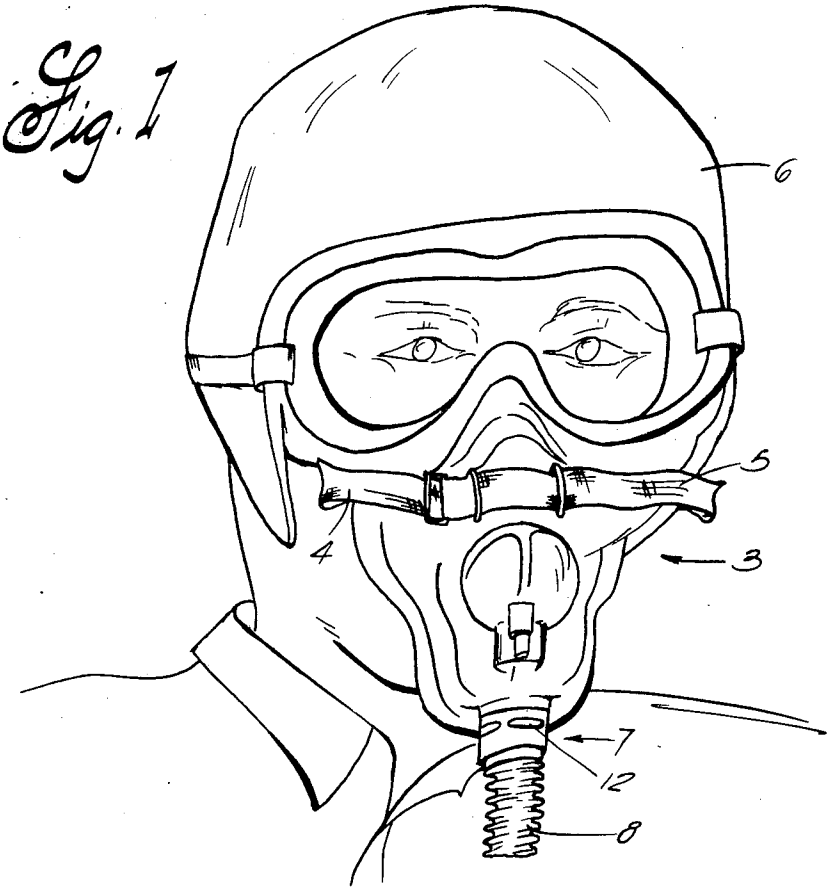
Jan. 3, 1961 A. BLOOM 2,966,917

COMBINATION VALVE FOR BREATHING EQUIPMENT

Filed Feb. 8, 1955

Fig. 1



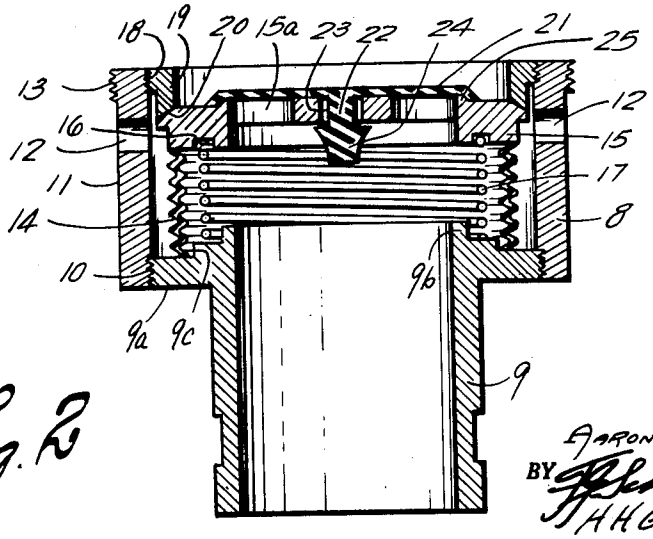


Fig. 2

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COMBINATION VALVE FOR BREATHING EQUIPMENT

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(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to breathing mask equipment and the like and more particularly to a novel and improved valve element therefor.

In the construction and design of various types of breathing masks and other similar equipment it is ordinarily necessary and desirable to provide a suitable valve structure whereby purified air, oxygen or the like from a suitable source may be drawn and withdrawn with minimum resistance into and from the mask during the alternate inhalation and exhalation portions of the respiratory cycle. Moreover, valve apparatus suitable for use with breathing equipment of this type must be arranged and designed so as to prevent undue escape of the incoming gases to atmosphere as the wearer of the mask inhales and the back flow of exhaled gases toward the gas source as he exhales. Although various types of valves and valve systems have been devised heretofore for use with such equipment, considerable difficulty has been experienced in the past in providing a valve element which is relatively simple in construction and yet entirely reliable and effective in operation.

It is a principal object of the present invention to provide a novel and improved valve element for breathing masks and other similar equipment.

It is a further object of the present invention to provide a novel and improved combination inhalation and exhalation valve assembly for breathing equipment which is reduced in weight, relatively simple in construction and effective in use.

It is a further object of the present invention to provide a novel and improved valve element for breathing equipment which limits respiratory resistance and prevents undue back flow of the exhaled gases toward the air or oxygen supply source.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is an illustration in perspective of a preferred embodiment of the present invention as it is used with its associated breathing mask equipment.

Figure 2 is a cross sectional view of the valve assembly shown in Figure 1.

In general the improved valve assembly of the present invention includes a valve housing having a valve seat positioned therein, a perforated member slidably positioned in the housing that at times engages and effects a seal with the valve seat in the housing, and a check valve, which moves toward and away from a sealing engagement with the perforations in the member. It has been found that such a valve though relatively simple in construction provides particularly efficient and reliable results in use

with the various types of breathing equipment and the like.

A preferred embodiment of the present invention is illustrated in Figures 1 and 2 of the drawing. As shown therein, the face mask which is generally indicated by reference numeral 3 is preferably positioned and secured by means of the strap members 4 and 5 to the individual's helmet or the like 6. The inhalation and exhalation valve assembly 7 to which the present invention is primarily directed is preferably positioned as shown at the base of the mask 3 adjacent its connection with the upper extremity of the flexible conduit or the like 8. Though not shown in the drawing as will be more apparent hereinafter, any suitable supply source of air, oxygen or the like is operatively connected to the other extremity of the conduit 8.

Although a preferred mask and helmet is shown in Figure 1 of the drawing and is referred to hereinabove, it is to be understood that any other suitable mask and/or helmet equipment could be used without departing from the spirit or scope of the present invention.

Referring now to the valve assembly 7 which is shown in detail in Figure 2 of the drawing, the tubular member 9 which forms the lower portion of the valve assembly is coupled to the flexible air supply duct or the like 8 in any suitable manner. The flanged portion 9*a* of the tubular member 9 is preferably externally threaded as shown at 10 to engage the complementary internal threads of the upwardly extending sleeve 11 which together with the tubular member 9 forms the outer shell of the valve structure. As will be more apparent thereinafter the various ports 12 located about the periphery of the sleeve 11 are adapted to vent the interior of the shell to the atmosphere.

The upper extremity of the sleeve 11 is preferably externally threaded as shown at 13 to engage complementary internal threads in the base of the mask assembly 3.

The bellows element or the like 14, which is securely affixed and sealed in any suitable conventional manner to the upper surface of the flange portion 9*a* of the tubular member 9 and extends upwardly therefrom, is similarly secured to the lower surface of the disk member 15 which is slidably positioned within the sleeve 11. The annular groove 16 in the base of the disk member and the annular boss 9*b* on the upper extremity of the tubular member 9 supports and guides the helical compression spring 17 between the disk and the tubular member and as will be more apparent hereinafter normally biases the disk toward its uppermost position in the sleeve member. The step portion 9*c* between the flange portion of the tubular member and the boss thereon is preferably provided to separate the bellows element from the helical spring and maintain the relative concentiric disposition shown therebetween.

The inner surface of the sleeve 11 is preferably threaded as at 18 to engage the complementary external threads of the annular member or the like 19 which extends downwardly into the chamber formed by the sleeve. The lower extremity of the annular member 19 is preferably beveled as shown at 20 to provide the annular valve seat for the complementary and juxtaposed beveled upper edge of the disk member 15. In this way as will be more apparent hereinafter a substantially airtight seal is normally maintained between the interior of the annular member 19 and the atmosphere through ports 12 in the sleeve 11.

The disk-shaped diaphragm check valve element or the like 21 preferably includes the axially disposed stem element 22 which extends downwardly from the lower surface of the check valve element and passes through the centrally located aperture 23 in the disk member 15. The

flanged extremity 24 of the valve stem 22 is adapted to allow limited movement of the check valve with respect to the disk member 15 but prevent its complete disengagement from the aperture 23 formed therein. In this way as will be more apparent hereinafter the flow of air from the flexible conduit 8 and the supply source not shown in the drawing connected thereto is permitted during the inhalation portion of the respiratory cycle.

As shown in the drawing the upper surface of the disk member 15 is preferably raised or embossed as at 25 to cooperate with the downwardly angulated peripheral extremity of the check valve 21 so as to provide an improved seal thereat.

In operation during the inhalation portion of the respiratory cycle the helical compression spring 17 causes the beveled portion of the surface of the disk member 15 to securely engage the annular valve seat formed by the annular member 19 and to isolate the interior of the mask from communication with the atmosphere through the ports 12 in the sleeve 11. As the individual wearing the mask begins to inhale the suction thus created together with the relatively small pressure at which the air from its supply source is maintained, lifts the check valve 21 from the embossed upper surface of the disk member 15 and allows air to flow from the source through the perforations 15*a* into the mask with practically negligible resistance. When, however, the individual begins to exhale the pressure of the exhaled air causes the check valve 21 to again seat itself upon the annular embossed portion of the disk member and to seal off communication between the interior of the mask and the air or gas supply source. The pressure of the exhaled air or gas also causes the entire disk member 15 to be moved downwardly against the bias of the helical spring 17 such that the exhaled gases are vented to the atmosphere through the ports 12 in the sleeve 11.

It is to be understood that although the above described valve assembly is particularly useful with the various forms of breathing equipment for masks and the like, it could also be used as a combination valve for any other suitable purpose without departing from the spirit or scope of the present invention.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described:

What is claimed is:

1. In respiratory apparatus a valve which respectively vents exhaust tidal gases of a pulmonar subject to the atmosphere and admits a fresh supply of gas from a suitable source during alternate exhalation and inhalation portions of the respiratory cycle said valve comprising a valve housing, said housing having a port which connects the interior of the housing with the atmosphere; means forming a valve seat within the housing; a valve member within the housing which normally engages the valve seat and subdivides the interior of the housing into a pair of chambers and which has an aperture therethrough that interconnects the chambers, one of the said chambers being an inlet chamber adapted to receive a fresh supply of gas and the other said chamber being an outlet chamber communicating with the port in the valve housing during the exhalation portion of the respiratory cycle; flexible means connected between the valve member and the internal peripheral surface of the housing and arranged to seal off the inlet chamber from the port in the housing; spring means for normally biasing the valve member towards its valve seat engaging position; and a diaphragm-type check valve which is adapted to move toward and away from a sealing engagement with the apertured valve member.

2. A valve according to claim 1 further including means for limiting movement of the check valve away from the disk member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,239,169	Franck	Apr. 22, 1941
2,261,885	Kowacz	Nov. 4, 1941
2,264,656	Briscoe	Dec. 2, 1941
2,647,727	Edwards	Aug. 4, 1953
2,698,054	Brown	Dec. 28, 1954
2,820,469	Seeler	Jan. 21, 1958

FOREIGN PATENTS

186,340	Switzerland	Jan. 16, 1937
103,440	Sweden	Jan. 5, 1942
734,899	Germany	Apr. 30, 1943
622,821	Great Britain	May 9, 1949
1,048,542	France	Dec. 22, 1953