Nov. 14, 1944. C. J. LAMBERTSEN 2,362,643

BREATHING APPARATUS FOR USE UNDER WATER

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Fig-1

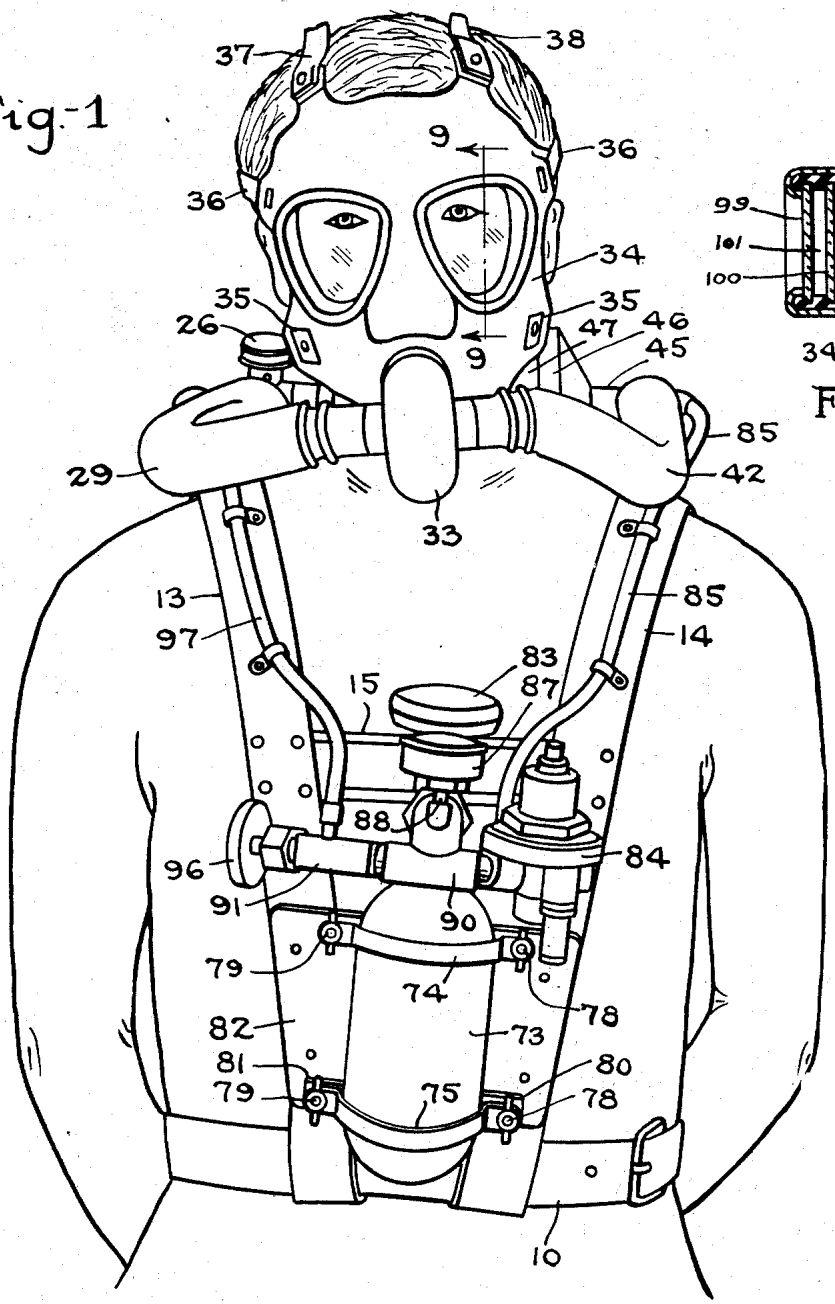

Fig-9

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BREATHING APPARATUS FOR USE UNDER WATER

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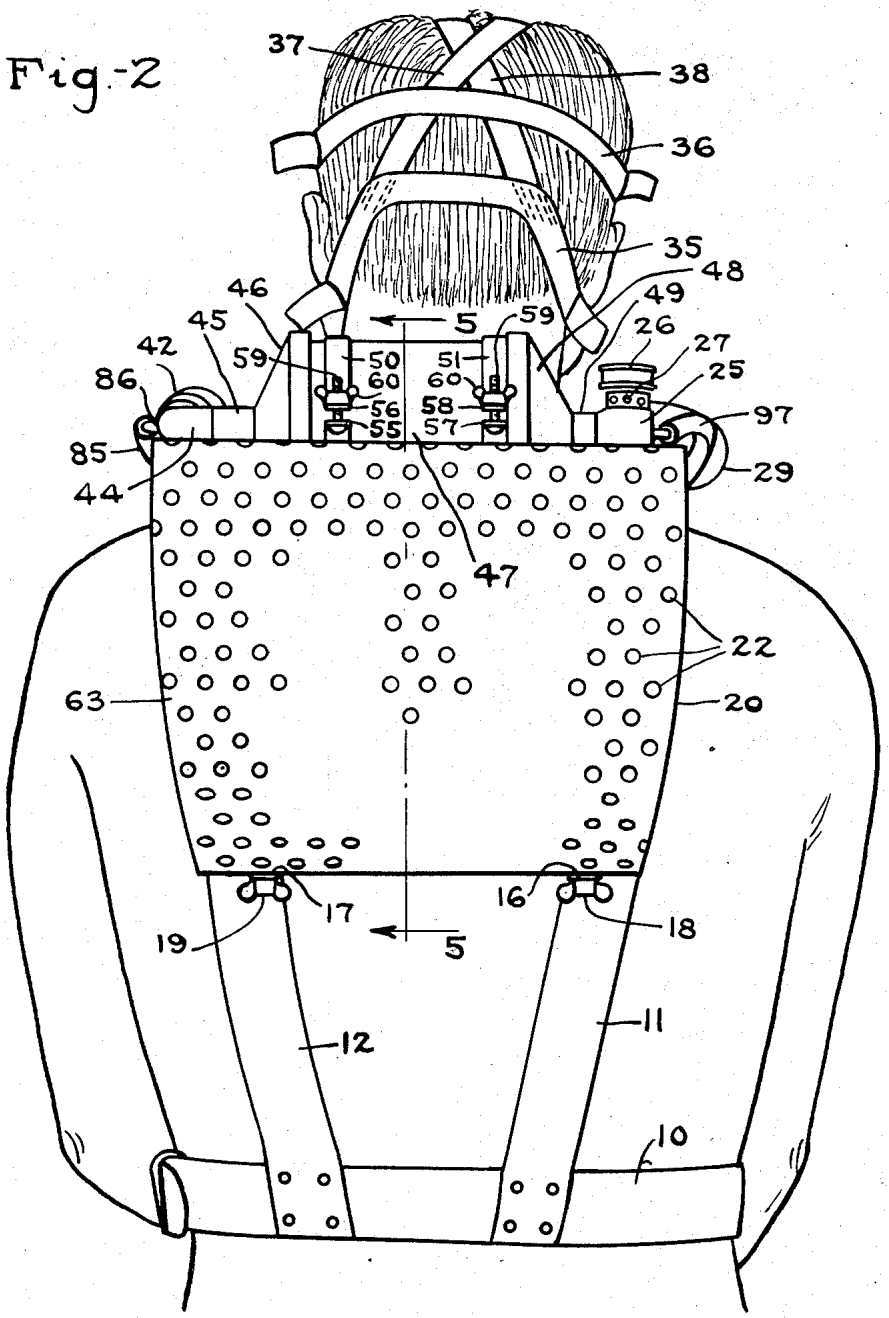
Fig. 2



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BREATHING APPARATUS FOR USE UNDER WATER

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Fig.-3

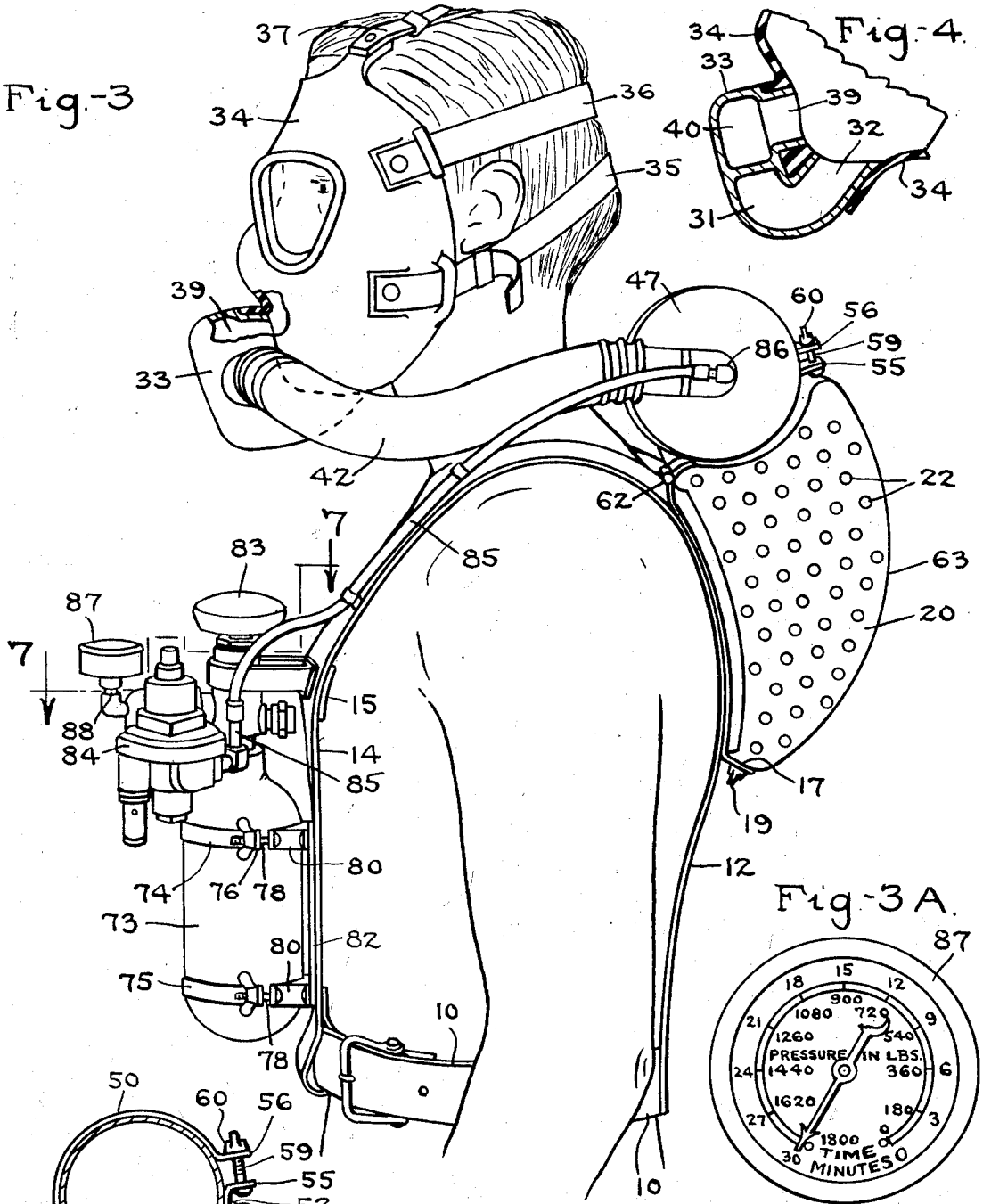

Fig.-4.

Fig.-3A.

Fig.-5

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Nov. 14, 1944. C. J. LAMBERTSEN 2,362,643

BREATHING APPARATUS FOR USE UNDER WATER

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Fig-6

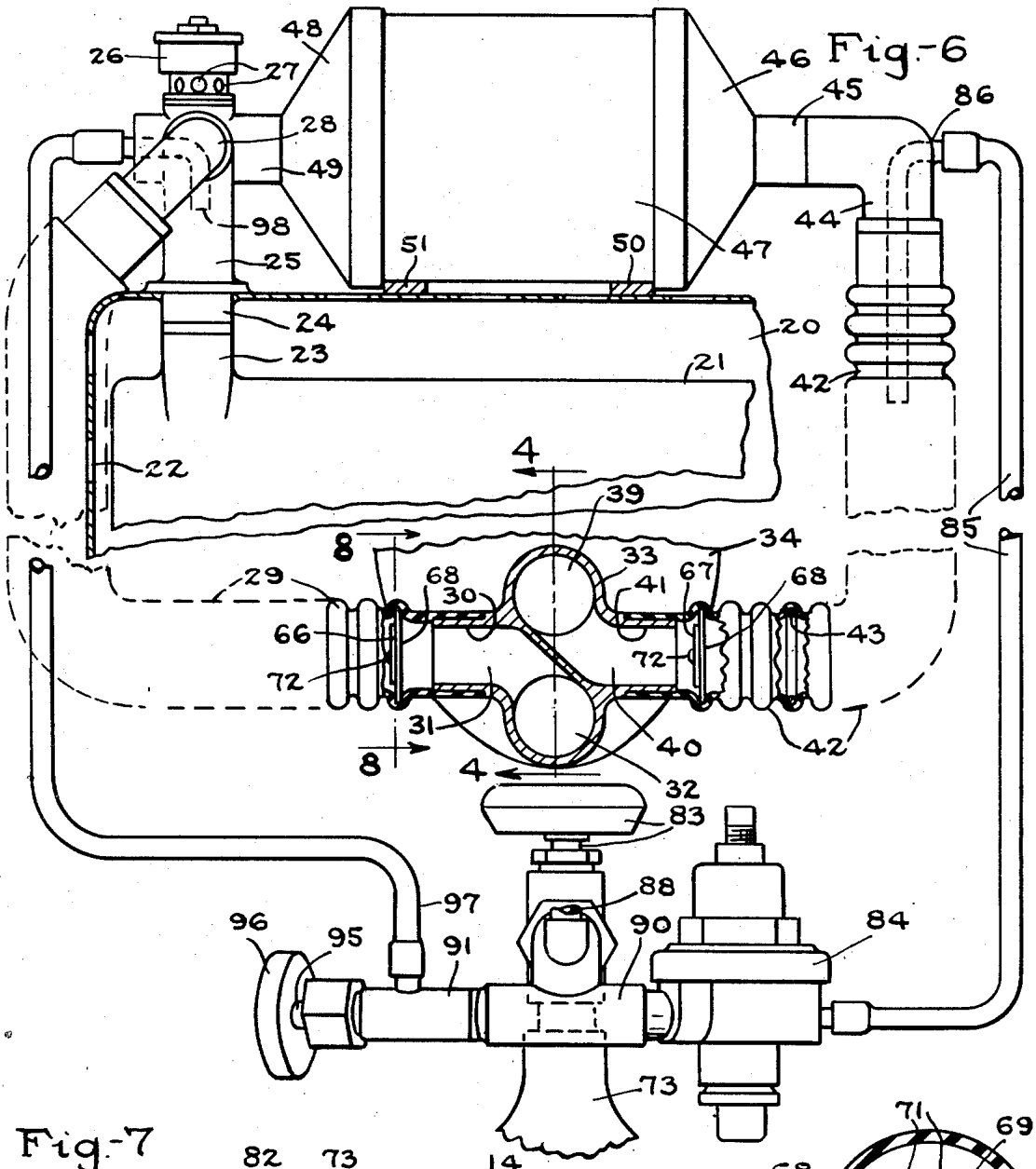
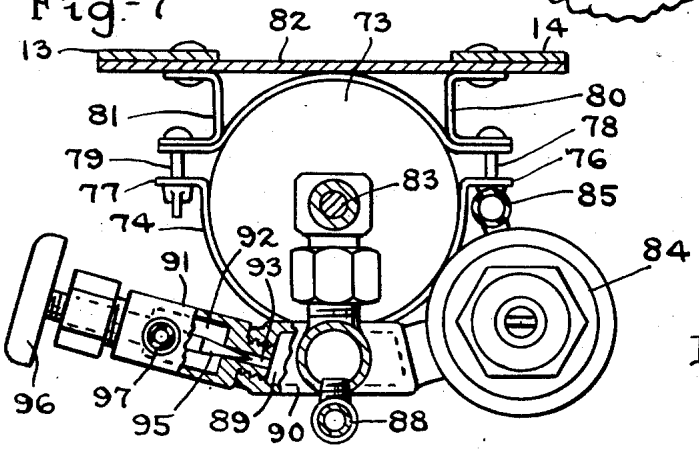


Fig-7



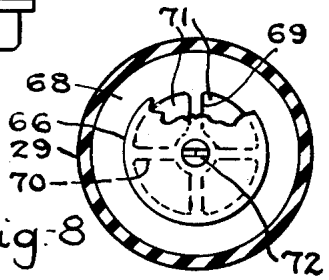


Fig-8

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Patented Nov. 14, 1944 2,362,643

UNITED STATES PATENT OFFICE

2,362,643

BREATHING APPARATUS FOR USE UNDER WATER

Christian J. Lambertsen, Philadelphia, Pa.

Application January 21, 1942, Serial No. 427,604

2 Claims. (Cl. 128—142)

My invention relates to breathing apparatus for use under water and has for its object to provide a breathing apparatus adapted to be attached to the wearer including means for supplying oxygen for a certain period of time and means for controlling the breathing of said oxygen for effecting removal of carbon dioxide therefrom and permitting exhaust of excess part of exhalation into the water. The apparatus can be quickly applied and with it a guard or diver may descend to a depth of water greater than sixty feet and remain at such depth for considerable periods of time long enough to make a proper search for the recovery of bodies or of persons who had gone down and might be drowned or be drowning, to search for other objects to travel under water relatively long distances and for similar purposes.

This application is an improvement upon the invention of my application Serial Number 370,242, filed December 16, 1940. As pointed out in that application there are many conditions and situations in which diving apparatus as the term is ordinarily understood cannot be available for use, for such apparatus requires a sealed diving suit and helmet and suitable air pumps for supplying air to the wearer and assistants to operate the pumps. Diving apparatus of this type obviously cannot be available in a very large number of situations such as above outlined par-

let substantially in the plane of the mouth with exhalation and inhalation tubes leading therefrom, the exhalation tube going directly to the rebreathing bag, and a relief valve structure in the exhalation tube together with an inhalation tube leading from the mouth device through a soda lime container and thence either independently or through connection with the exhaling tube going to the rebreathing bag.

It is a further object of my invention to provide a protective casing for the rebreathing bag of such size and large area of wall surface and of perforations therethrough that there will be substantially no confining of water within the protective cover and the rebreathing bag can expand and contract freely as the water enters and leaves the protective casing.

It is a further and highly important object of my invention to provide a relative arrangement of oxygen casing, rebreathing bag protective casing, soda lime container and other parts connected with or attached to the harness so that the entire apparatus as worn will have a balanced distribution of weight such that a wearer will find it simple and easy to maintain proper position in the water while going down into the water and coming up from it.

In this connection it is a further object of my invention not only to distribute the weight as above indicated, but to adjust it so that when the

operated needle valve going direct to the rebreathing bag from where it may be drawn upon for inhalation.

It is a further object of my invention to position the removable oxygen tank at the front of the harness with valve handles for controlling flow of oxygen continuously through the regulator valve or directly for emergency purposes in convenient reach of the wearer, also with a gage which the wearer can see at all times and by which he can determine the pressure of oxygen being delivered, and the duration of any remaining oxygen supply, the latter important to warn the wearer of a time when it will be necessary to leave the water.

It is a further object of my invention to provide a mask structure having the aforesaid breathing passages adjacent the mouth and having means for securing the mask structure firmly upon the head of the wearer together with dou[illegible] double glass eye

1 showing the double lens structure of the eye openings of the mask.

As illustrated my apparatus comprises a harness having a belt 10, rear shoulder straps 11 and 12 secured to the back portion of belt 10, and continuing over the shoulders to front straps 13 and 14 secured at their lower portions to belt 10 by loops for free-slipping movements and held together adjacent their central parts by a cross belt 15. Secured to angle pieces 16 and 17 on back straps 11 and 12 by means of thumb screws 18 and 19 is a case 20 of a shape clearly indicated in Figs. 2 and 3 and of relatively large internal capacity and within this case is housed a rebreathing bag 21. The rebreathing bag case 20 has relatively large external wall area which is provided with numerous apertures 22 through the ends and back, as clearly shown in Figs. 2 and 3. The rebreathing bag is provided with a neck 23 which fits over a nipple 24 extending from a passageway 25 surmounted by a release

64 on the front part 63. This enables the two parts to be separated when desired to permit withdrawal and change of the rebreathing bag structure from inside the case 20.

It will be noted that the rebreathing bag 21 in its casing 20, which supports the canister of soda lime, comes, in the erect position of the wearer, see Fig. 2, substantially between the level planes which embrace the lungs of the wearer. This is a desirable and highly important position of the rebreathing bag relatively to the lungs as it will keep pressures on the rebreathing bag and on the lungs substantially the same. If this were not so, at considerable depths, breathing might become laborious or even impossible.

It is important also to note that the arrangement of the rebreathing bag relative to the lungs is such that in all normal and usual positions of the body when the wearer is swimming or diving, there will be little difference in depth under the water of the rebreathing bag and of the lungs

With a reverse pressure brought about by exhalation the pressure in passageways 31 and 32 will cause flap valve 66 to uncover openings 71 and permit flow of gas through exhalation passageway first to fill rebreathing bag 21 and then to go to atmosphere through pressure release valve 26 to escape through the water.

An oxygen tank 73 is mounted upon front straps 13 and 14 by means of a pair of semi-circular bands 74 and 75 which have ears 76 and 77 connected by bolts 78 and 79 which in turn are connected with brackets 80, 81 and an intervening plate 82 with the front straps 13 and 14, as best shown in Fig. 7. The oxygen tank 73 is thus readily removable and exchangeable and is carried at the front of the body in relation to the soda lime container 47 and rebreathing bag casing 20 so as to substantially balance the weight of the entire apparatus when taken in conjunction with the mask structure held upon the face. The flow of oxygen from the tank is controlled

ing delivered from the oxygen tank 73 and also the normal duration of supply from the maximum when the valve 83 is first operated to turn the gas into chamber 89 to the minimum as the supply of oxygen is exhausted and its pressure falls to zero.

The mask structure itself is adapted to be held by the system of strapping tightly against the face so as to seal against ingress of the surrounding medium such as water, when submerged. The pressure of atmosphere outside of the mask, and even more, the pressure of water when submerged, will aid in effecting complete sealing action. In order that fogging may be avoided when going into cold water I provide vision openings covered with two layers of glass 99 and 100 sealed into the mask frame with a space 101 between them. This space is substantially air tight and prevents accumulation of moist air between the glasses and so prevents a clouding or fogging effect on the inside of the outer glass which will naturally be cold when in the water.

There is, of course, some release of heat in the absorption of carbon dioxide in passing through the soda lime container 47. But when the apparatus is used under water the cooling effect of the water will be amply sufficient to remove this heat.

The advantages of my invention have been heretofore pointed out in more or less detail in the specification. The fundamental advantage is that an apparatus is provided which may quickly and easily be put in position on the wearer and which enables descent in the water to substantial depths without the use of air pumps or heavy sealed metal helmets. The apparatus is wholly self-contained. It provides means for satisfactorily breathing with adequate supply of oxygen in a substantially closed breathing circuit wherein carbon dioxide is continuously being removed. The arrangement of the breathing lines, separate and independent passages for exhalation and inhalation, makes this closed circuit not only effective but easy for breathing. The rebreathing bag being positioned in a rigid case cannot be ruptured or torn, and the size of the case and the large area of openings through it insures uniform water pressure during expansion and contraction of the rebreathing bag.

The apparatus can be used effectively to very considerable depths, such as sixty to eighty feet and up to over one hundred feet and for long

1. Breathing apparatus for use under water, comprising a mask adapted to be supported on the face of the wearer and form a breathing chamber at the front of the face and to seal the same against inlet of water when a swimmer wearing the apparatus is subject to water pressures up to pressures at very considerable depths, separate and distinct inhaling and exhaling tubes extending directly from the lower part of the chamber, a rigid perforated casing, a flexible rebreathing bag held therein and connected with the exhaling and inhaling passages, means supporting the casing upon the back of the wearer as the apparatus is worn so that the rebreathing bag and the container will be held when the wearer is in an erect position within limits defined by horizontal planes passing through the upper and lower parts of the lungs, a soda lime container supported by the casing and connected directly in the inhaling passage, means for causing the gases of the rebreathing bag upon inhalation to go through the soda lime container and upon exhalation to go to the rebreathing bag, a tank of oxygen supported in front and toward the waistline as the apparatus is worn, and means for delivering oxygen therefrom into the inhalation passageways beyond the soda lime container.

2. Breathing apparatus for use under water, comprising a supporting harness embodying a belt and shoulder straps connected with the front and back of the harness forming a support for the breathing apparatus, a tank of oxygen connected with the front of the harness and supported thereby toward the waistline, a perforated rigid casing secured to the upper part of the harness on the back as worn, a flexible rebreathing bag in said casing supported thereby in a position such that when the apparatus is worn and the wearer is in erect position the lower part of the bag will be held substantially between horizontal planes between which is the main body of the lungs of the wearer, a soda lime container positioned directly upon the rebreathing bag casing, a mask and separate inhaling and exhaling tubes leading from the mask over the respective shoulders, the exhaling tube having independent direct connection with the rebreathing bag and the carbon dioxide absorber and the inhalation tube having independent direct connection with the carbon dioxide absorber