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2,311,955

OXYGEN SUPPLY APPARATUS

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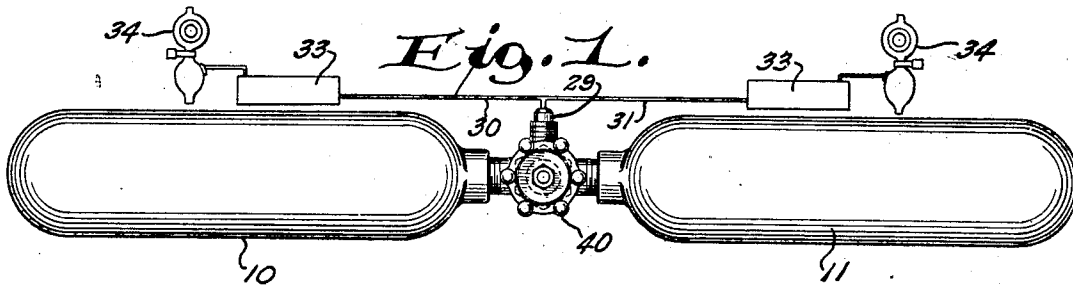


Fig. 2.

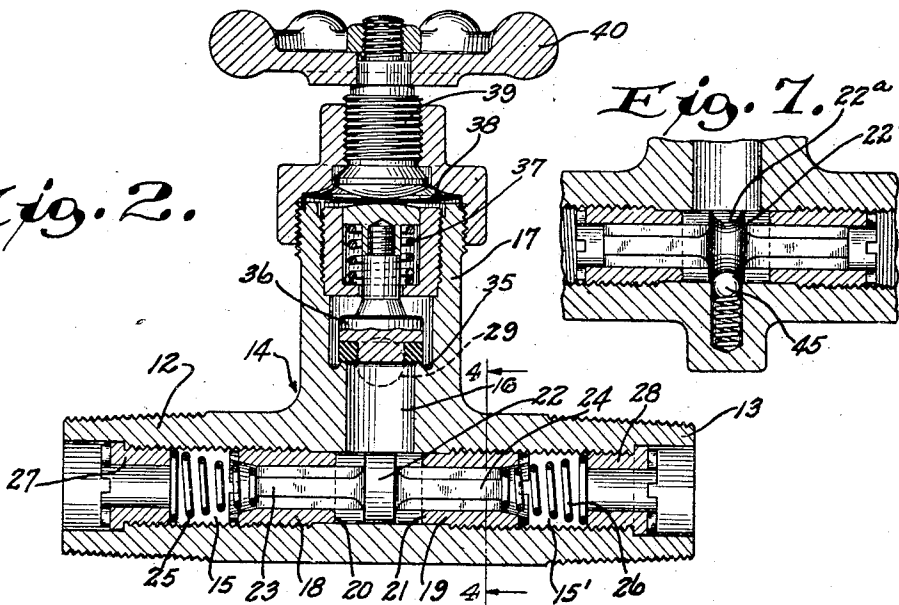


Fig. 7.

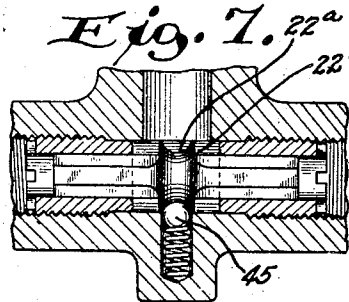


Fig. 5.

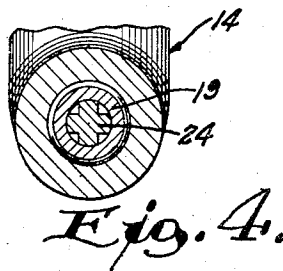


Fig. 4.

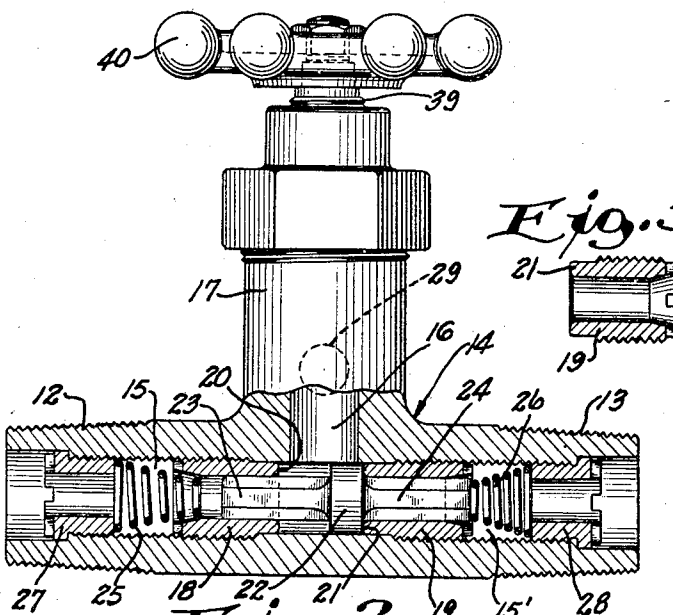


Fig. 3.

BY



Fig. 6.

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## UNITED STATES PATENT OFFICE

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## OXYGEN SUPPLY APPARATUS

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7 Claims. (Cl. 221-73.5)

This invention relates to an oxygen supply apparatus especially designed and adapted for use by military air-craft personnel.

Due to the high altitudes at which modern military air-craft operate, it is necessary to supply the crew with oxygen. For such purposes oxygen is ordinarily furnished in a high pressure cylinder equipped with necessary pressure-reducing equipment and respirators. The pressure at which the oxygen is stored in the cylinder is of the order of eighteen hundred to two thousand pounds per square inch. Because of weight and space limitations a minimum amount of oxygen is now carried in a single cylinder, and if this cylinder is pierced with a bullet, the oxygen supply is immediately dissipated and there is little likelihood of saving the airplane and crew.

The present invention proposes to provide oxygen supply apparatus adapted for use by military air-craft personnel and wherein the single cylinder heretofore used is replaced by a plurality of, preferably two, smaller cylinders, each of which may have approximately one-half the capacity of the single cylinder now used. The two cylinders are combined and organized with the pressure-reducing equipment and respirators in a special way, that is, by means of a special valve and distributing mechanism, which may conveniently comprise a valve casing having branches individually connected to the cylinders and equipped with valve means for automatically blocking either of said branches upon a sudden drop of pressure in the cylinder connected to either branch. While this valve means may take various forms, it preferably comprises a double-acting, floating piston valve, interposed between aligned or opposed valve seats in the branches, normally biased out of engagement with both valve seats, but automatically closing against the valve seat adjacent a cylinder in which there is a sudden pressure drop. The valve casing is also provided with an outlet located on the outlet side of said floating valve, and leading to the pressure-reducing equipment and respirators. Flow of the oxygen through the outlet is controlled by a manually operable shut-off valve. The valve and distributing mechanism is also so constituted as to facilitate recharging of the cylinders.

Another object of the invention is to provide an oxygen supply apparatus having these advantages and capacities, and which is simple, compact, and highly organized in construction, reliable and safe in operation, comparatively light in weight, and easy and comparatively inexpensive to manufacture.

Other objects and advantages reside in certain novel features of the construction, arrangement, and combination of parts, which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawing forming a part of this specification, and in which:

Figure 1 is a view in top plan showing an oxygen supply apparatus embodying the present invention, the pressure-reducing mechanism and respirators connected to the outlet of the valve mechanism being illustrated diagrammatically;

Figure 2 is a view in longitudinal, vertical, cross section, taken on line 2-2 of Figure 1, and looking in the direction of the arrows, the cylinders being omitted and the floating piston valve being shown in its normal position, that is, out of engagement with both valve seats.

Figure 3 is a fragmentary view partly in longitudinal, vertical cross section and partly in side elevation, but showing the floating valve seated against one of the valve seats;

Figure 4 is a view in transverse vertical cross section taken on line 4-4 of Figure 2;

Figures 5 and 6 are detail views in longitudinal, vertical cross section, and in end elevation, respectively, of one of the valve stem guides; and

Figure 7 is a fragmentary view in longitudinal, vertical cross section, showing a modification of the invention.

Referring to the drawing, and more particularly to Figure 1, it is seen that an oxygen supply apparatus embodying the present invention comprises a plurality, preferably two, of oxygen supply cylinders, designated at 10 and 11. These cylinders are of identical construction and each contains a supply of oxygen under pressure. The neck of each cylinder is internally threaded to adapt the cylinders to be connected to the externally threaded inlet fittings 12 and 13 provided on a valve casing 14 of generally inverted T-shaped form. The inlet fittings are at the ends of the cross bar of the inverted T-shaped valve casing 14 and they provide the branch passage-ways 15 and 15' which lead from one end of the main passage-way 16 extending through the vertical leg 17 of the valve casing. Sleeve-like valve stem guides 18 and 19 are threaded into branch passage-ways 15 and 15', and their confronting ends are machined or otherwise fashioned to provide valve seats 20 and 21. A floating, double-acting piston valve 22 is interposed between the valve seats 20 and 21. Integral with the valve 22 are similar elongated valve stems 23 and 24 cruciform in cross section. Springs 25 and 26 are

provided to normally maintain valve 22 disengaged from both seats. The springs 25 and 26 are identical and each has its inner end bearing against the adjacent end of the valve stem guide 23 or 24, as the case may be. Bushings 27 and 28, threaded into the outer ends of the passageways 15 and 16, afford abutments for the outer ends of the springs 25 and 26.

The vertical leg of the valve casing 14 is provided with an outlet 29 which is connected with distributing lines 30 and 31 leading through pressure-reducing devices 33 to suitable respirators 34. In the passage-way 17 leading to the outlet 29 is a valve seat 35. A manually operable shut-off valve 36 coacts with this valve seat 35 to control the flow of oxygen out through the outlet 29. This valve 36 may be of any suitable type. The drawing shows a well-known type of valve suitable for this purpose, in that it is opened by a spring 37, is diaphragm-sealed as at 38 and may be moved to closed position by means of an actuating screw 39 conveniently adjusted by hand-wheel 40.

With this construction, when oxygen is to be supplied to the respirators, the hand-wheel 40 is turned back off the screw 39 to allow the spring 37 to open the valve 36. Thereupon oxygen flows from both cylinders 10 and 11, past the valves 22 and 26 to the outlet 29, and thence through the distributing lines 30-31 and pressure-reducing devices 33 to respirators 34. If there is a sudden drop in pressure in either cylinder 10 or 11, due, for example, to one of the cylinders being pierced by a bullet, the pressure will automatically move valve 22 against the seat 20 or 21 adjacent the cylinder in which there is a sudden pressure drop. This will shut off the damaged cylinder from the system and oxygen will thereafter be supplied from the unimpaired cylinder.

The apparatus lends itself to ready recharging. When the cylinders are empty the valve connection 29 can be disengaged and cylinders 10 and 11 with valve 40 may be removed as a unit. If the cylinders are intact, valve 22 will remain in a central position during the charging operation, since the pressures in both cylinders are equal. Should one or the other of the cylinders have been damaged it can merely be removed from valve 40 and a new one put in its place and recharging performed in the usual manner. In the case of one cylinder having been damaged it is only necessary to open the valve to drain the other cylinder completely of pressure in order to assure that valve 22 moves back into its neutral position.

The form of the invention shown in Figure 7 is identical with that just described, save that the springs 25 and 26, and their abutments 26 and 27, are omitted, and the body of the piston valve, designated at 22', is formed with an annular groove 22a of concave cross section. A spring-pressed ball detent 45 carried by the valve casing coacts with the groove 22a to releasably retain the valve 22' in central or unseated position, but in the event of a sudden pressure drop in either cylinder the pressure overcomes the action of the detent 45 and the valve is closed to shut off the damaged cylinder. With this construction, when the apparatus is to be recharged, the valve 22' must be punched back to neutral position by a suitable tool.

While I have shown and described several constructions in which the invention may be advantageously embodied, it is to be understood that

the constructions shown have been selected merely for the purpose of illustration or example, and that various changes in the size, shape, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. An oxygen supply apparatus of the character described comprising two cylinders, each cylinder containing a supply of oxygen under pressure, a valve casing having a passage-way therethrough, said passage-way having two aligned inlet branches, one connected to one of said cylinders and the other connected to the other of said cylinders, opposed valve seats in said inlet branches, a single balanced, double-acting, floating piston valve interposed between said valve seats, yieldable means for normally maintaining the piston valve disengaged from both seats but allowing the pressure within the valve casing acting directly on the valve to close the valve automatically against a seat adjacent a cylinder in which there is a sudden drop of pressure, said valve casing having an outlet communicating with said passageway on the outlet side of said piston valve and from which oxygen is dispensed.

2. An oxygen supply apparatus of the character described comprising two cylinders, each cylinder containing a supply of oxygen under pressure, a valve casing having a passageway therethrough, said passageway having two aligned inlet branches, one connected to one of said cylinders and the other connected to the other of said cylinders, opposed confronting valve seats in said inlet branches, a single double-acting piston valve having a single piston head interposed between said valve seats, and yieldable means for normally maintaining the piston valve disengaged from both seats but allowing the pressure within the valve casing acting directly on the valve to close the valve automatically against a seat adjacent a cylinder in which there is a sudden drop of pressure, said valve casing having an outlet communicating with said passageway on the outlet side of said valve and through which oxygen is dispensed.

3. An oxygen supply apparatus of the character described comprising two cylinders, each cylinder containing a supply of oxygen under pressure, a valve casing having a passage-way therethrough, said passageway having two aligned inlet branches, one connected to one of said cylinders and the other connected to the other of said cylinders, opposed confronting valve seats in said inlet branches, a single double-acting piston valve having a single piston head interposed between said valve seats, and a spring projected detent cooperable with said piston head for normally maintaining the piston valve disengaged from both seats but allowing the pressure within the valve casing acting directly on the valve to close the valve automatically against a seat adjacent a cylinder in which there is a sudden drop of pressure, said valve casing having an outlet communicating with said passageway on the outlet side of said valve and through which oxygen is dispensed.

4. An oxygen supply apparatus of the character described comprising two cylinders, each containing a supply of oxygen under pressure, an inverted T-shaped valve casing having inlet fittings at the ends of its cross bar connected to said cylinders and also having an outlet connection in its vertical leg from which the oxygen is

dispensed, tubular valve stem guides threaded into the inlet fittings and having confronting valve seats, a single double-acting piston valve having a single piston head interposed between said valve seats and having oppositely extending valve stems slidably interfitted with said tubular valve stem guides, and yieldable means for normally maintaining the piston valve disengaged from both seats but allowing the pressure to close the valve automatically against the seat adjacent the cylinder in which there is a sudden drop of pressure.

5. An oxygen supply apparatus of the character described comprising two cylinders, each containing a supply of oxygen under pressure, an inverted T-shaped valve casing having inlet fittings at the ends of its cross bar connected to said cylinders and also having an outlet connection in its vertical leg from which the oxygen is dispensed, tubular valve stem guides threaded into the inlet fittings and having confronting valve seats, a single double-acting piston valve having a single piston head interposed between said valve seats and having oppositely extending valve stems slidably interfitted with said tubular valve stem guides, springs in the inlet fittings having their inner ends engaged with the ends of the valve stems, bushings threaded into the inlet fittings and providing abutments for the outer ends of said springs whereby said springs normally maintain the piston valve disengaged from both seats to allow pressure within the valve casing acting directly on the valve to close the valve automatically against the seat adjacent the cylinder in which there is a sudden drop of pressure.

6. An oxygen supply apparatus of the character described comprising two cylinders, each

containing a supply of oxygen under pressure, an inverted T-shaped valve casing having inlet fittings at the ends of its cross bar connected to said cylinders and also having an outlet connection in its vertical leg from which the oxygen is dispensed, tubular valve stem guides threaded into the inlet fittings and having confronting valve seats, a single double-acting piston valve having a single piston head interposed between said valve seats and having oppositely extending valve stems slidably interfitted with said tubular valve stem guides, and yieldable means for normally maintaining the piston valve disengaged from both seats but allowing the pressure to close the valve automatically against the seat adjacent the cylinder in which there is a sudden drop of pressure, said valve stems being of cruci-form in cross section.

7. An oxygen supply apparatus of the character described comprising two cylinders, each cylinder containing a supply of oxygen under pressure, a valve casing having a passage-way therethrough, said passageway having two inlet branches, one connected to one of said cylinders and the other connected to the other of said cylinders, valve seats in said inlet branches, a single double-acting piston valve interposed between said valve seats, yieldable means for normally maintaining said piston valve disengaged from both seats but allowing the pressure to close the valve automatically against the seat adjacent the cylinder in which there is a sudden drop of pressure, and an oxygen-distributing system including a pressure-reducing device and a respirator connected to said valve casing on the outlet side of said piston valve.

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