Aug. 22, 1950 H. L. BURNS ET AL 2,519,349

EXHALATION VALVE

Filed Oct. 8, 1945

Fig 1

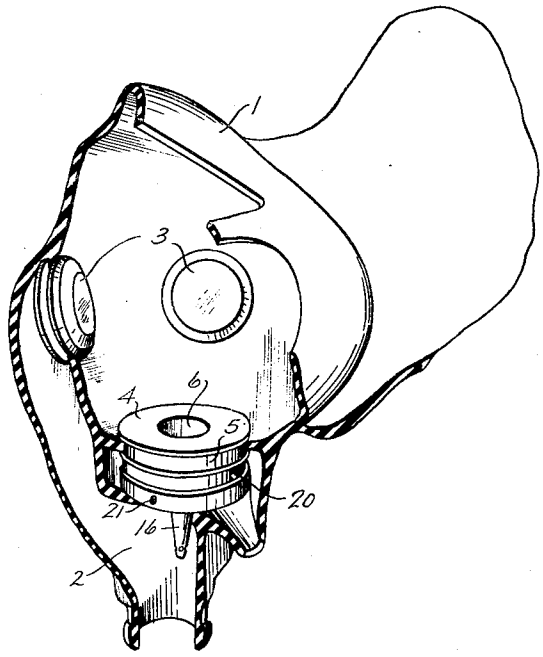


Fig 2

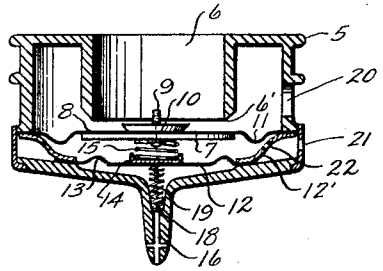
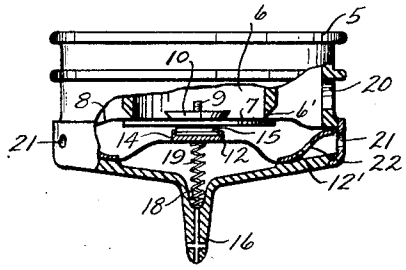


Fig 3



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EXHALATION VALVE

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1

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

This invention relates to a new and improved exhalation valve.

A primary object of the invention is to provide an exhalation valve for oxygen masks and the like that will permit exhaust gases to escape from the mask only after a predetermined pressure has been attained within the mask. In the present type of oxygen masks in common use for pressure breathing, an exhalation valve is provided which is subjected to load pressure of the incoming gas on one side with an additional spring pressure applied thereto and to pressure within the mask on the opposing side which will permit the exhaust valve to open and release the exhaust gas within the mask only when the pressure within the mask overcomes the pressure exerted by the load of the incoming gas and spring. In the event of a leakage of the conventional check valve controlling the flow of gas into the facepiece of the mask or in the event of failure of the pressure regulator at the source of oxygen supply to regulate the pressure of gas flowing into the mask, the pressure against both sides of the valve is equalized and the valve is rendered inoperative forcing the user to remove the mask in order to exhale. It is an object of the invention to provide an exhalation valve that will function at all times to permit the user to exhale upon attaining a predetermined pressure within the mask.

Another object of the invention is to provide an exhalation valve that will permit the user to exhale at a predetermined pressure within the mask where the flow of oxygen is not regulated as with an oxygen bottle commonly used when performing parachute jumps from high altitudes.

Other and further objects and advantages of the present invention will be apparent to those skilled in the art from a consideration of the following description of a specific embodiment of the invention shown in the accompanying drawings in which:

Fig. 1 is an elevational sectional view of the facepiece of the conventional mask showing the exhalation valve mounted therein.

Fig. 2 is an elevational sectional view of the valve assembly and

Fig. 3 is an elevational plan view with the housing broken away showing the valve in closed position.

Referring now more specifically to the drawing, the numeral 1 designates the facepiece of the conventional oxygen mask having the passageway 2 and the check valves 3, 3 therein.

2

The valve assembly 4 is mounted in said mask in the conventional manner, said valve assembly having the rigid housing 5 and the port 6 in the upper end of said housing. The internal wall of said port 6 extends downwardly into said casing and the lower end of said wall forming a valve seat 6'. Mounted within said housing 5 is the valve 7 having the exhaust diaphragm 8 constructed of rubber or similar material mounted thereon by means of the bolt 9 and nut 10. The exhaust diaphragm 8 has the annular bead 11 adjacent the outer edge thereof to permit the movement of said diaphragm. The loading diaphragm 12 is mounted in the lower end of the housing, and is constructed to provide an effective load area of less circumference and consequently less load capacity than the port 6, the annular outwardly flared ring 12' anchoring said exhaust diaphragm and loading diaphragm within the housing. The loading diaphragm 12 has the annular bead 13 adjacent the outer edge thereof to permit the movement of said diaphragm. Mounted on the loading diaphragm 12 is the spring retainer 14 in which the spring 15 is seated, exerting opposing pressure against the valve 7 and loading diaphragm 12. The lower end of the casing 5 has the downwardly extending tubular passageway 16, the internal walls thereof being flared providing the internal annular shoulder 18. Mounted on said annular shoulder 18 is the coil spring 19, the upper end of said spring 19 exerting pressure on the loading diaphragm 12. The housing 5 has the outlet port 20 through which exhaust gas escapes when the valve 7 is in open position. The port 21 in the housing 5 and the port 22 in the annular ring 12' permits the equalization of barometric pressure between the exhaust and loading diaphragms and the atmosphere.

In operation, the pressure flow of oxygen to the mask is predetermined and controlled by regulators at the source of supply. The oxygen flows into the mask through passageway 2 and through check valves 3, 3 into the inside of the facepiece of the mask. The pressure of gas in the passageway 2 is transmitted to the diaphragm 12 through the passageway 16, forcing the diaphragm 12 upwardly against the valve 7, moving same into closed position with valve seat 6'. Upon pressure being built up in the mask by the flow of gas through the check valves 3, 3 and by the exhalation of the wearer, said pres-

sure will act upon the valve 7. The circumference or the cross-sectional area and the consequent load capacity of the port 6 in conjunction with the effective area of diaphragm 8 being greater than that of the effective area of the diaphragm 12, only sufficient additional pressure over that of the loading diaphragm 12 is required to overcome the resistance of the spring 19 to permit the valve 7 to move downwardly out of engagement with the valve seat 6' and permit pressure in the mask to be relieved by the exhaust gas flowing through port 20. Immediately upon reduction of the pressure within the mask, the spring 19 and the pressure of the incoming gas against the diaphragm 12 will close the valve 7 maintaining the predetermined pressure in the mask until by exhalation of the wearer the pressure is again built up to a point where the valve 7 will again open. The pressure differential required to operate the exhaust diaphragm is graduated, becoming less as the pressure of incoming gas increases, until a point is reached where the pressure required to operate the exhaust diaphragm is equal to that of the incoming gas, at which point the exhaust valve, because of the greater pressure effective area, will depress the spring 19 and remain open, allowing the gas in the facepiece of the mask to escape through the port 20 until the gas pressure in the facepiece of the mask is reduced below the point of equalization, at which time the normal operation of the assembly as heretofore described is resumed.

No claim of invention is made to the construction herein described except the feature of providing an exhaust port of greater load capacity than the loading means, permitting the exhaust valve to open under any circumstances, upon reaching a predetermined maximum pressure within the facepiece of the mask.

Having thus described our invention, what we claim is new and desire to secure by Letters Patent of the United States is:

1. An exhalation valve assembly comprising, a housing adapted to be mounted in the facepiece of a pressure breathing mask, an inlet port and an outlet port in said housing, a valve in said housing controlling the fluid flow through the inlet and outlet ports, a pressure responsive means in said housing subjected to inlet and outlet pressures operatively connected to said valve for operation thereof, a load pressure responsive means in said housing having a lesser working pressure area than said first mentioned pressure responsive means, resilient means positioned between said first mentioned pressure responsive means and said load pressure responsive means and resilient means positioned between said load pressure responsive means and the housing wall to resiliently hold said valve and both pressure responsive means in a predetermined related position, and a passageway in said housing to permit the application of fluid under pressure to said load pressure responsive means for closing said valve whereby

pressure of fluid in said inlet port equal to or greater than the pressure of fluid on said load pressure responsive means effects valve opening.

2. An exhalation valve assembly having a valve housing, a valve in said housing, an exhaust diaphragm mounted on said valve, a load diaphragm in said housing, an annular retainer ring anchoring said diaphragms within the housing, means between said diaphragms holding same in position, a load pressure inlet port in said housing, means mounted in said port for exerting mechanical pressure against said load diaphragm, an exhalation port in said housing of greater load capacity than the pressure area of the load diaphragm, the lower end of said exhalation port forming a valve seat for said valve.

3. In a valve assembly, a housing, an inlet port and an outlet port in said housing, a valve controlling said ports, an exhaust diaphragm and a load diaphragm actuating said valve, a spring retainer mounted on said load diaphragm, a coil spring seated in said spring retainer, said spring acting against said exhaust diaphragm and said load diaphragm, a tubular passageway in said housing to permit the application of fluid pressure to said load diaphragm, a spring mounted in said tubular passageway exerting pressure against said load diaphragm, said exhaust diaphragm having a greater pressure effective area than said load diaphragm.

4. In an exhalation valve assembly of the character described, a housing, an inlet port and an outlet port in said housing, a valve in said housing, an exhaust diaphragm and a load diaphragm actuating said valve, said exhaust diaphragm having a greater pressure effective area than the said load diaphragm, means for applying constant fluid pressure to said load diaphragm to hold the valve in closed position, said inlet port having a cross-sectional area of proper size for admitting sufficient fluid pressure to said exhaust diaphragm to overcome said pressure upon said load diaphragm.

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