, the bellows 24 will expand due to the decrease in the pressure of the atmosphere. With such expansion of the bellows the link 26 is moved upwardly, carrying the arm 28 upwardly about pivot point 28a and sector gear 29 downwardly so as to operate the gear train comprising gears 22a, 23, 22 and 21. Gear 21 consequently rotates shaft 14 therewith and thus dial 20 and index 30 move in a clockwise direction, while the indicator 18 will, at this instant, remain stationary, thus indicating that vane 15 is yieldably held in a closed position since no oxygen has been admitted by operating valve 11.

At this point, since the two indicators are widely diverging from each other, it will be apparent that oxygen should be supplied to the pilot or to the cabin and, therefore, valve 11 is opened manually, whereupon oxygen will flow through inlet 7, moving vane 15 and indicator 18 against the tension of spring 16 in a clockwise direction. If the valve has not been operated sufficiently, an unbalanced condition will exist between the two indicators, as illustrated in Fig. 2, and thus indicate to the pilot that more oxygen is needed. Valve 11 will then be operated further until both indicators will coincide, thereby indicating that a correct amount of oxygen is being supplied for the particular altitude attained.

With a decrease in altitude, a reverse operation is effected. The bellows 24 begins to contract due to increase in pressure and will accordingly move indicator 30 in a counterclockwise direction by way of the multiple gearing illustrated in Fig. 1. If the position of valve 11 has not been changed, the indicator 18 will remain at its last position while the indicator 30 has moved away therefrom. This immediately indicates to the pilot that too much oxygen is being supplied at the lower altitude and he will proceed to close valve 11 manually to decrease the flow of oxygen, and spring 16 will operate to cause the vane 15 to move in a counterclockwise direction, thereby decreasing the opening formed between the end of vane 15 of the interior of casing 5 to diminish the supply of oxygen in the outlet 8.

There are thus provided novel means whereby the amount of oxygen supplied to a consuming device is quickly and accurately regulated in accordance with altitude changes so as to maintain the quantity of oxygen at the proper and desired amount.

While the device has been described in connection with the control of oxygen it is to be expressly understood that the control of any gas may be accomplished in this manner. Further, the device may be influenced by any pressures extraneous to the apparatus itself and arising in a static medium, and the use thereof is not necessarily limited to the atmospheric control but may be used wherever distribution of a flow medium is to be controlled by variations in pressure in another and static medium in which the apparatus is immersed and stationary or independent of the particular medium distributed and controlled.

Although but a single embodiment of the invention has been illustrated and described, further changes and modifications in form, materials, and relative arrangement of parts, which will now appear to those skilled in the art, may be made without departing from the scope and spirit of the invention. Reference is, therefore, to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A gas regulator comprising, in combination, a valve having a casing, a hollow shaft rotatably mounted in said casing, a vane member carried by said shaft to vary the output of said casing, an indicator rotatable with said hollow shaft, pressure responsive means, a dial having an index and actuated by said pressure responsive means to indicate said pressure, and manually operated means for supplying said gas to said chamber to actuate said vane member until said indicator is in a position coincident with said index.

2. A gas regulator comprising, in combination, a valve having a casing, a hollow shaft rotatably mounted in said casing, a vane member carried by said hollow shaft to vary the output of said casing, an indicator carried by said hollow shaft, pressure responsive means, a dial provided with an index, means comprising a shaft rotatably mounted within said hollow shaft for connecting said pressure responsive means and said dial, and means for supplying said gas to said casing to operate said valve so as to bring the indicator into coincidence with the index.

3. In a gas regulator, a valve casing having an inlet and an outlet, a rotatable vane controlling the volumn of gas flowing from said outlet, a hollow shaft in said casing carrying said vane, means responsive to pressure variation, indicating means, means within said hollow shaft for connecting said indicating means with said pressure responsive means, manually controlled means to supply gas to said casing in accordance with said pressure variation, and means carried by said hollow shaft for indicating that a predetermined amount of said gas is being supplied at any given pressure change.

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