May 14, 1935. R. H. DAVIS 2,001,673

SUBMARINE LIFESAVING OUTFIT

Filed Oct. 16, 1933

FIG. 1.

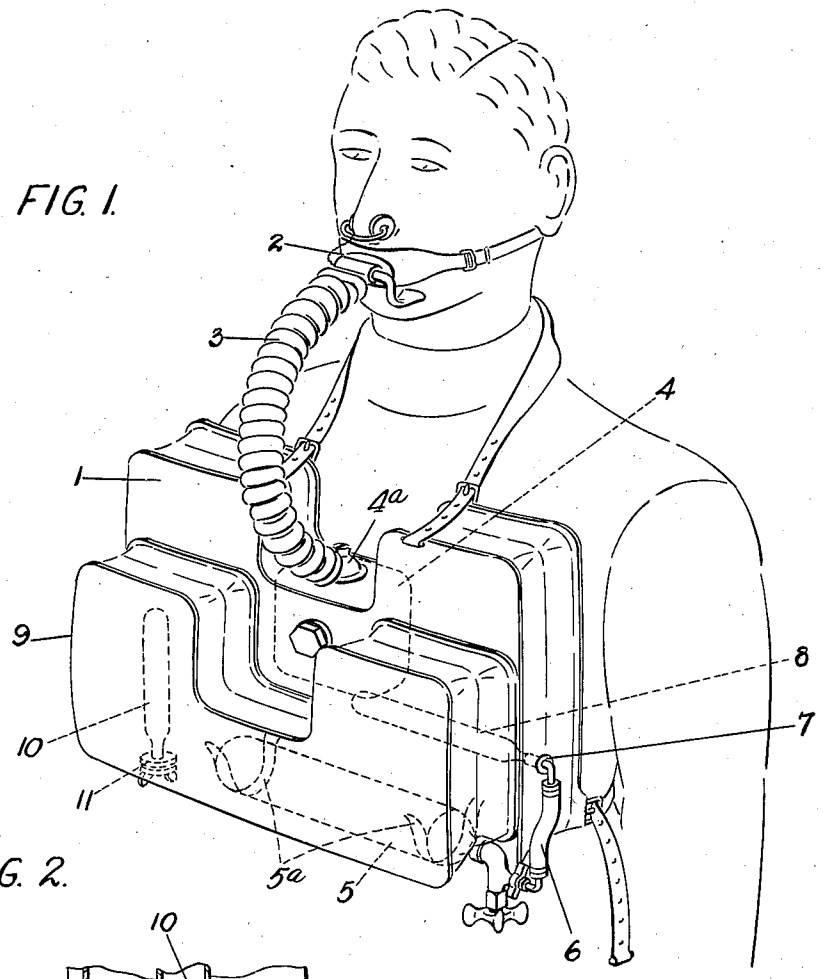
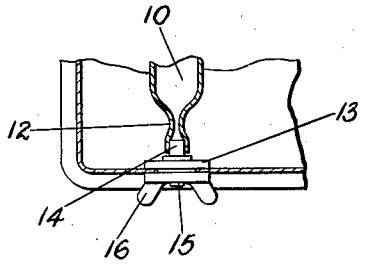


FIG. 2.



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Patented May 14, 1935 2,001,673

UNITED STATES PATENT OFFICE

2,001,673

SUBMARINE LIFESAVING OUTFIT

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Application October 16, 1933, Serial No. 693,877

5 Claims. (Cl. 128—191)

This invention relates to self-contained breathing outfits for submarine life saving use, and has reference to the well-known type of such outfits, which comprises, in the form of a complete pre-assembled unit, an inflatable breathing bag of rubber or the like which occupies in the donned outfit a vertically disposed position in front of the wearer's chest; a mouth-piece, generally having straps or the like to hold it in position upon the wearer's head; a breathing tube connection between the mouthpiece and the breathing bag; means for absorbing exhaled carbon dioxide from the wearer's breath prior to its return to the mouthpiece for re-inspiration; means for supplying oxygen or other respiratory gas to the interior of the breathing bag, for example, an oxygen cylinder forming a part of the apparatus and provided with a valve-controlled connection with the breathing bag; and an inflatable buoyancy chamber situated preferably upon the face of the breathing bag and adapted to maintain the wearer of the outfit afloat upon his reaching the surface of the water, this buoyancy chamber being arranged to be inflated at the will of the wearer of the outfit by his manually breaking a small capsule of compressed gas located in readiness for use within the chamber.

In connection with the inclusion of this last-mentioned item, namely the buoyancy chamber and its inflation capsule, among the integers of the complete unit, it should perhaps be remarked that when the wearer of the outfit reaches the surface of the water, he may be in an unconscious condition or too unwell to close the shut-off valve of the breathing bag (normally provided in the mouthpiece of the outfit) and thereby convert this bag into a buoyancy chamber in the usual way (the wearer thereafter breathing from the open air instead of through the mouthpiece) and if not rescued in a short time, may exhaust his supply of air and oxygen in the breathing bag, with the result that this bag may become so deflated as to be of insufficient buoyancy to keep the wearer afloat. Or, should the wearer be unconscious or dead when he reaches the surface, the mouthpiece may become dislodged from his mouth and exposed to the sea, whereupon the breathing bag will simply flood, with complete loss of buoyancy to the appliance. In any of these contingencies, as will be appreciated, the person wearing the outfit will sink, without leaving any trace of his whereabouts.

The provision in the unit of an inflatable buoyancy chamber additional to the breathing bag, in conjunction with a readily breakable capsule of compressed gas located within the chamber for its immediate inflation at will by the wearer of the apparatus, admirably meets this difficulty, for, in perfect conformity with the essential requirements of any component part of a submarine life saving outfit, such a buoyancy chamber inflated simply by the breaking of a compressed gas capsule situated within it, represents the very height of simplicity and foolproofness, and, inasmuch as the buoyancy chamber is collapsible into the flat when not inflated, its inclusion among the integers of the outfit very little increases the overall dimensions of the apparatus. In addition, said inclusion of the buoyancy chamber and its inflation means only increases the total weight of the outfit by a very small fraction. Moreover, the wearer of the outfit is in a position to inflate the buoyancy chamber if necessary, after he has made his escape from the conning tower or other part of the submarine that is to say after he has emerged into the open sea where of course it would be quite impossible to inflate the buoyancy chamber by breathing into it.

It has now been found, however, that it is a great advantage if, with the inclusion of such a buoyancy chamber and inflation capsule therefor in the well known type of outfit referred to, the quantity of gas compressed in the inflation capsule be only just that quantity which is requisite for the full inflation of the buoyancy chamber at external atmospheric pressure.

By this means, the chamber may be constructed as a wholly closed and independent chamber, that is to say sealed and devoid of communication, not only with the breathing bag of the apparatus, but also with the external atmosphere, which ensures that once the chamber is inflated it remains at its full degree of inflation against leakage of the inflating gas out of the chamber such as sometimes occurs in cases where the chamber is fitted with an excess-pressure valve communicating with the external atmosphere or with a valved connection with the breathing bag, these valves tending, especially in course of time, to leak.

A further important advantage of storing in the breakable capsule in the buoyancy chamber only just that quantity of compressed gas which on release will suffice to inflate the chamber fully at external atmospheric pressure, is that when the person wearing the outfit first emerges into the sea from the submarine, the sea pressure upon the face of the chamber readily overcomes the small internal gas pressure within and presses the chamber substantially into the flat, so

that its volume of displacement in the sea is very small as compared with that the chamber would assume at or near the surface of the water (that is to say, at external atmospheric pressure), with the result that, although the wearer has released the gas for the eventual inflation of the chamber, the upward force of buoyancy of the total outfit, tending to raise the wearer to the surface of the water, is not substantially increased by the breakage of the capsule, and in consequence, the wearer's speed of ascent to the surface of the water is not materially or undesirably increased as it would otherwise be if the amount of gas introduced into the buoyancy chamber were such that the chamber would be fully or more fully inflated at depth, that is to say down at the level below the surface of the water at which the submarine happens to be located.

In this connection, it may be remarked that it is well known to be undesirable that a person escaping from a submarine located at any considerable depth below the surface of the sea should rise to the surface quickly; there are certain physical reasons why if possible his speed of ascent should be relatively slow.

A further consideration in connection with the conception to employ a capsule containing just that quantity of compressed gas which is sufficient fully to inflate the buoyancy chamber at the surface of the sea, is that by this means all mechanical strain upon the walls of the chamber is avoided and the chamber may, therefore, be constructed of quite thin flexible rubber or like impervious material and the seams and joints of the chamber, not requiring to withstand material internal gas pressure within the chamber, can also be made of a simple and light character, with consequent saving in the manufacturing costs of the outfit.

Accordingly, the present invention comprises a submarine life saving outfit of the type hereinbefore specified, wherein the inflation capsule within the buoyancy chamber contains a quantity of compressed gas no greater than is sufficient fully to inflate the chamber at external atmospheric pressure, the said chamber being a wholly closed chamber in the sense indicated above.

The invention will now be further described with reference to the accompanying drawing, in which:—

Figure 1 is a perspective view showing the well-known outfit in position upon the wearer, and

Figure 2 is a fragmentary section through the bottom left hand corner of the buoyancy chamber, hereinafter identified in reference to Figure 1, this fragmentary view illustrating the way in which the breakable capsule within the chamber is mounted upon a wall of the latter.

The outfit shown comprises a breathing bag **1**; a mouthpiece **2**; a breathing tube **3** connecting the mouthpiece to the breathing bag **1** by way of a canister **4** containing a substance adapted to absorb exhaled carbon dioxide from the wearer's breath prior to its return to the mouthpiece for re-inspiration therethrough; an oxygen cylinder **5** communicating with the interior of the breathing bag by way of a tube **6** and an inlet **7**; a breakable oxygen capsule **8** mounted upon the said inlet **7** and projecting therefrom into the interior of the breathing bag, this capsule being provided for emergency purposes and being arranged to be broken for the revivifying of the atmosphere within the breathing bag upon the normal supply from the cylinder **5** failing; and a buoyancy chamber **9** vulcanized on to the face of the breathing bag **1** and arranged to be inflated at the will of the wearer of the outfit by manual breakage of a small capsule **10** of compressed gas, this capsule being located within the buoyancy chamber and mounted upon a fitting **11** secured in the bottom wall of the chamber **9**.

The canister **4** may be of usual construction, that is to say it may comprise a closed rectangular container of sheet metal having an inlet **4a** in the top wall and an outlet (not shown) in the bottom wall, and accommodated between perforated partitions extending across the interior of the container, one below the inlet **4a** and the other above the outlet, a charge of granular material adapted, as stated, to absorb carbon dioxide from the wearer's breath, which latter, as the wearer breathes, first passes downwardly through the charge of granular material into the breathing bag via the said outlet in the bottom wall of the canister and in this passage becomes denuded of carbon dioxide and then returns through the canister to the mouthpiece **2** as the wearer re-inspires.

The oxygen cylinder **5** may be mounted in any suitable manner in place in the outfit. For example, it may be strapped in place therein by means of rubber, canvas or like straps **5a** vulcanized on to the lower part of the breathing bag **1**.

The capsule **10**, like the capsule **8**, is arranged to be broken off at the narrow neck portion **12** at the base end of the capsule.

The said fitting **11** consists of a flange **13** integral with a spigot **14** and with a second spigot **15**, and a wing nut **16** screwed on to the spigot **15** and firmly clamping in a gas-tight manner the bottom wall of the buoyancy chamber between the base of the nut and said flange **13** as shown, the spigot **14** being screwed or welded into the mouth of the filled capsule **10**, which latter is introduced into place within the buoyancy chamber through the hole in said bottom wall thereof in which the fitting **11** is located.

Both the breathing bag **1** and the buoyancy chamber **9** (which in the drawing are both shown in the inflated condition) are of a flat-folding construction so as normally, in the stowage condition, to lie flat.

In the use of the outfit, the breathing bag **1** is inflated in the usual way, and in the event of the wearer judging it to be advisable or necessary to inflate the buoyancy chamber **9**, he simply breaks off the capsule **10**, with the result that, although at first the chamber remains substantially in the flat (that is to say, still in the collapsed condition) owing to the external pressure of the sea upon its walls, it gradually, as the wearer ascends through the water, inflates, until, upon the wearer actually reaching the surface, it is fully inflated by the gas which has been released into it from the broken capsule.

It will be appreciated by those acquainted with the art and in particular with the type of submarine escape outfit hereinbefore specified, that the invention is capable of considerable modification without departure from its spirit and scope, that is to say, for example, in respect of the shape and position in the buoyancy chamber of the breakable capsule, the manner in which the capsule is mounted upon the wall of the chamber and again in regard to the shape of the chamber

itself and its position and manner of incorporation in the unit.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A self-contained submarine escape breathing outfit comprising, in the form of a complete pre-assembled unit, an inflatable breathing bag occupying in the donned outfit a vertically disposed position in front of the wearer's chest, a mouthpiece, a shut-off valve therein, a breathing tube connection between the mouthpiece and the breathing bag, means for re-conditioning the air breathed into the breathing bag, an inflatable buoyancy chamber capable of maintaining the wearer of the outfit afloat in the event of the breathing bag becoming flooded, a readily breakable capsule of compressed gas located in readiness for use within the buoyancy chamber for the inflation of the latter and capable of being broken by manual pressure applied to it through the flexible wall of the chamber, the said chamber being a completely closed chamber in the sense herein specified and the capsule within it containing a quantity of compressed gas not greater than is sufficient fully to inflate the chamber at external atmospheric pressure.

2. A self-contained submarine escape breathing outfit comprising, in the form of a complete pre-assembled unit, an inflatable breathing bag occupying in the donned outfit a vertically disposed position in front of the wearer's chest, a mouthpiece, a shut-off valve therein, a breathing tube connection between the mouthpiece and the breathing bag, means for re-conditioning the air breathed into the breathing bag, an inflatable buoyancy chamber mounted upon the face of the breathing bag and capable of maintaining the wearer of the outfit afloat in the event of the breathing bag becoming flooded, a readily breakable capsule of compressed gas located in readiness for use within the buoyancy chamber for the inflation of the latter and capable of being broken by manual pressure applied to it through the flexible wall of the chamber, the said chamber being a completely closed chamber in the sense herein specified and the capsule within it containing a quantity of compressed gas not greater than is sufficient fully to inflate the chamber at external atmospheric pressure.

3. A self-contained submarine escape breathing outfit comprising, in the form of a complete pre-assembled unit, an inflatable breathing bag occupying in the donned outfit a vertically disposed position in front of the wearer's chest, a mouthpiece, a shut-off valve therein, a breathing tube connection between the mouthpiece and the breathing bag, means for re-conditioning the air breathed into the breathing bag, which means consists of an air permeable mass of material absorbent of carbon dioxide and so positioned as to intercept the air flowing between the mouthpiece and the breathing bag, an inflatable buoyancy chamber mounted upon the face of the breathing bag and capable of maintaining the wearer of the outfit afloat in the event of the breathing bag becoming flooded, a readily breakable capsule of compressed gas located in readiness for use within the buoyancy chamber for the inflation of the latter and capable of being broken by manual pressure applied to it through the flexible wall of the chamber, the said chamber being a completely closed chamber in the sense herein specified and the capsule within it containing a quantity of compressed gas not greater than is sufficient fully to inflate the chamber at external atmospheric pressure.

4. A self-contained submarine escape breathing outfit comprising, in the form of a complete pre-assembled unit, an inflatable breathing bag occupying in the donned outfit a vertically disposed position in front of the wearer's chest, a mouthpiece, a shut-off valve therein, a breathing tube connection between the mouthpiece and the breathing bag, means for re-conditioning the air breathed into the breathing bag, an inflatable buoyancy chamber capable of maintaining the wearer of the outfit afloat in the event of the breathing bag becoming flooded, a readily breakable capsule of compressed gas located in readiness for use within the buoyancy chamber for the inflation of the latter and capable of being broken by manual pressure applied to it through the flexible wall of the chamber, the said chamber being a completely closed chamber in the sense herein specified, the capsule within the chamber containing a quantity of compressed gas not greater than is sufficient fully to inflate the chamber at external atmospheric pressure and the said capsule being replaceable through a sealed opening in the wall of the buoyancy chamber.

5. In a self-contained submarine escape breathing outfit of the type hereinbefore specified, the combination comprising an inflatable breathing bag, a buoyancy chamber adjacent thereto and having with it at least one common wall and a breakable capsule of compressed gas within the buoyancy chamber, the said capsule containing a volume of gas not greater than is sufficient to inflate the buoyancy chamber fully at atmospheric pressure and the said buoyancy chamber being a wholly enclosed chamber in the sense herein specified.

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