Oct. 28, 1958 J. L. PAULY 2,857,910

REGULATOR

Filed Nov. 16, 1949

FIG. 2

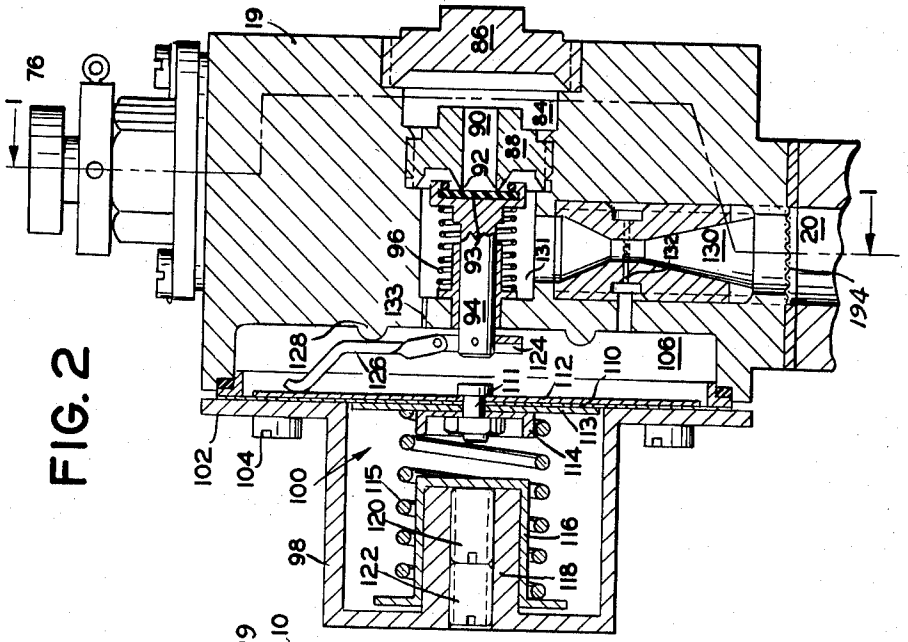
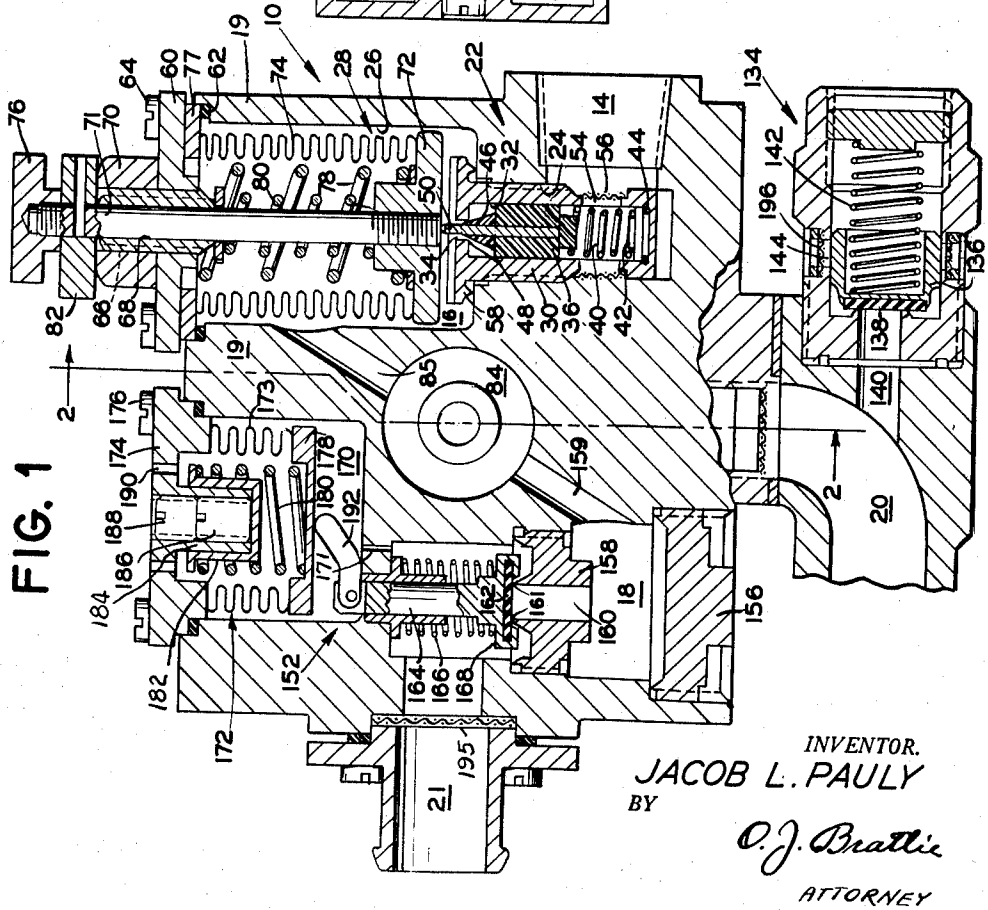


FIG. 1



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United States Patent Office 2,857,910
Patented Oct. 28, 1958

2,857,910

REGULATOR

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Application November 16, 1949, Serial No. 127,611

9 Claims. (Cl. 128—144)

The present invention relates to regulators and more particularly to regulators for supplying oxygen to persons bailing out from aircraft flying at high altitudes.

Human beings may bail out from aircraft flying at altitudes up to twenty thousand feet altitude without the use of artificial respiration aids but at higher altitudes it is necessary that they be supplied with oxygen to remain conscious until they have descended to an altitude where there is sufficient pressure to support normal breathing requirements. At altitudes above fifty thousand feet, it is necessary to pressurize the body by way of pressurization suits in order to assure normal function of the body organs. The present invention contemplates the provision of a novel oxygen regulator which will maintain normal breathing pressure to a user bailing out from aircraft flying at high altitudes, as well as maintaining a predetermined pressure in the pressure suit worn by the user.

Accordingly one object of the present invention is to provide a novel and effective regulator adapted to be connected to a source of fluid under high pressure for supplying an outlet with fluid at a predetermined pressure regardless of demand.

Another object is to provide a novel regulator for connection with a source of fluid supply for supplying fluid at a predetermined pressure regardless of demand at one outlet therefrom and for supplying fluid at a predetermined static pressure at another outlet therefrom.

Another object is to provide a novel, simple and effective regulator for connection to a source of oxygen under high pressure for supplying oxygen under normal breathing pressure regardless of demand to a person bailing out from aircraft at high altitudes.

Still another object is to provide a novel regulator for connection to a source of oxygen supply under high pressure for supplying oxygen at normal breathing pressure at one outlet thereof regardless of demand and for supplying oxygen at a predetermined pressure substantially higher than the breathing pressure at another outlet.

The foregoing 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 purpose of illustration and description only, and is not intended as a definition of the limits of the invention.

In the drawing,

Fig. 1 is a view, partly in section and partly in elevation of the novel regulator taken substantially along line 1—1 of Fig. 2, and

Fig. 2 is a sectional view taken substantially along line 2—2 of Fig. 1.

For a better understanding of the present invention, reference is had to Fig. 1 wherein an oxygen pressure

reducer indicated at **10** is arranged to maintain a predetermined working pressure of oxygen admitted through inlet **14** in chambers **16**, **84** and **18**. The various elements of the regulator are assembled and supported in a block or casing **19** which may be of a light-weight material such as aluminum.

Inlet **14** is provided with pipe threads to engage corresponding threads of a nipple connected to an oxygen container such as a bottle (not shown). Valve assembly **22** is contained in a recess **24** forming an extension of a well **26** for receiving bellows assembly **28** and communicating with inlet **14**.

Valve assembly **22** is supported within a sleeve **30** having a cylindrical bore **32** communicating with well **26** through a centrally located orifice **34**, and comprises fluted cylindrical member **36** having a sliding fit for reciprocal movement within the bore and biased upwardly as shown in the drawing by a compression spring **40** abutting a retainer **42** held in position by a snap ring **44**. Member **36** is provided with a conical extension or valve **46** adapted to engage valve seat **48** to close orifice **34** and carries a contact pin **50** extending through the orifice into the chamber **16** as shown in order to provide means for actuating the valve. Sleeve **30** is provided with a plurality of passages **54** covered by a filter **56** whereby oxygen may freely flow from inlet **14** through the passages and the flutes in member **36** to the valve. The sleeve may be a force fit within recess **24** in order to maintain it in fixed position or it may be secured therein in some other convenient manner, and it is provided with a shoulder **58** for establishing the position of the valve assembly with respect to bellows assembly **28**.

The bellows assembly **28** is mounted on a cover plate **60** which is fastened to the casing **19** against a seal **62** by bolts **64**. A stud **66** having a central bore **68** is threaded to the cover plate and held in position by lock nut **70**. Extending through the bore **68** is a rod **71** carrying at one end a closure plate **72** for bellows **74** and at the other end a flat cap **76**. The bellows is secured to cover plate **60** for instance by peening it over and soldering it to a ring member **77** interposed between the cover plate and the casing and is biased toward extended position by a compression spring **78** and by a smaller damping spring **80**. A split wedge **82** is normally interposed between cap **76** and lock nut **70** to maintain the bellows in compressed condition in order to permit valve **46** to rest against valve seat **48** as shown. It has been found that a valve made of a material such as nylon and a valve seat of bronze will give satisfactory service over a long period of time. A chamber **84** is connected to chamber **16** by a passage **85** and is sealed from the atmosphere by means of a plug **86**. An annular insert **88** having a central bore **90** is secured within the chamber and terminates in a valve seat **92** for receiving a disc valve **93** carried by a valve stem **94**. A compression spring **96** is provided for biasing the valve stem to the right as shown thereby tending to move the valve against the valve seat to close off bore **90**.

A cup shaped member **98** encloses a diaphragm assembly generally indicated at **100** and is provided with an outwardly extending flange **102** secured to casing **19** by a plurality of circumferentially spaced bolts **104** to cover a recess **106** in casing **19**. Interposed between the flange and the casing is a diaphragm **110**. Centrally located in the diaphragm is a nut and bolt **111** for clamping a rigid plate **112** to one side of the diaphragm and for securing an end plate **113** and a spring guide **114** for receiving one end of a compression spring **115** to the other side thereof. The other end of the spring abuts an outwardly extending flange of a cup-shaped member **116** telescoping an inwardly extending centrally located hub **118** of member

98. The compression of the spring may be adjusted by a screw 120 in the hub bearing against member 116 as shown and adapted to be secured in the adjusted position by a lock screw 122. Valve stem 94 extends into recess 106 and carries a spider 124 to which a plurality, preferably at least three, of levers 126 are pivoted. The levers are resting on fulcrums 128 attached to or forming part of casing 19 and are so shaped as to abut rigid plate 112 as shown when valve 93 is closed and when diaphragm 108 is in a centralized position.

A venturi tube 130 connects chamber 131 with outlet 20 and one or more passages 132 connect the restricted portion of the venturi tube with recess 106 for a purpose which will be apparent hereinafter. Recess 106 and chamber 131 are interconnected by a bleeder passage 133. Outlet 20 is connected to the oxygen mask (not shown) to maintain a predetermined pressure at the intake thereof. In order to prevent excessive pressures to build up at the intake of the gas mask in the event of faulty operation of the pressure reducer, a safety valve indicated at 134 is connected to outlet 20 and comprises generally a piston 136 carrying a disc valve 138 adapted to close a passage 140 communicating with outlet 20. Excessive pressure in the outlet will cause the piston to move to the right against the pressure of spring 142 until the openings 144 are uncovered permitting some oxygen to flow into the atmosphere in order to permit the outlet pressure of the regulator to fall to a safe value.

When a person bails out from an aircraft at extremely high altitudes, it is not only necessary to supply oxygen for breathing purposes but pressure must also be provided for the person's body in order to enable the organs thereof to function normally in the rarified atmosphere. According to the present invention, the pressure to the pressure suit of the wearer is supplied from the same source of oxygen used for providing oxygen for breathing purposes. This of course obviates the necessity of providing for a separate source for maintaining the pressure of the pressure suit above a certain level. It should be noted that once the desired pressure has been built up within the pressure suit, there will be no further flow of oxygen thereto from the source of oxygen.

The pressure in the pressure suit should preferably be approximately five times the breathing pressure. In order to provide a suitable pressure in the pressure suit, outlet 21 communicating therewith is connected to chamber 16 of pressure reducer 10 through a second pressure reducer, which may be termed a capstan reducer generally indicated at 152.

Chamber 18 confined between a pair of plugs 156 and 158 secured to the casing 19 is connected to pressure reducer 10 through passages 159 and 85 in casing 19. Plug 158 has a central bore 160 terminating in a valve seat 161 for receiving a valve 162 carried by a valve stem 164 and biased toward closed position by a compression spring 166 biasing against the housing and a shoulder 168 of the valve stem as shown. The valve communicates with outlet 21 leading to the pressure suit and with chamber 170 surrounding bellows assembly 172. The bellows assembly comprises a bellows 173 fastened between a cover plate 174 secured to housing 19 as by bolts 176 and an end plate 178. The bellows is biased toward extended position by a compression spring 180 interposed between the end plate and a cup-shaped retainer member 182 telescoping a centrally disposed inwardly extending hub 184 of cover plate 174. The hub is centrally provided with a threaded bore to receive an adjusting screw 186 for the compression spring and biasing against the retainer 182 and a lock screw 188 is provided for securing screw 186 in adjusted position. The interior of bellows 173 is connected to the atmosphere through passages 190 in the cover plate 174.

Valve stem 164 extends into chamber 170 and has pivotally attached thereto a lever 192 fulcrumed on the housing and having its end resting against end plate 178. The compression of spring 180 is adjusted so as to bear against lever 192 with sufficient force to lift valve 162 off valve seat 160 against spring 166 when the pressure in chamber 170 falls below a predetermined value relative to the atmospheric pressure existing within the bellows.

Coming now to the operation of the regulator described in detail above, inlet 14 thereof is connected to a source of gaseous oxygen under high pressure such as a flask adapted to be strapped to the body of a person. The regulator is maintained inoperative as long as wedge 82 is kept in position as shown in the drawing between nut 70 and cap 76 attached to valve stem 71 whereby the latter is held in retracted position permitting valve 46 to close orifice 34 thereby preventing any flow of oxygen therethrough. Outlet 20 may be connected to a mask for covering the mouth and nostrils of the user and outlet 21 may be connected to a pressure suit fitting about his body. Before he bails out from the craft he removes the wedge by pulling a string or a ring attached thereto. This will enable spring 78 to extend the bellows against the low pressure existing in chamber 16 and the flat end of rod 71 will depress valve pin 50 to lift valve 46 off valve seat 48 to permit oxygen to flow through orifice 34 into chamber 16 through passage 85 to chamber 84 and through passage 159 to chamber 18. As the pressure builds up within chamber 16, bellows 74 will be compressed thereby moving rod 71 upwardly to gradually close valve 46. In this manner the pressure within chamber 16 is maintained at a desired level determined by the force exerted by compression spring 78. The pressure inside bellows 74 is maintained at atmospheric pressure by leakage between rod 71 and bore 68 of sleeve 66. It has been found that with a source of oxygen under a pressure between 100 and 2000 p. s. i., a working pressure within the chamber of approximately 55 p. s. i. is desirable.

Valve 93 which is normally biased toward closed position by spring 96, in conjunction with diaphragm assembly 100 comprises a demand valve for supplying oxygen to outlet 20 at a breathing pressure from 50 to 175 mm. of mercury over and above the ambient pressure of any amount needed by the user. As oxygen is withdrawn from outlet 20, it is immediately replaced through tube 130 from chamber 131 tending to reduce the pressure therein and consequently the pressure in recess 106. This will cause diaphragm 110 to flex inwardly into recess 106 carrying with it rigid plate 112 which will bear against levers 126 to lift valve 93 off valve seat 92 to permit sufficient oxygen to flow into chamber 131 to maintain the desired pressure therein. At relatively low oxygen consumption, the flexing of diaphragm 110 will be proportional to the pressure drop in recess 106 to operate valve 93 so as to provide a normal oxygen pressure in outlet 20. However, with increased demand when it is desired to open the valve 93 wider it has been found that the flexing of the diaphragm is not proportional to the pressure drop in recess 106 at greater displacements of the diaphragm when the demand is heavy due to the smaller force exerted by spring 115 in extended position and due to the gradual increase of resistance against flexing by the diaphragm at larger displacements thereof.

To compensate for the non-linearity between displacement of the diaphragm and flow of oxygen, there is provided a venturi tube between chamber 131 and outlet 20. It is well known that a pressure differential is developed between the throat and the outlet of a venturi tube proportional to some function of the rate of flow therethrough. In order to aid the diaphragm at larger deflections thereof, recess 106 is connected by passage 132 to the throat of the venturi tube whereby the pressure in 106 will vary inversely with the rate of flow of oxygen. Thus during periods of low demand the pressure within recess 106 is substantially equal to pressures existing within chamber 131 and the spring 115 acting on the diaphragm will cause increased flow

of oxygen as soon as the pressure tends to drop. As the demand increases and larger flexing of the diaphragm is required the decreased pressure in the throat of the venturi tube will aid the spring in displacing the diaphragm. In order to stabilize the system, or in other words, prevent hunting, a small passage **133** connecting chamber **131** with recess **106** is provided to bleed some oxygen directly into the recess. The pressure within cup-shaped member **98** and behind diaphragm **110** is maintained at ambient pressure due to leakage around adjusting screw **120** and locking screw **122**.

In order to prevent excessive pressure from building up in outlet **20** in the event of failure of one or more components of the regulator there is provided a pop-off valve **134** connected to the outlet by passage **140**. As the pressure in the outlet exceeds a predetermined value, valve **138** will be lifted off its seat sufficient to permit pressure to build up over the total area of piston **136** whereupon the piston will be forced to the right to permit oxygen to escape into the atmosphere through outlets or vents **144**. It should be noted that normally the pressure is acting only on the small area exposed by disc valve **138**, but as soon as it is lifted off its seat, pressure will act on the total area of the piston **136** to force it violently to the right.

It was previously noted that chamber **18** of capstan pressure reducer **152** is connected to pressure reducer **10** through suitable passages and is normally maintained at a pressure of approximately 55 p. s. i. The capstan pressure reducer is adapted to reduce this pressure to approximately five times the breathing pressure or approximately 500 mm. of mercury (9.6 p. s. i.) in the outlet **21** leading to the pressure suit. If the pressure in outlet **21** and hence in chamber **170** connected thereto by passage **171** is less than the desired pressure of 9.6 p. s. i., bellows **173** will expand due to the action of compression spring **180** to bear against lever **192** to lift the valve **162** off its seat **161**. As the pressure in chamber **170** rises to the predetermined value of 9.6 p. s. i., it will cause the bellows to contract thereby permitting valve **162** to close under the force exerted thereon by spring **166**. The pressure supplied to the pressure suit is determined by the compression of spring **180** and may be set by adjusting screw **184** locked in position by screw **188**.

Various filters are provided throughout the unit to prevent dust, dirt and other foreign matters from interfering with the proper operation of the respective parts. Thus, filter **56** filters the oxygen entering from the source of supply, and filters **194** and **195**, respectively, filter the gas supplied to the breathing mask and to the pressure suit, respectively. A filter **196** prevents dirt from entering passage **144** to impair the operation of piston **136**.

Although only one embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art.

I claim:

1. A high altitude bail-out gas regulator for supplying a gas to a person, bailing out of an aircraft, in an amount determined by his breathing and to a pressurized suit worn by the person to maintain the suit pressure at a predetermined value, comprising a casing having an inlet and a pair of outlets, said inlet being adapted for connection to a source of gas under pressure and one of said outlets being adapted for connection to a breathing mask and the other to the pressurized suit, an inlet chamber in said casing to receive the gas under pressure, a pressure reduction chamber within said casing, normally closed valve means controlling communication between said inlet and pressure reduction chambers, normally restrained pressure responsive valve actuating means in said pressure reduction chamber and operable upon release to engage and actuate said valve means to communicate said inlet and pressure reduction chambers and to maintain the pressure in said latter chamber at a predetermined value, a demand chamber within said casing, a demand valve communicating said pressure reduction and demand chambers and being normally yieldably urged to close communication between said pressure reduction and demand chambers, a venturi communicating said breathing outlet with said demand chamber, a diaphragm responsive to pressure change within said demand chamber for operating said demand valve, means communicating venturi pressure to said diaphragm for aiding the operation of said diaphragm, and pressure reduction means between said pressure reduction chamber and said suit outlet for maintaining the pressure at said last-named outlet substantially constant.

2. A high altitude bail-out gas regulator for supplying a gas to the breathing mask of a person, bailing out of an aircraft, in an amount determined by his breathing comprising a casing having an inlet and an outlet, said inlet being adapted for connection to a source of gas under pressure and said outlet being adapted for connection to the breathing mask, an inlet chamber within said casing, a pressure reduction chamber within said casing, valve means in said inlet chamber communicating said inlet and pressure reduction chambers and being normally yieldably urged to close communication therebetween, pressure responsive valve actuating means in said pressure reduction chamber constructed and arranged to engage and actuate said valve means to maintain a predetermined pressure in said pressure reduction chamber, holding means releasably engaged with said valve actuating means and effective when engaged to maintain said valve actuating means disengaged from said valve means and upon disengagement to permit said valve actuating means to engage said valve means, a demand chamber within said casing, a demand valve communicating said pressure reduction and demand chambers and being normally yieldably urged to close communication between said chambers, a venturi communicating said outlet with said demand chamber, a diaphragm responsive to pressure changes within said demand chamber for operating said demand valve, and means communicating venturi pressure to said diaphragm for aiding in the operation of the latter.

3. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator, comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator in said casing controlling pressure delivered from said conduit means to said first outlet, and a second pressure reducer in said casing controlling pressure delivered from said conduit means to said second outlet.

4. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator, comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask,

a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a susbtantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator in said casing controlling pressure delivered from said conduit means to said first outlet, a pressure relief valve in said first outlet, and a second pressure reducer in said casing controlling pressure delivered from said conduit means to said second outlet.

5. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator, comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator including valve means responsive to pressure variations at said first outlet for controlling flow from said conduit means to said first outlet, and a second pressure reducer responsive to changes in ambient pressure for controlling flow from said conduit means to said second outlet.

6. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator, comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator including diaphragm actuated valve means responsive to a pressure differential between the pressure in said first outlet and ambient pressure for controlling flow from said conduit means to said first outlet, and a second pressure reducer responsive to changes in ambient pressure for controlling flow from said conduit means to said second outlet.

7. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator, comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator including valve means controlling communication between said conduit means and said first outlet, a pressure responsive diaphragm operatively connected to said demand valve means, and a venturi formed in said casing adjacent said outlet whereby flow through said venturi to said outlet actuates said diaphragm to operate said demand valve means, and a second pressure reducer responsive to changes in ambient pressure for controlling flow from said conduit means to said second outlet.

8. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator including a demand chamber having an inlet to said conduit means and an outlet to said first outlet, demand valve means controlling the inlet of said demand chamber, a diaphragm operatively connected to said demand valve, a venturi formed in said casing communicating the outlet of said demand chamber to said first outlet, and passageway means connecting said venturi to one side of said diaphragm whereby flow through said venturi actuates said diaphragm to operate said demand valve, and a second pressure reducer for controlling flow from said conduit means to said second outlet.

9. A bail-out oxygen demand regulator adapted to supply oxygen from a pressurized source of oxygen to the mask and pressurized suit of an aviator comprising a casing having an inlet for connection to the pressurized source of oxygen, a first outlet for connection to the mask, a second outlet for connection to the pressurized suit, and conduit means connecting said inlet to said first and second outlets, a first pressure reducer in said casing controlling pressure delivered from said inlet to said

conduit means, said first pressure reducer including valve means controlling communication between said inlet and conduit means and being normally yieldably biased toward closed position, and pressure responsive means engageable with said valve means and operative when engaged therewith to maintain pressure in said conduit means at a substantially constant value, holding means releasably engaged with said first pressure reducer and effective when engaged therewith to hold said pressure responsive means out of engagement with said valve means and when disengaged therefrom to free said pressure responsive means for operative engagement with said valve means, a demand regulator including a demand chamber having an inlet to said conduit means and an outlet to said first outlet, demand valve means controlling the inlet of said demand chamber, resilient means biasing said demand valve in one direction, a pressure responsive diaphragm operatively connected to said demand valve means, a venturi in said casing intermediate the outlet of said demand chamber and said first outlet, means for transmitting the pressure developed in said venturi due to flow therethrough to one side of said pressure responsive diaphragm, whereby said demand valve means is adjusted relative to the inlet in said demand chamber against the bias of said resilient means, a bleed passage communicating one side of said diaphragm with said demand chamber to inhibit hunting of said diaphragm, and a second pressure reducer controlling flow from said conduit means to said second outlet.

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