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RESERVE DISPOSAL ARRANGEMENT FOR BREATHING APPARATUS

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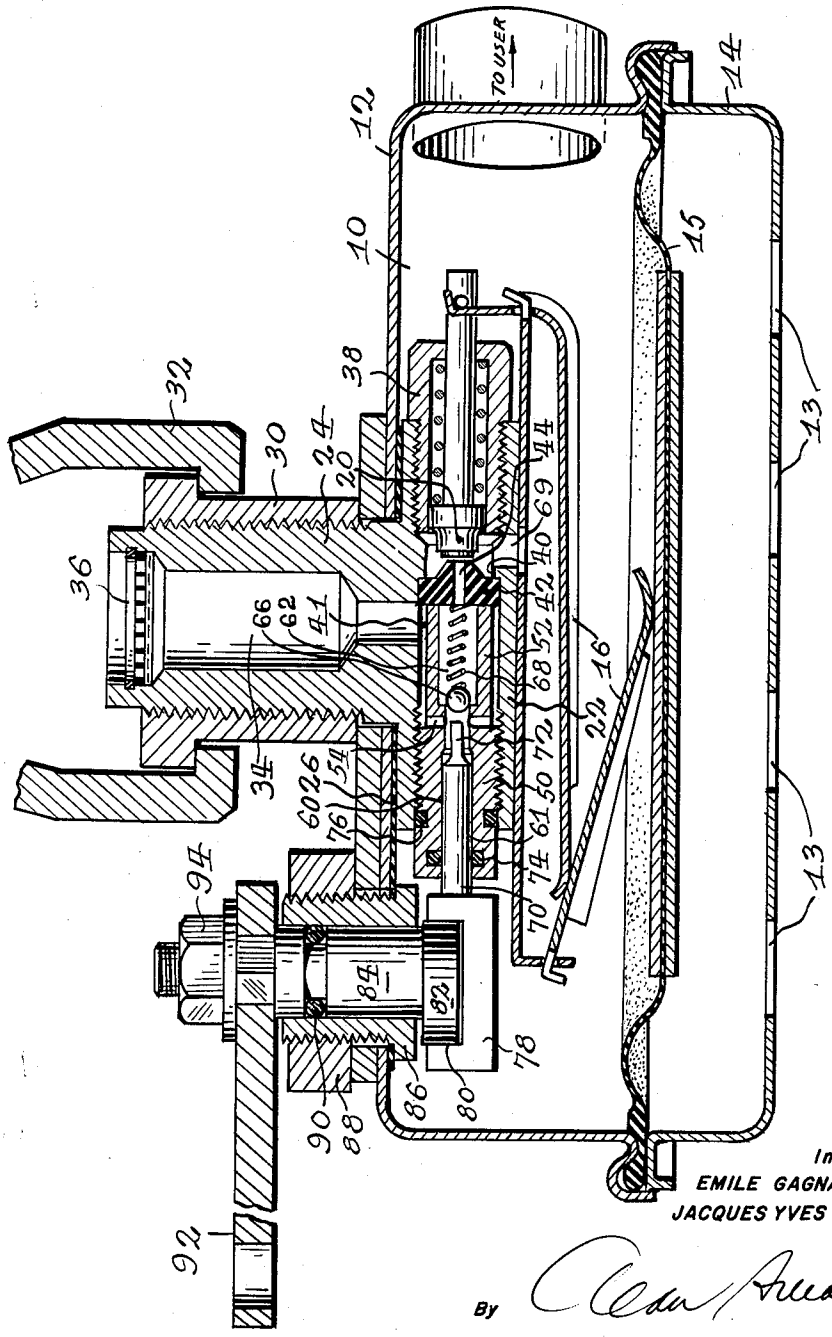


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# RESERVE DISPOSAL ARRANGEMENT FOR BREATHING APPARATUS

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The present invention relates to improvements in reserve disposal arrangements for underwater breathing apparatus.

A problem exists in the use of underwater breathing apparatus in that when the pressurized air within the usual tank or container is nearly used up the actual pressure of air supplied drops to a point where it is not sufficient to overcome the closing pressure on the usual spring biased reserve valve. When this occurs the diver, on finding it hard to breathe, immediately actuates a manual control connected to the reserve valve so that it is opened to its full capacity making the remaining air within the container available to the diver and so gives him sufficient air to proceed to the surface.

There are reserve disposal arrangements available which are designed for this purpose but all of these, known to the applicants, are mounted exteriorly of the usual pressure regulator. Accordingly, this adds to the external structure on the regulator, and more important, if leaks occur, leads to the discharge of air directly into the surrounding water creating disturbing bubbles and of course the loss of such air with respect to the diver.

Further, these known reserve disposal arrangements are disposed in the high pressure area of the apparatus, that is the portion of the apparatus whereby the pressurized gas is conducted to the regulator prior to its controlled release into the relatively low pressure area within the inhalation chamber. This adds to the problem of preventing leaks particularly when such apparatus is utilized in sea water which has a well known depreciating effect on pressure seals or the like.

The present invention provides an improved arrangement of a reserve disposal unit which overcomes these disadvantages by locating the unit within the inhalation chamber of the regulator body and accordingly within the low pressure area of the apparatus.

The accompanying drawing illustrates a preferred embodiment of the arrangement of the invention as it would appear when mounted within the pressure regulator housing 12 of a respiratory apparatus of the type mentioned. The present drawing only shows the regulator body in section, it being normally formed of two circular portions 12 and 14 between which there is clamped a flexible diaphragm or deformable membrane 15 the motions of which, through the levers 16, control the air intake valve 20 controlling the supply of air to the user. The portion 14 includes openings 13 whereby the outer surface of the diaphragm is exposed to the pressure of the surrounding medium.

In the construction shown a main valve supporting body 22 is mounted within the pressure regulator housing 12 so that the tail pipe or air supply portion 24 extends through the top wall of the regulator chamber. A sealing gasket 26 is provided between the valve supporting body 22 and the regulator wall and a threaded sleeve 30 is engaged with the tail portion 24 drawing and retaining it in sealed contact with the regulator. A yoke 32 is utilized to connect a source of air to the sleeve 30 in the usual manner so as to deliver air under pressure through the main air passage 34 of the portion 24. A filter 36 is provided in the upper portion of the passage 34. The valve 20 is supported in a valve supporting member 38



mounted in a boring 40 provided in the valve supporting body 22 transverse to the air passage 34. The valve 20 is spring biased to normally seat against a valve seat 42 having a valve orifice 44.

In accordance with the present invention a further valve supporting member 50 is mounted in the body boring 40 in axial alingment with the valve 20. The front portion 52 of the member 50 is of lesser diameter than the interior of the boring 40 so as to provide a cylindrical air passage 41 leading from the air passage 34 to a boring 54 extending through the member front portion 52. The member 50 is also provided with a stepped axial bore 60, the front enlarged portion 62 of this bore 60 accommodating a ball valve 66 resiliently biased by a spring 68.

With this arrangement, air under pressure proceeds through the passage 34, the passage 41, the boring 54 and by overcoming the resistance of the spring 68, through the bore portion 62 and the valve orifice 44 and from an outlet 69 into the inhalation chamber 10 under the control of the diaphragm 14, as is well known.

A valve engaging stem 70 having a valve contacting end 72 of reduced diameter is mounted for sliding axial movement in a second portion 61 of the bore 60 with seals being made against pressure leaks by sealing rings 74, 76. The outer end of the valve engaging stem is connected to an enlargement 78 having an internal recess 80 adapted to accommodate an actuating cam disk 82 mounted eccentrically on a shaft 84. The shaft 84 is mounted for rotary movement within a threaded sleeve 86 extending through the top wall of the regulator. The sleeve 86 is drawn into and retained in sealed condition by a sealing nut 88, and a sealing ring 90 is provided between the inner wall of the sleeve 86 and the shaft 84. A manually operable lever 92 is connected to the exterior end of the shaft 84 and is retained by a locking nut 94.

With this arrangement, should the pressure of the air delivered to the ball valve 66 from the supply tank, through the passage 34, drop beneath the pressure required to overcome the resistance of the spring 68, the supply of air to the user will be cut off, regardless of the position of the valve 20. The user is then aware that his supply of air is nearly exhausted and he immediately moves the lever 92. This lever movement, through the eccentric cam 82, moves the valve engaging stem 70 inwards to bring the end portion 72 into engagement with the ball valve 66 and permits the air remaining in the supply tank to pass through the valve orifice 44 to the inhalation chamber 10.

It will be appreciated that, in the normal operating condition as shown, there is sufficient clearance from the end 72 of the valve engaging stem 70 to the ball valve 66 to allow the valve to seat if the air pressure drops below a predetermined pressure.

Since the present reserve disposal valve arrangement is wholly disposed within the low pressure area of the regulator, that is within the body of the regulator, the regulator, the problem of maintaining an effective sealing against possible air leakage is substantially eliminated. If there is any leakage, the air released is delivered to the interior of the inhalation chamber and accordingly is utilized by the diver. This is a distinct advantage over the known reserve disposal arrangements which are disposed in the high pressure areas of the apparatus, that is in the portions of the apparatus conducting the highly pressurized air to the regulator.

We claim:

1. A reserve disposal arrangement for underwater breathing apparatus of the type including a pressure regulator having a casing enclosing an inhalation chamber, a supply source of breathable gas under pressure,

an inlet passage in said regulator leading breathable gas from said supply source into said inhalation chamber, a regulating valve controlling the delivery of gas from said inlet passage to said inhalation chamber, a diaphragm controlling by means of levers said regulating valve and actuated by the inhalations of a diver through an outlet passage in said regulator; said reserve disposal arrangement comprising a reserve valve seat in said gas inlet passage between said regulator valve and said supply source, a reserve valve closure member mounted in said gas inlet passage and spring means urging said valve closure member against said valve seat, a reserve valve opening member having one end adapted to engage and displace said reserve valve closure member from said reserve valve seat, said regulator valve, reserve valve seat, reserve valve closure member and reserve valve opening member being mounted in axial alignment wholly within the pressure regulator housing; said reserve valve opening member comprising a cylindrical plunger mounted for sliding axial movement towards said reserve valve closure member, an enlargement on said plunger at the end remote from said reserve valve engaging end, said plunger enlargement having an internal recess and an eccentric cam disk mounted on said recess, said cam disk mounted on a rotatable shaft disposed perpendicularly to the axis of said plunger and extending through a hollow sleeve mounted in a wall of said regulator to a connection with said manually operable reserve valve actuating member, and a sealing means between said shaft and sleeve and said sleeve and regulator wall.

2. A reserve disposal arrangement for underwater breathing apparatus of the type including a pressure regulator having a casing enclosing an inhalation chamber, a



supply source of breathable gas under pressure, an inlet passage in said regulator leading breathable gas from said supply source into said inhalation chamber, a regulating valve controlling the delivery of gas from said inlet passage to said inhalation chamber, a diaphragm controlling by means of levers said regulating valve and actuated by the inhalation of a diver through an outlet passage in said regulator; said reserve disposal arrangement comprising a reserve valve seat in said gas inlet passage between said regulator valve and said supply source, a reserve valve closure member mounted in said gas inlet passage and spring means urging said valve closure member against said valve seat, a reserve valve opening member having one end adapted to engage and displace said reserve valve closure member from said reserve valve seat, said regulator valve, reserve valve seat, reserve valve closure member and reserve valve opening member being mounted in axial alignment wholly within the pressure regulator housing, a manually operable reserve valve actuating member mounted outside said regulator housing and mechanical means of the eccentric type connecting said actuating member with said reserve valve opening member allowing to displace instantaneously the reserve valve closure member by a single manual motion of said actuating member.

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