Sept. 14, 1943. S. A. MOREHOUSE 2,329,289

OXYGEN SUPPLY FOR PARACHUTISTS

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Fig. 1.

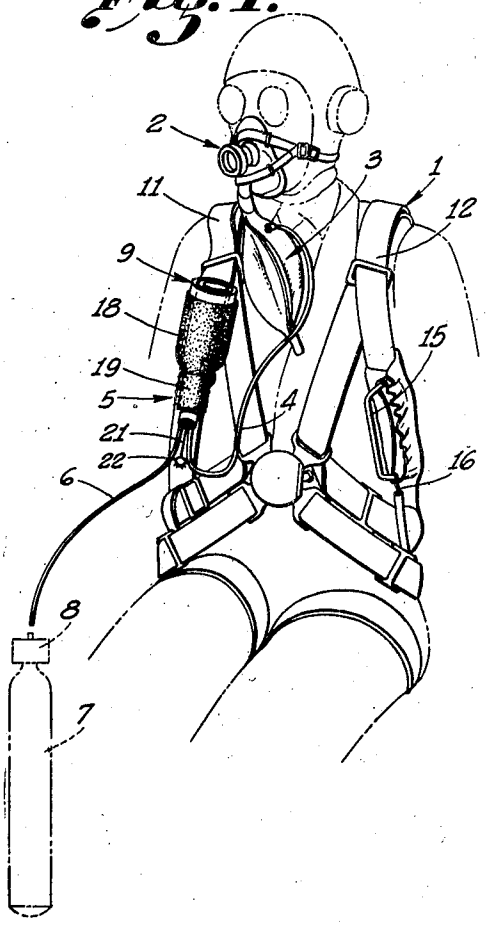
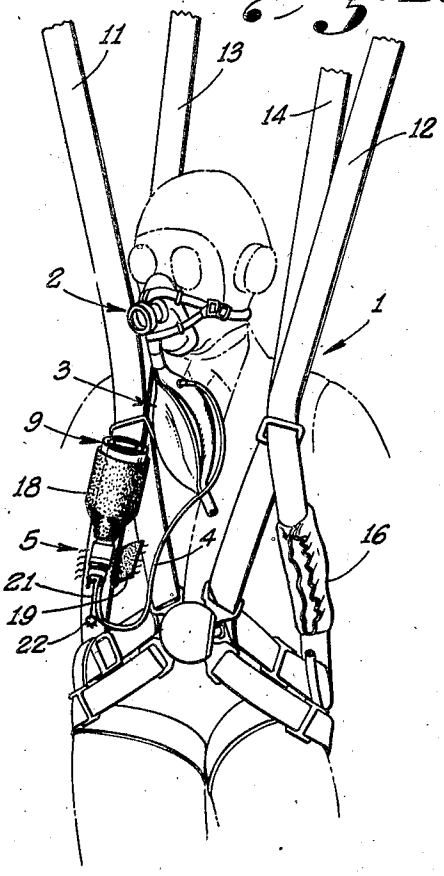


Fig. 2.



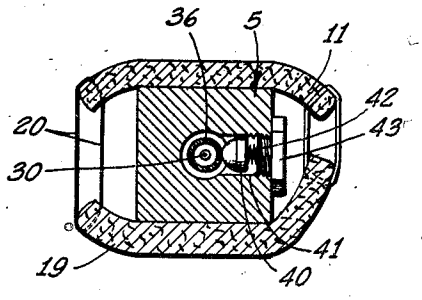


Fig. 4.

Inventor

SILAS A. MOREHOUSE

By Lyon & Lyon

Attorneys.

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Fig. 3.

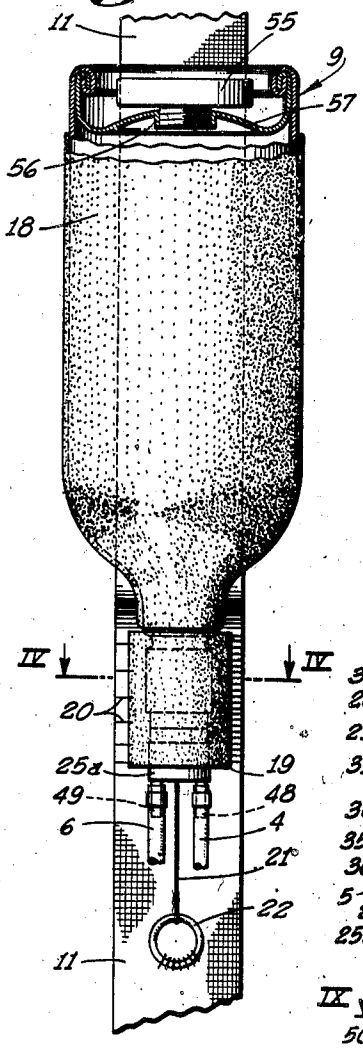


Fig. 5.

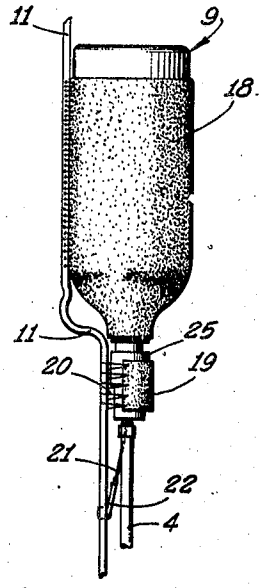
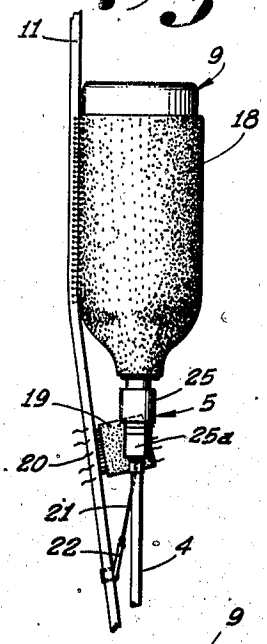


Fig. 6.



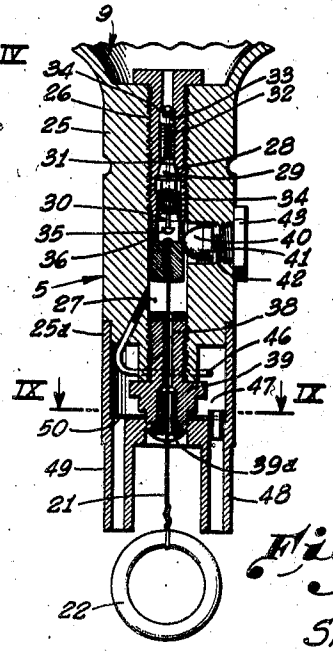


Fig. 7.

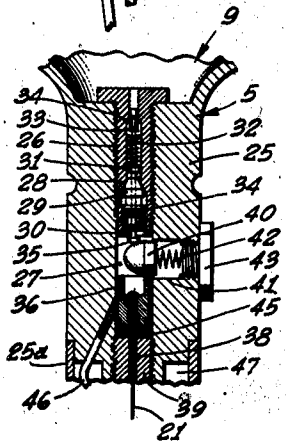


Fig. 8.

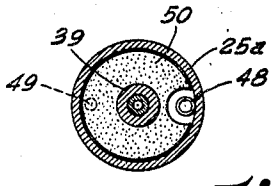


Fig. 9.

Inventor
SILAS A. MOREHOUSE

By Lyon & Lyon
Attorneys.

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UNITED STATES PATENT OFFICE

2,329,289

OXYGEN SUPPLY FOR PARACHUTISTS

Silas A. Morehouse, Glendale, Calif.

Application September 14, 1940, Serial No. 356,809

7 Claims. (Cl. 128—142)

This invention relates to equipment for supplying oxygen to aviators and has to do particularly with the emergency supply of oxygen to aviators when they are forced to bail out of their ships at high altitudes.

It is well recognized that an artificial oxygen supply is essential to most aviators when flying at altitudes of from 15,000 to 30,000 feet and higher. Equipment has been provided for this purpose, and usually consists of a mask covering the nose and mouth of the aviator and connected by flexible tubing to a supply of oxygen. The latter usually consists of a tank of substantial proportions and weight, together with a suitable pressure reducing valve. The weight and bulk of the tank and valve equipment is such that it cannot be carried on the person of the aviator.

It has also been recognized by others that aviators forced to jump from their ships at high altitude, say 30,000 feet, may suffer from lack of oxygen before they reach a level at which the natural supply is sufficient, and they may become unconscious. Therefore it has already been proposed that aviators be equipped with small oxygen bottles to be carried with them when they bail out, and containing sufficient oxygen to last until a reasonably low altitude is reached. Such prior systems of which I am aware are subject to the serious criticism that they require a manual operation by the aviator to transfer his oxygen supply connections from the large tank in the ship to the small bottle carried on his person. This is objectionable because under conditions that necessitate abandoning the ship, the aviator may become confused or may be physically incapable of performing the necessary operation.

An object of the present invention is to provide an emergency oxygen supply apparatus that is fully automatic in its operation and requires no attention on the part of the aviator.

Another object is to provide a simple, reliable and foolproof valve structure for transferring an aviator's oxygen mask from connection with a regular oxygen tank to an emergency oxygen bottle carried by the aviator, the valve being operable automatically when the aviator bails out.

Another object of the invention is to simplify the maintenance of emergency oxygen equipment for aviators.

Various other specific objects and features of the invention will become apparent from the detailed description to follow of a particular embodiment of the invention, as disclosed in the drawings.

In the drawings:

Fig. 1 is a perspective view of an aviator equipped with a parachute and with oxygen supply apparatus in accordance with the invention;

Fig. 2 is a view illustrating the apparatus of Fig. 1 in the position it assumes after the aviator has bailed out and his parachute has opened;

Fig. 3 is an enlarged detail view of the emergency oxygen bottle and valve in accordance with the invention, shown in normal condition (ready for use);

Fig. 4 is a section in the plane IV—IV of Fig. 3;

Fig. 5 is a schematic view, similar to Fig. 3, but taken at right angles thereto;

Fig. 6 is a schematic view similar to Fig. 5, but showing the apparatus after it has been tripped by opening of the parachute;

Fig. 7 is a longitudinal sectional view through the valve unit of my invention, showing the valve in normal condition;

Fig. 8 is a view similar to Fig. 7, but showing only a portion of the valve mechanism with the parts in the position they assume after the valve has been tripped; and

Fig. 9 is a cross section taken in the plane IX—IX of Fig. 7.

Referring first to Fig. 1, there is shown an aviator equipped with a conventional parachute harness 1, a conventional oxygen mask 2, a rebreathing bag 3, an oxygen supply tube 4 extending to a valve unit 5 (constituting a part of the present invention), and a second oxygen supply tube 6 extending from the valve 5 to a conventional oxygen tank 7 equipped with a conventional pressure reducing valve 8. The aviator is shown in sitting position, such as he might occupy in an airplane during normal flying operations, and the parachute (not shown) may be of conventional seat type upon which the aviator sits.

As will be explained later, the valve 5 normally interconnects the tubes 4 and 6 so that the aviator's oxygen mask 2 is supplied with oxygen from the tank 7 in the customary manner, just as though the valve 5 were not present and the tube 4 were directly connected to the tube 6.

However, the valve 5 is adapted to be actuated, in response to opening of the parachute, to connect the tube 4 to an emergency oxygen bottle 9 which is supported on the parachute harness and goes with the aviator when he bails out. The tube 6 may be frictionally engaged with a connection on the valve 5 so that it pulls off at the

time the aviator bails out. It will be apparent, therefore, that the substitution of the emergency oxygen bottle 9 for the main oxygen supply tank 7 is accomplished entirely automatically without any attention on the part of the aviator.

The pulling off of the tube 6 from the valve 5 when the aviator bails out is caused by the fact that the main oxygen supply tank 7 is mounted on the airplane and not on the aviator. Thereafter, oxygen will be wasted from the tank 7 through the tube 6 but this is of no moment when an emergency has occurred that necessitates the aviator leaving the airplane.

The conventional parachute harness includes four risers 11, 12, 13 and 14, which support the aviator's weight from the parachute canopy after the latter has opened. These risers are therefore shown extending upwardly from the aviator in Fig. 2 of the drawings. Only the two front risers 11 and 12, respectively, appear in Fig. 1, the rear risers 13 and 14 extending down and back of the aviator in this view. The riser 12 carries the handle 15 of the rip cord 16 which extends to the parachute pack (not shown). This handle 15 is stitched with relatively weak thread to the riser 12 so that when the aviator gives it a good pull it tears loose from the riser 12 and withdraws the cord 16 from the parachute pack to open it. In Fig. 2 the rip cord and handle have been pulled loose and discarded.

The right front riser 11 (Fig. 1) carries the emergency oxygen bottle 9 and the valve 5, which is formed integrally with the bottle 9. Thus the bottle 9 is contained in a fabric case 18 which is solidly stitched to the riser 11 as shown in Figs. 5 and 6. The valve 5 is secured to the riser 11 by a band 19 which is stitched with weak thread to the riser 11. Furthermore, as most clearly shown in Fig. 5, the riser 11 is normally slack between the point of attachment of the case 18 and the point of attachment of the band 19 so that when the parachute opens and the aviator's weight is supported by the risers, the weak stitching 20 (Fig. 5) holding the band 19 to the riser 11, is broken, permitting the riser to straighten out below the case 18 as shown in Fig. 6.

The resultant downward movement of the lower portion of the riser 11, relative to the casing 18 and the valve 5, is utilized to actuate the valve. Thus the valve is provided with an actuating cable 21 which extends from the lower end thereof and is secured to a ring 22, which in turn is firmly secured to the riser 11 at a point below the band 19 so that when the latter is torn loose, as shown in Fig. 6, the cable 21 is pulled downwardly to actuate the valve.

The internal construction of the valve 5 will now be described with particular reference to the sectional views of Figs. 7 and 8. The valve 5 consists of a stem 25 which forms the neck of the emergency oxygen bottle 9. It has a central longitudinal passage in which there is mounted a valve stem 26 of the general type employed in pneumatic tires. Thus the valve stem is threaded to screw into a threaded portion of the central passage 27 and has a seat 28 which is normally closed by a conical plug 29. The plug 29 has a central passage extending therethrough which loosely receives a valve rod 30 and is normally closed by a valve disc 31 connected to the rod 30 and urged into seating position by a helical spring 32, compressed between the valve disc 31 and a spider 33 loosely mounted on the rod 30 and seated against a shoulder 34 in the stem 26. The plug 29 is forced against the seat 28 by a threaded plug 34.

It will be apparent that the valve disc 31 normally seals the passage through the stem 26 and pressure within the bottle 9 tends merely to force this disc more firmly against its seat. However, it may be opened either by pressure applied at the lower end of the passage 27 or by upward movement of the valve rod 30.

The lower end of the valve rod 30 projects through the screw plug 34 and terminates in a head 35. However, this head 35 is normally covered by a sleeve 36 loosely mounted for free vertical movement in the passage 27. This sleeve 36 is permanently connected to the cable 21, previously referred to, it being extended through a small central passage 38 in a screw plug 39 which closes the lower end of the passage 27. The lower end of the passage 38 is enlarged and threaded to receive a hollow screw 39*a*, which functions to secure a lower closure member 25*a* in place on the stem 25.

The sleeve 36 is frictionally engaged by a button 40 slidably mounted for lateral movement in a lateral passage 41 extending from the central passage 27, the button 40 being urged against the side of the sleeve 36 by a spring 42 compressed between the button 40 and a closure plug 43. However, when the cable 21 is pulled in the manner previously described, the sleeve 36 is retracted into lowermost position, as shown in Fig. 8, in which the upper end of the sleeve is below the button 40, whereupon the latter is forced inwardly by the spring 42 into position between the valve head 35 and the upper end of the sleeve 36 and the end of the button 40 is tapered, as shown, so that it depresses the head 35 to open the valve and permit oxygen under high pressure in the bottle 9 to escape past the valve and into that portion of the passage 27 containing the sleeve 36.

Escape of the oxygen, now under high pressure in the passage 27, through the small passage 38 through which the cable 21 extends, is prevented by a resilient gasket 45 surrounding the upper orifice of the passage 38 against which the lower solid end of the sleeve 36 seats, and is maintained seated by the high pressure of the oxygen acting against its upper side.

Oxygen thereafter slowly escapes from the passage 27 through a short length of capillary tubing 46 into a chamber 47 in the lower end of the stem 25 and thence through a nipple 48 to the tube 4 (Fig. 3), and thence to the oxygen mask 2 (Fig. 1).

The tube 6, leading from the main oxygen tank 7 previously mentioned, connects to a nipple 49 which is also adapted to communicate with the chamber 47. However, whereas the nipple 48 is in permanent free communication with the chamber 47, the nipple 49 has oneway communication with the chamber 47 past a rubber flap valve 50. While the oxygen bottle 9 is cut off by the valve disc 31 from the chamber 47, oxygen can flow from the main tank 7 through the tube 6 and the nipple 49 past the flap valve 50 into the chamber 47, and thence through the nipple 48 and tube 4 to the mask 2. However, when the valve has been tripped, as shown in Fig. 8, and oxygen is permitted to escape from the bottle 9 into the chamber 47, its escape through the nipple 49 is prevented by the valve 50 so that it is forced to escape through the nipple 48 and the tube 4 to the mask.

It will be understood that although it is desirable to provide a pressure reducing valve between a source of oxygen under very high pressure and a mask, as indicated at 8 in connection with the main tank 7 of Fig. 1, this is not essential and for emergency equipment of the type here described, which has to function for only a few minutes, and the discharge of the oxygen from the bottle 9 is satisfactorily regulated by the short length of capillary tubing 46. Although the rate of flow of oxygen through the tubing 46 diminishes as the pressure within the bottle 9 drops, this is not important, since the greatest amount of oxygen is required when the valve is first tripped at the highest altitude. Obviously as the aviator drops to lower and lower altitudes his requirement of artificial oxygen diminishes.

It will be noted that with the valve 5 in normal position as shown in Fig. 7, the chamber 47 is communicated through the capillary tubing 46 with the chamber 27, which in turn is communicated through the passage 38 with the atmosphere. It follows that there is a path for wastage of oxygen under pressure within the chamber 47. However, this wastage is negligibly small because of the small size and high resistance to gas flow therethrough of the capillary tube 46, and the low pressure that exists within the chamber 47. Thus the pressure existant within the chamber 47 seldom exceeds one or two inches of water.

It is desirable to provide a pressure gauge 55 in the upper end of the bottle 9 so that the aviator can determine at a glance whether or not the bottle is filled. As shown, the gauge 55 is provided with a threaded neck 56 threaded into an opening provided therefor in the end wall 57 of the bottle 9. This opening is also used in assembling a portion of the valve mechanism. Thus it will be observed from Fig. 7 that the stem 26 is screwed into the neck 25 of the bottle from the interior. This assembly is accomplished with a wrench extended through the opening in the end wall 57 of the bottle before the pressure gauge 55 is screwed into place.

The bottle may be filled with oxygen by removing the plug 43 and replacing it with a connection to a source of oxygen under high pressure. The pressure opens the valve disc 31, permitting the oxygen to flow into the bottle until the pressure is substantially equalized, whereupon the valve 31 closes. The supply connection is then removed and the button 40, spring 42 and plug 43 replaced, care being taken to see that the sleeve 36 is in the upper position, as shown in Fig. 7, at the time these parts are replaced.

The time required to fill the bottle in the manner described, is only a few seconds, so that the leakage which simultaneously occurs through the capillary tubing 46 is not important.

It will be understood that any desired type of oxygen mask may be employed with my invention, and also that any type of main tank 7 and pressure reducing valve 8 may be employed.

Furthermore, my invention may be useful under conditions when a regular supply of oxyxgen is not required. Thus it is conceivable that closed cabin airplanes may be developed capable of maintaining an atmosphere at sufficient pressure to eliminate any necessity of using an oxygen mask while the aviator is in the ship. Under such circumstances the tube 6, tank 7 and pressure reducing valve 8 would simply be eliminated from the apparatus, as shown in Fig. 1.

It is important in a practicable apparatus of the type to which this invention relates that the apparatus mounted on the person of the aviator be kept as compact and light as possible. I therefore prefer to form the valve 5 integral with the bottle 9, as shown in the drawing. However, such construction is not essential and the valve 5 may be constructed as a separate unit adapted to be screwed onto, or otherwise secured to, the bottle.

It will be understood that although a particular construction has been disclosed in the drawing for the purpose of explaining the invention, numerous departures from this particular construction may be made without departing from the invention, which is to be limited only to the extent set forth in the appended claims.

I claim:

1. In an oxygen supply system for aviators, an oxygen mask, an emergency tank containing oxygen under pressure, a valve body defining a first passage in communication with said emergency tank, and a second passage in communication with said mask, a normally spring closed valve for intercommunicating said passages, a spring actuated latch movable when released to open said valve, a movable blocking member normally blocking said spring-actuated latch against release, and an actuating member connected to said blocking member for moving the latter out of blocking relation with said spring-actuated means.

2. In an oxygen supply system for aviators, an oxygen mask, an emergency tank containing oxygen under pressure, a valve body defining a first passage in communication with said emergency tank, and a second passage in communication with said mask, a normally closed valve for intercommunicating said first and second passages, said body member having a third passage extending from said second passage to the exterior of said valve body, means for opening said valve including a member movable within said second passage and having an actuating member extending through and loosely fitting in said third passage, said movable member engaging against and sealing the inner orifice of said third passage when moved into position to open said valve.

3. In an oxygen supply system for aviators, an oxygen mask, an emergency tank containing oxygen under pressure, a valve body defining a first passage in communication with said emergency tank, a first chamber, a normally closed valve between said first passage and said first chamber, a second chamber in direct communication with said mask, means defining a restricted path for oxygen flow between said first and second chambers, auxiliary means for supplying oxygen at low pressure, means including a oneway valve for admitting oxygen from said auxiliary means to said second chamber, a second passage extending from said first chamber to the exterior of said valve body, an actuating member for said valve extending through and loosely fitting in said second passage, and means responsive to movement of said actuating member for opening said valve to seal the inner orifice of said second passage.

4. Safety equipment for an aviator, comprising in combination, a parachute, an oxygen mask, and an oxygen bottle all adapted to be mounted on the person of the aviator, connecting means including normally closed valve means for delivering oxygen from said bottle to

said mask, in response to opening of said valve means, and valve-opening means operably connecting the parachute to said valve means for automatic actuation by relative movement between the valve means and parachute during operative use of the parachute.

5. Safety equipment for an aviator, comprising in combination, a parachute including a canopy and risers for supporting the aviator from the canopy, an oxygen mask, and an oxygen bottle all adapted to be mounted on the person of the aviator, connecting means including normally closed valve means for delivering oxygen from said bottle to said mask in response to opening of said valve means, and means responsive to a strain on one of said risers for opening said valve means.

6. Safety equipment for an aviator, comprising in combination, a parachute including a canopy and risers for supporting the aviator from the canopy, an oxygen mask, and an oxygen bottle all adapted to be mounted on the person of the aviator, connecting means including normally closed valve means for delivering oxygen from said bottle to said mask in response to opening of said valve means, yieldable means forming a loop in one of said risers, and means responsive to straightening of said loop for opening said valve means.

7. Safety equipment for an aviator, comprising a parachute including a canopy and risers for supporting the aviator therefrom, an oxygen mask, an emergency oxygen tank, a normally closed valve having a passage adapted to connect said mask with said tank, spring-actuated means movable when released to open said valve, a movable blocking member normally blocking said spring-actuated means against release, and means for pulling said blocking member out of blocking relation with said spring-actuated means, said pulling means being attached to one of said risers and being adapted to be pulled thereby when the riser is strained.

SILAS A. MOREHOUSE.