July 2, 1946. J. BROWNE 2,402,984

SELF CONTAINED BREATHING LUNG

Filed Aug. 4, 1944 4 Sheets-Sheet 1

Fig. 9

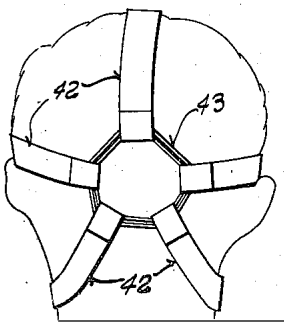
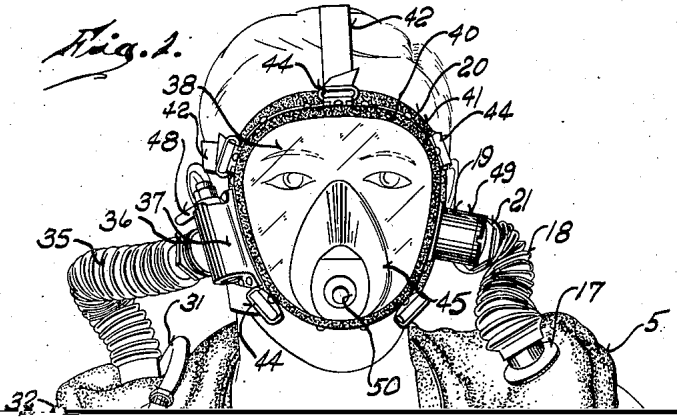



Fig. 1.

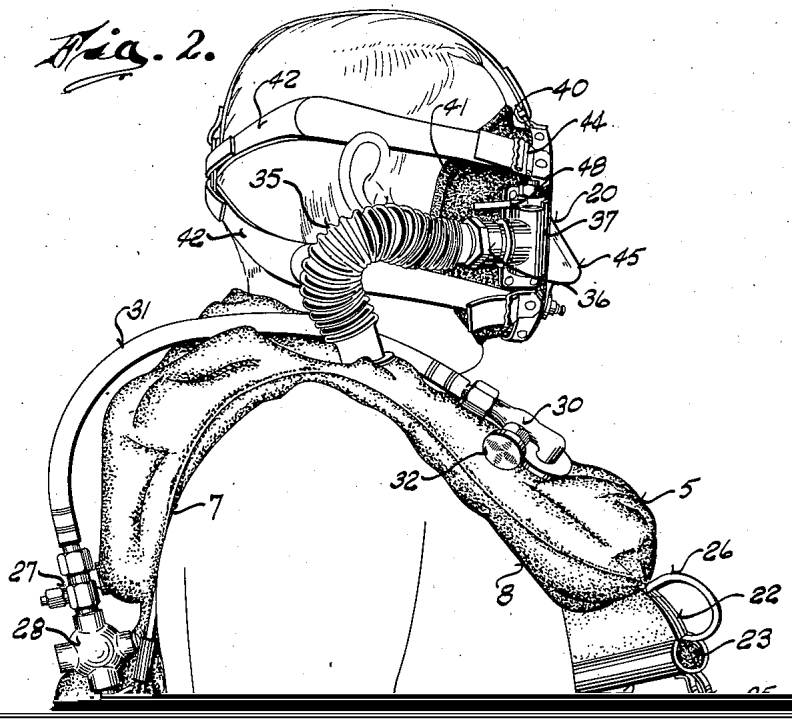


July 2, 1946. J. BROWNE 2,402,984

SELF CONTAINED BREATHING LUNG

Filed Aug. 4, 1944 4 Sheets-Sheet 2

Fig. 2.

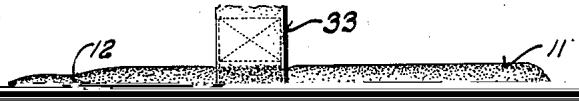


July 2, 1946. J. BROWNE 2,402,984

SELF CONTAINED BREATHING LUNG

Filed Aug. 4, 1944 4 Sheets-Sheet 3

Fig. 4.

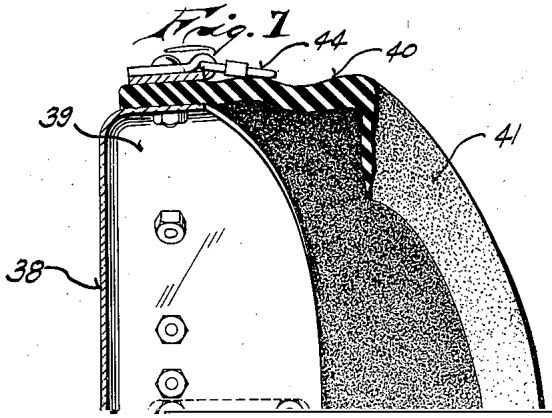


July 2, 1946. J. BROWNE 2,402,984

SELF CONTAINED BREATHING LUNG

Filed Aug. 4, 1944 4 Sheets-Sheet 4

Fig. 7



Patented July 2, 1946

2,402,984

# UNITED STATES PATENT OFFICE

2,402,984

## SELF-CONTAINED BREATHING LUNG

Jack Browne, Milwaukee, Wis., assignor to Diving Equipment and Supply Company, Inc., a corporation of Wisconsin

Application August 4, 1944, Serial No. 548,063

6 Claims. (Cl. 128—142)

1

This invention relates to diving equipment and refers particularly to a self contained breathing apparatus or lung especially designed for shallow diving and all types of under water service not requiring long periods of submersion.

One of the objects of this invention is to provide a self contained breathing lung which is light and not cumbersome to the wearer.

Another object of this invention is to provide a self contained breathing lung which may be used on the surface as a life preserver and which is so designed that even after the supply of oxygen or other life sustaining gas under pressure is exhausted buoyancy may be maintained by manually blowing up the breathing bag of the apparatus.

More specifically it is an object of this invention to provide an under water breathing lung wherein the breathing bag itself constitutes the supporting carrier for the various elements of the apparatus.

In this connection, it is a further object of this invention to provide an apparatus of the character described wherein the air purifying canister is contained within the breathing bag, being inserted through an opening in the bag which is held tightly closed by a simple sealing means.

Another object of this invention resides in the provision of means for insuring an open inhaling connection to the life sustaining gas in the breathing bag regardless of the position of the wearer in the water and the possibility of that part of the bag to which the inlet hose is connected being deflated.

Another object of this invention is to provide a mask of improved design and construction suitable for use with apparatus of this type and which is so designed that the space within the mask in which exhaled air might accumulate is reduced to a minimum.

A further object of this invention is to provide an improved manner of effecting a fluid-tight seal between the mask and the face of the wearer.

Still another object of this invention is to provide means whereby a portion of the breathing bag may be collapsed to prevent its ballooning and thus insure other portions of the bag being expanded.

With the above and other objects in view which will appear as the description proceeds, this invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

2

The accompanying drawings illustrate two complete examples of the physical embodiments of the invention constructed according to the best modes so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a front view of a self contained breathing lung embodying this invention and illustrating its manner of use;

Figure 2 is a side view thereof;

Figure 3 is an enlarged side view of the mask;

Figure 4 is a plan view of the breathing bag with parts thereof broken away and in section;

Figure 5 is a detail sectional view taken through Figure 4 on the plane of the line 5—5;

Figure 6 is a sectional view similar to Figure 5 but showing part of the bag collapsed to prevent ballooning thereof;

Figure 7 is an enlarged vertical sectional view through the mask;

Figure 8 is a plan view similar to Figure 4 but showing a slightly altered arrangement of the bag; and

Figure 9 is a view showing the back of the wearer's head and illustrating the manner in which the mask attaching straps are maintained under tension.

Referring now more particularly to the accompanying drawings in which like numerals indicate like parts, the numeral 5 designates a fabric breathing bag made of canvas or any suitable fabric. In its outer outline the bag is substantially oblong in shape as generally shown in Figure 4, but a hole 6 in its medial portion gives the bag a substantially doughnut-like construction.

As shown in Figures 1 and 2 the breathing bag is worn by being draped over the shoulders of the wearer like a collar with the neck received within the hole 6 and with one end portion 7 of the bag at the back of the wearer and the opposite end portion 8 at the front of the wearer.

The end portion 7 is closed by a seam 9 covered by rubber tape 10 and beyond the seam the bag has a pocket 11 open at one side of the bag for the reception of an oxygen tank or bottle 12. Lacing 13 closes the open end of the pocket 11 to hold the oxygen tank in place.

The opposite end of the bag is open to permit access into the interior thereof, and an air purifier canister 14 inserted through this open end is located within the bag The outlet of the canister opens directly into the bag. Its inlet 15 has a flexible hose 16 detachably connected thereto, the opposite end of which is connected to a fit-

ting 17 which is secured in one wall of the bag at a point so located as to be substantially over the shoulder of the wearer. Another section of flexible hose 18 is connected to the fitting 17 and leads from the bag to the outlet port 19 of a mask 20 to which it is removably connected by a coupling 21.

In effect, therefore, the outlet port 19 of the mask is connected to the inlet of the canister 14 by a flexible hose which passes through the wall of the bag.

The opening in the end 8 of the bag has rubber straps 22 secured to its opposite side edges. These straps are joined at their ends and have ribs 23 projecting from the outer surfaces thereof. A channel shaped clamping member 24 is slidingly engageable with the rubber straps 22 to hold the same firmly together, the ribs 23 guiding the clamping member in its sliding movement.

To facilitate sliding the clamping member 24 onto and from the rubber straps, handle loops 25 are secured to the ends thereof and loops 26 are secured to the adjacent edges of the bag.

The air purifier canister 14 contains a chemical suitable for absorbing the carbon dioxide from the exhaled breath. Soda lime may be used for this purpose.

Oxygen from the tank 12 is discharged directly into the interior of the bag through a metering valve 27, the inlet of which is connected to the oxygen tank through a pressure reducing valve 28. A conventional shut-off valve 29 on the tank provides a manual control for the main oxygen supply.

The valve 27 meters the influx of oxygen and maintains the same at a given fixed rate. For emergency purposes a manually operable inlet valve 30 connected to the valve 27 by a hose 31 and opening into the interior of the bag is conveniently located at the front portion of the bag. The valve 30 has a control knob 32 within easy reach of the wearer and enables quick increase of oxygen supply if emergency conditions call for this measure.

Straps 33 and 34 secured to opposite ends of the bag provide means by which the bag may be secured in position on the wearer, the straps being adapted for attachment to a belt (not shown) or to pass under the wearer's crotch.

A flexible hose 35 is connected to the bag at a point substantially opposite the fitting 17 to open directly into the interior of the bag. Like the hose 18, the hose 35 has a coupling 36 by which it is attachable to an inlet port 37 on the mask 20.

The mask 20 comprises a front wall 38 of transparent plastic material, the marginal edge of which has a flange 39 formed integrally therewith and extended rearwardly. Secured to this flange 39 is a side wall 40 of rubber or other similar suitable elastically deformable material. Obviously, the attachment of the rubber side wall 40 to the flange 39 is so effected as to insure a fluid-tight connection. The edge of the rubber side wall is shaped to fit the face as shown in Figures 1 and 2 and has a feathered marginal edge portion 41 adapted to lie flat against the face and be held thereagainst by pressure within the mask. In this manner a soft secure fit is possible between the mask and the wearer's face.

Straps 42, one connected to the top and two connected to each side of the mask, serve to hold the mask in position. These straps are all connected to a rubber ring 43 located at the back of the wearer's head and the free ends of the straps



are adjustably secured to the mask by suitable fasteners 44.

The front wall 38 of the mask has an outward protrusion 45 shaped to receive the nose of the wearer and thus enable the mask to closely fit the wearer's face. Inasmuch as the wearer exhales directly into the mask it follows that the interior of the mask constitutes a pocket for foul air which if large enough would result in serious consequences.

For this reason the mask is so shaped that it fits the face of the wearer quite closely and thus reduces to a minimum the dead air space within the mask.

The inlet port 37 which is mounted on one side of the mask opens to the interior thereof through a hole 46. A light rubber flap valve 47 secured to the side of the mask over the hole 46 provides a check valve closed against exhalation, but adapted to open immediately upon inhalation.

The port 37 also includes a manually controlled rotatable valve plug adapted to be actuated by a handle 48. Shoulders on the body of the inlet port engage the handle 48 to define the open and closed positions of the valve plug.

The outlet port 19 which is secured to the opposite side of the mask incorporates a check valve 49, the valve element of which (not shown) is spring urged to a closed position and is adapted to be opened upon exhalation.

A manually operable relief valve 50 in the front wall of the mask provides means for manually relieving pressure within the mask in the event it builds up beyond a comfortable value.

In use the wearer places the bag over his head as illustrated, and secures the fastening straps 33 and 34 to hold the bag down on his shoulders. The mask with the inlet and outlet ducts attached to their respective ports is then strapped in place.

With the main valve 29 open and the metering valve 27 adjusted to maintain the desired flow of oxygen into the interior of the bag the wearer is ready to submerge.

Obviously, upon inhalation air is drawn directly from the bag into the mask and upon exhalation the air expelled is forced through the purifier canister 14.

To insure the wearer a continuous supply of air notwithstanding that his position in the water might collapse that side of the bag to which the inlet hose 35 is attached, a non-collapsible duct 51 is so positioned within the bag as to extend around the back of the wearer's neck from one side of the bag to the other with one end of the duct adjacent to the inlet end of the hose 35.

Consequently, even though the bag may collapse adjacent to the point of connection of the hose 35 communication is always maintained to some part of the bag which remains expanded.

To prevent the bag bursting due to internal pressure a relief valve 52 is provided.

In the embodiment of the invention described the oxygen tank 12 is located at the back and the purifier canister in the front. In the modified embodiment of the invention shown in Figure 8 the location of these parts is reversed and the opening to the interior of the bag is shorter than the full width thereof.

With this arrangement the valve handle 29 for the oxygen tank is in front of the wearer as is also the metering control valve 53 which in this case provides the only adjustment for the rate of oxygen flow into the interior of the bag.

From the foregoing description taken in con-

nection with the accompanying drawings, it will be readily apparent to those skilled in the art that this invention provides an under water breathing lung which is sufficiently light and compact to enable swimming under water and performing many operations which cannot be conveniently accomplished with conventional type diving equipment.

It will also be apparent that this invention provides a combination under water breathing lung and life preserver, for on the surface the inflated bag provides adequate buoyancy to support the



protruding through said hole and with one end portion of the bag overlying the back of the wearer and the other end portion overlying the front of the wearer; means whereby the wearer inhales air directly from the interior of the bag including a flexible hose connected to the bag at that portion thereof which overlies the shoulder of the wearer; and straps carried by one wall of the bag and connected with the opposite wall of the bag at said one end portion of the bag which overlies the back of the wearer and by