May 17, 1938. C. E. P. GOURDOU 2,117,952

INHALING EQUIPMENT

Filed Dec. 19, 1935

Fig.1.

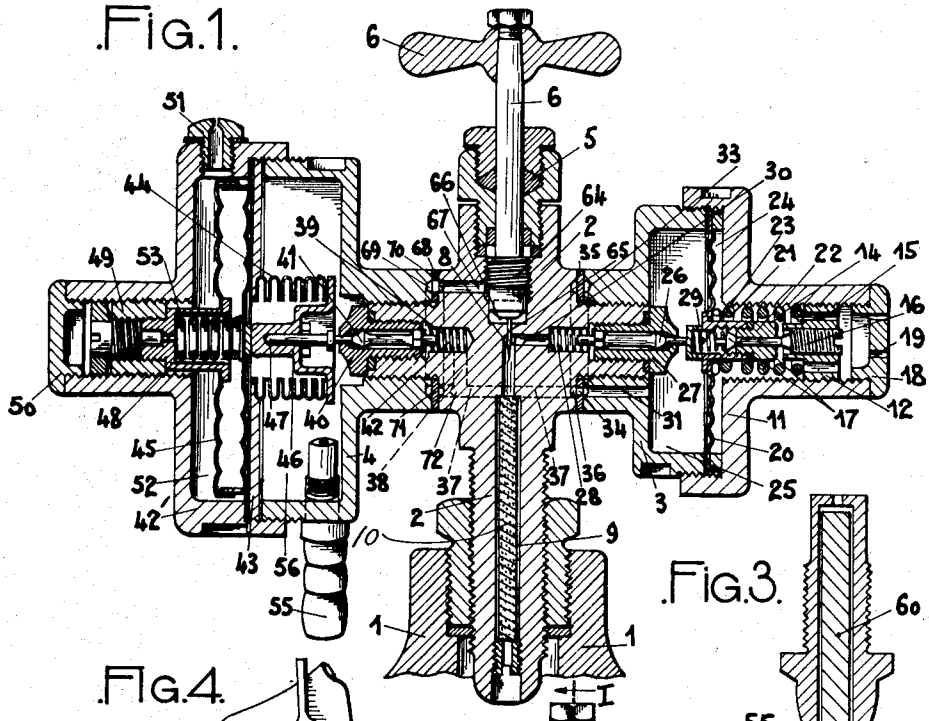


Fig.3.

Fig.4.

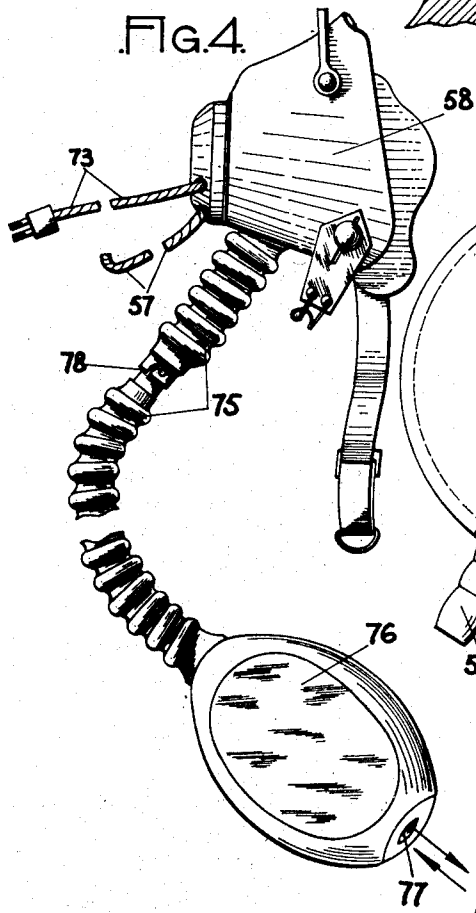
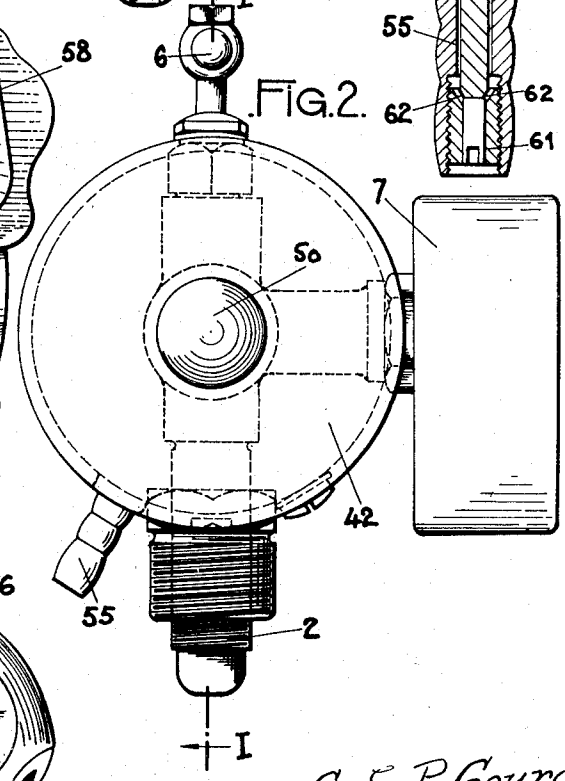


Fig.2.



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INHALING EQUIPMENT

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1 Claim. (Cl. 128—202)

This invention relates to an inhaling equipment utilizable generally speaking but more particularly on board airplanes for allowing, at a high altitude, to supply oxygen particularly to a breathing mask worn by the pilot.

In known equipments, utilized for the purpose indicated and comprising an inhaler constituted, on the one hand, by a preliminary pressure reducer communicating with a cylinder containing oxygen under a high pressure and, on the other hand, by a distributor fed by the pressure reducer and communicating with the breathing mask, it has been proposed, particularly as indicated in the French Patent No. 677,285, to place these two apparatuses side by side on a member fitted on the oxygen cylinder.

In devices of this type, use is made of tubes for putting in communication, on the one hand, the pressure reducer with the oxygen cylinder and more particularly the member fitted on the latter and, on the other hand, for putting in communication said pressure reducer with the distributor. Owing to the vibrations taking place on board airplanes, the tubes frequently break, this constituting a serious inconvenience.

A first object of the invention is to provide an inhaling equipment in which said communication tubes are dispensed with and replaced by channels or conduits provided in the member fitted on the oxygen cylinder, the pressure reducer and distributor being directly fitted on said member for constituting a single unit.

A second object of the invention is to provide an olive-shaped member, which is rigid with the distributor and connected to the breathing mask by a tube, with an inner rod made of a metal having a lower coefficient of expansion than the metal of the olive-shaped member, so as to automatically modify the section of the passageway for the oxygen between said olive-shaped member and the tube relatively to the atmospheric temperature, in order to obtain a sufficient supply of oxygen.

A third object of the invention is to form the parts or members of the pressure reducer and distributor of metals having different coefficients of expansion so as to preserve in said apparatus a supply substantially independent of the atmospheric temperature.

A fourth object of the invention consists in combining with the inhaling equipment a forced flow cock, fitted on the member secured on the oxygen cylinder and allowing, in case of unsatisfactory action of the pressure reducer, to feed the distributor directly from the oxygen cylinder through the medium of channels directly provided in the said member and in the body of the distributor.

A fifth object of the invention consists in providing the breathing tube of the mask with a receptacle communicating with said tube and with the atmosphere, the inlet end of the tube supplying oxygen to the mask being surrounded by heating means.

Other objects and features of the invention will appear from the following description with reference to the accompanying drawing, given by way of example only and in which:

Fig. 1 is a general elevation, with axial longitudinal section, made according to line I—I of Fig. 2, showing a form of construction of a unit constituted by a pressure reducer, a distributor and an intermediate member carrying these apparatuses, said member being fitted on the oxygen cylinder.

Fig. 2 is an end view corresponding to Fig. 1 when looking at the apparatus from the left.

Fig. 3 is an axial longitudinal section, on an enlarged scale, showing the olive-shaped member for connecting the oxygen supply tube to the mask.

Fig. 4 is a general elevation, on a smaller scale, showing the mask provided with its receptacle; in this figure, a dot and dash line diagrammatically indicates the connecting tube between the mask and the outlet olive-shaped member of the distributor (Fig. 1).

In the form of construction illustrated and referring more particularly to Figs. 1, 2 and 3, the oxygen is stored under pressure in a cylinder 1 provided, as usual, with means for opening and controlling the supply; these means, which are commonly used, are not illustrated and do not form a part of the invention. On the oxygen cylinder is screwed a member 2 on which are fitted, on the one hand, by screwing, the body 3 of the pressure reducer, the body 4 of the distributor, and, on the other hand, through the medium of a stuffing-box 5, a safety and forced flow cock 6. On the member 2 is also fitted a pressure gauge 7 subjected to the pressure of the oxygen in the cylinder by means of a channel 8 opening into a channel 9 directly communicating with the cylinder 1. A packing 10, formed of nickel wires, is provided in channel 9, as shown in Fig. 1.

On the body 3 of the pressure reducer is screwed a cover 11 with an axial bore for receiving a screw 12 adapted to adjust a spring 14; this screw 12 is provided with perforations 15 and with a

central tapped bore adapted to receive an adjusting screw 16 constituting an abutment for a valve 17. The axial bore of cover 11 is protected by a plug 18 perforated at 19. Between the body 3 and cover 11, but with interposition of fluid-tight packings, is peripherally clamped a diaphragm 20 on which is centrally secured a member 21 on which is screwed the seat 22 of valve 17, the latter being normally urged against its seat by a small spring 23. The diaphragm 20 divides the pressure reducer into two chambers 24 and 25. The chamber 24 is subjected to the surrounding pressure, whilst chamber 25 receives oxygen from the cylinder 1, under the control of a needle valve 26 urged against its seat, carried by a member 27, through the medium of a spring 28, the member 27 being screwed in a corresponding tapped bore of member 2. The position of the needle valve 26 is adjusted by the position of member 21 against which it bears. The bore of member 21 is moreover in communication with chamber 25 through perforations 29, and the space provided in member 27 for receiving the needle valve 26, is in communication, through a channel or conduit 30, with the oxygen supply channel or conduit 9.

The operation of the pressure-reducer above described is as follows:

When the cock of the oxygen cylinder is opened, the gas reaches, through channels or conduits 9 and 30, the needle valve 26, the position of which is adjusted by that of diaphragm 20. The gas is thus caused to expand in chamber 25, the spring 14, which bears on diaphragm 20, balancing the pressure of the gas in chamber 25. The expanded gas issues through a channel or conduit 31 and is admitted into the distributor, as will be indicated later on. In case of dangerous overpressure, the diaphragm 20, which is moved towards the right, actuates the valve 17 which abuts against the screw 16, and the gas is evacuated to the exterior through the perforations 29 and channels 15 and 19.

The gas, admitted into the channel 31 at a suitable pressure, flows into an annular groove 33, then, through a perforation 34 provided in a packing 35, into a groove 36 into which opens a channel or conduit 37 communicating, through a channel or conduit 38, with a space 39. Opposite this space 39 is screwed a member constituting a seat for a needle valve 41 urged towards its seat by a spring 42.

On the body 4 of the distributor is screwed a cover 42' clamping a support 43 for a pleated tube 44 and a vacuum box 45. On the pleated tube is fitted a plug 46 carrying an abutment 47 for the needle valve 41. The vacuum box 45 carries, on one of its faces, a member 48, the position of which is adjustable by screwing in a member 49 which supports it, a plug 50 obturating the central perforated end of cover 42'. The latter carries a member 51 putting in communication with the atmosphere the chamber 52 in which is arranged the vacuum box internally subjected to the action of a spring 53. Moreover, an olive-shaped member 55 opens into a chamber 56 into which enters the gas coming from the pressure reducer, this olive-shaped member 55 being connected by a flexible pipe 57 (see also Fig. 4) to the mask 58.

The operation of the distributor described above is as follows:

When the surrounding pressure diminishes, the faces of the vacuum box 45 are subjected to a reduction of pressure and move apart under the action of spring 53. Now, as one of the faces is substantially held stationary centrally by member 48, the other face moves away and acts on the member 46 carrying the abutment 47. The latter acts on the needle valve 41 for allowing the admission, into chamber 56, of the gas passing through the pressure reducer as previously indicated.

It has been found that, by maintaining for the orifice of olive-shaped member 55 a constant cross section, an increase from 15 to 20% of the supply of oxygen relatively to the supply measured when the apparatus remains at about +15° C. took place when the surrounding temperature was of the order from −30 to −50° C. In order to maintain a constant supply, the olive-shaped member 55 is internally provided, as shown in Fig. 3, with a rod 60 made of a metal having an extremely low coefficient of expansion relatively to the coefficient of expansion of the olive-shaped member, so as to automatically determine, owing to the variations of temperature, a modification of the distance separating the end of rod 60 from the bottom of the tube of the olive-shaped member. This rod is secured at 61 in the olive-shaped member for allowing an initial adjustment, and it is provided with perforations 62 for the circulation of the gas.

In case of unsatisfactory operation of the pressure reducer, it is possible, owing to the forced supply cock 6, to directly feed, from the oxygen cylinder 1, the channel or conduit 38 supplying fuel to the chamber 39. For that purpose, the stem of cock 6 is screwed, at 64, in a corresponding tapped bore of member 2 and carries, at its end, a pin 65 fitted into a corresponding channel putting the channel or conduit 9 in communication with a space 66. By acting on cock 6, it is possible to control the supply of gas to the space 66. This gas then flows, through a channel 67, a circular groove 68 and a perforation 69 provided in a packing 70, into a circular groove 71. In practice, the gas directly flows from groove 68 into a channel 72 opening at the point of communication between channels or conduits 37 and 38.

The mask 58 is constituted by a rubber casing lined with chamois leather. The inlet end of the oxygen supply tube 57 is electrically heated, the current supply wires being indicated at 73. Breathing out no longer takes place to the atmosphere, but through the medium of a rubber tube 75 pleated in accordion fashion and at the lower end of which is provided a receptacle 76 directly opening, at 77, to the atmosphere. The air breathed out partly remains in said receptacle 76 and is partly absorbed by the pilot who thus recovers a small amount of carbonic acid necessary for breathing at high altitude, and a small amount of moisture. The tube 75 can be separated into two portions, owing to a bayonet connection 78, for allowing free breathing when on the ground.

The embodiment proposed allows of testing the apparatus without enclosing them in a large pneumatic bell. For that purpose, in the place and instead of the plug 18 on the pressure reducer, and of the member 51 on the distributor, are screwed olive-shaped members allowing to produce at these points, through the medium of pipings and of a vacuum pump, the pressure existing at a given altitude, the same pressure being produced at the outlet of the olive-shaped member 55. The output is measured at the outlet of the olive-shaped member 55 and the ap-

paratus being closed on all sides, it is subjected to the same partial vacuum at the altitude under consideration.

Experience shows that it is unnecessary to produce, at the olive-shaped member screwed in the place and stead of the plug 18 of the pressure reducer, the pressure under consideration, as the outflow or supply is practically independent of the pressure at the preliminary pressure reducer, as long as its variations are of small importance.

It is obvious that the form of construction described and illustrated herein is given by way of indication only and not in a limiting sense. All changes or modifications which do not alter in any way the main features above set forth and the desired result, remain included in the scope of the present invention.

What I claim as my invention and desire to secure by Letters Patent is:

In an inhaling equipment of the type described, the combination with an oxygen cylinder under pressure, a breathing mask, an exhaling tube mounted at one end on the said mask, a wall bounding a chamber communicating directly with the exterior and terminating the said exhaling tube, a pressure reducer for reducing the oxygen to a pressure lower than that of the cylinder, a distributor for automatically modifying the supply of oxygen relatively to the external pressure prevailing around the mask, the oxygen being admitted to the said mask, a tube communicating between the mask and the distributor, an intermediate member provided with conduits permitting the pressure reducer to communicate with the distributor, and the cylinder with the pressure reducer and with the distributor, a pointed screw terminating with a needle point in said intermediate member and adapted to be manually displaceable for controlling the said conduits and permitting the direct admission of oxygen to the distributor, means for securing the intermediate member to the cylinder and for securing the pressure reducer as well as the distributor to said intermediate member, an olive-shaped metal tube rigid with the distributor and on which is secured said exhaling tube communicating with the mask, an adjustable rod, said rod being mounted with play in the interior of said olive-shaped metal tube and made of a metal having a coefficient of expansion much lower than that of the metal of the said olive-shaped tube so that the section of the conduit for the oxygen passing into the said olive-shaped tube is modified relatively to the temperature for maintaining a supply of oxygen independent of the atmospheric temperature.

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