J. E. DADE.

PROTECTIVE SUIT.

APPLICATION FILED DEC. 10, 1917. RENEWED MAY 17, 1921.

1,401,677. Patented Dec. 27, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

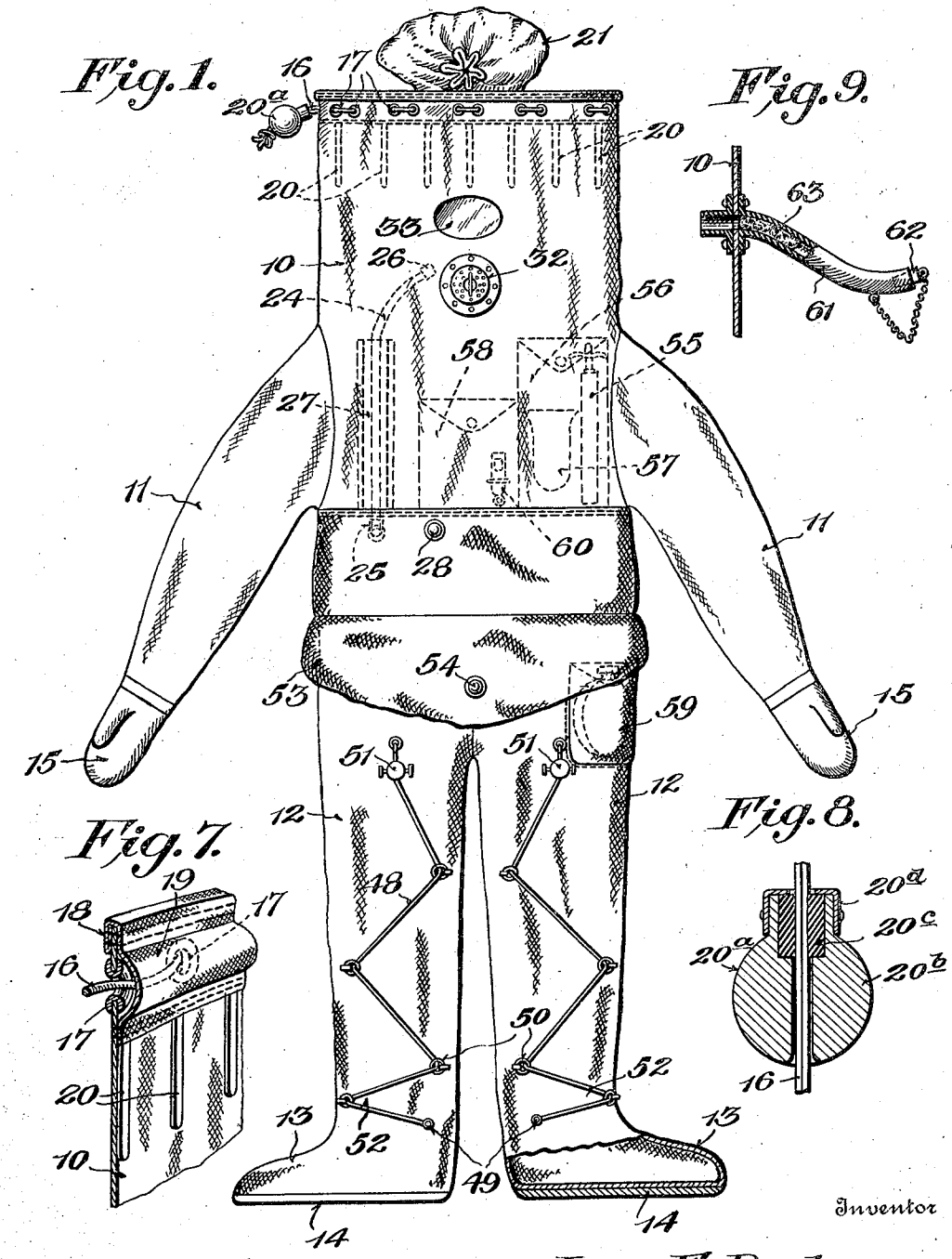


Fig. 9.

Fig. 8.

Fig. 7.

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2 SHEETS—SHEET 2.

Fig. 2.

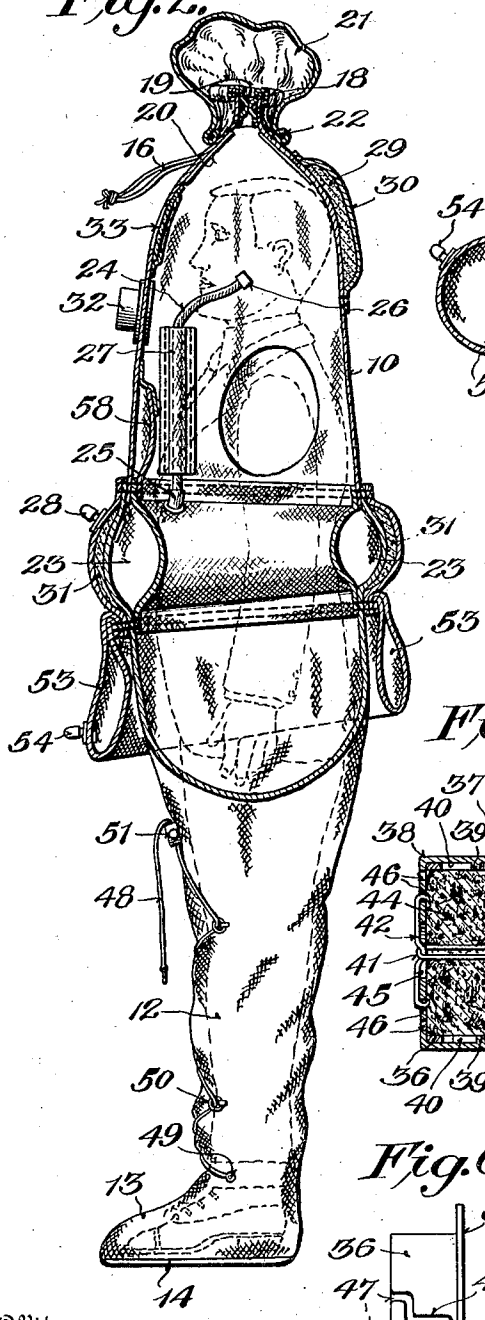


Fig. 3.

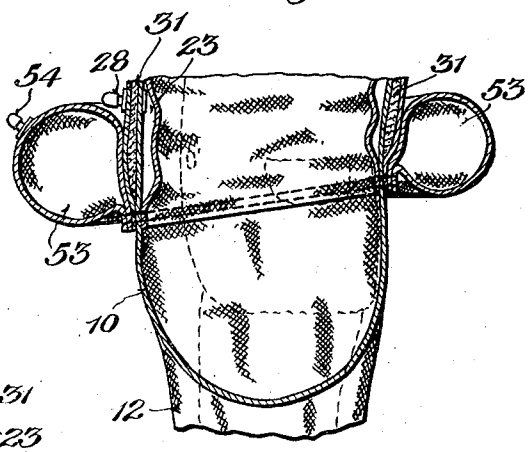


Fig. 4.

Fig. 5.

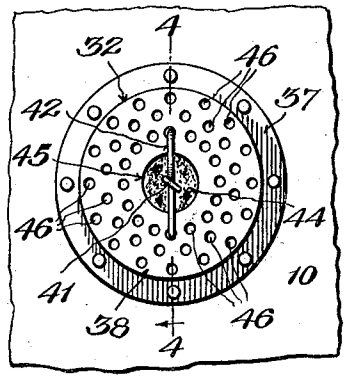
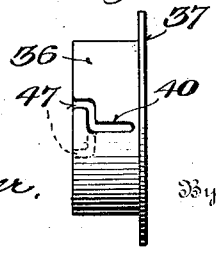


Fig. 6.



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UNITED STATES PATENT OFFICE.

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PROTECTIVE SUIT.

1,401,677. Specification of Letters Patent. Patented Dec. 27, 1921.

Application filed December 10, 1917, Serial No. 206,481. Renewed May 17, 1921. Serial No. 470,325.

To all whom it may concern:

Be it known that I, JESSE E. DADE, a citizen of the United States, residing at Littlefork, Koochiching county, State of Minnesota, have invented certain new and useful Improvements in Protective Suits; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to protective suits, and especially to buoyant waterproof suits, such as life saving suits for use at sea in case of shipwreck, and also suits for hunting, fishing, swimming, etc.

A principal object of the invention is to provide a suit of the character specified which is simple and strong in its construction, which is easy to manipulate, and perfectly safe for the user, which affords complete protection from water and cold, and which is comparatively inexpensive to manufacture. These and other advantages attained in the present invention will be apparent to those skilled in the art from the following description of a practical embodiment of the invention as illustrated in the accompanying drawings, in which,

Figure 1 is a front elevation, partly broken away and in section, of a life saving suit constructed in accordance with the principles of the invention;

Fig. 2 is a central longitudinal section thereof;

Fig. 3 is a fragmentary longitudinal section illustrating a method of employing an auxiliary outer float or life belt;

Fig. 4 is a detail section, and Fig. 5 is a front element, on a larger scale, of one form of breathing device or respirator which may be used;

Fig. 6 is a detail of the device, in elevation;

Fig. 7 is a detail, on a larger scale and partly in section, illustrating the preferred construction of the suit at the upper or open end;

Fig. 8 is an enlarged sectional detail of a fastening or retaining device suitable for the closure drawstring;

Fig. 9 is a view, partly broken away and in section, of another form of breathing device which may be employed.

Generally described, the suit here chosen for purposes of explaining the principles of the invention is of the one-piece type, and it is constructed for the most part of stout waterproof fabric, of the best grade, a fabric comprising several plies of rubberized cloth and rubber sheeting being eminently suitable. The particular type of suit here illustrated is capable of enveloping the entire person of the wearer who may be, and preferably is, fully clothed; and to this end, the suit is of ample size. The upper body and head portion 10, as well as the arms 11, may be of somewhat lighter and more flexible material than the lower body and legs 12, which latter may advantageously be of thicker fabric than the upper part of the suit, and which should also be heavily lined for protection against cold. The feet 13 are best weighted with lead at 14, to aid in properly balancing and stabilizing the suit in the water. The mitts 15 may be of rubber; but when a high grade rubberized fabric is used for the arms, the mitts are better made of the same material and lined. It will be understood that the various parts mentioned are secured together by waterproof seams to form an integral suit.

The suit is without opening except at the upper end, where it can be opened full width to permit the wearer to enter feet first and to work the suit up around and over his body. This opening may be closed over the head of the wearer, by means of a drawstring 16 passing through eyelets 17 provided in the margin of the opening. Most desirably this margin is faced on the inside by a strip of soft and very flexible material such as rubberized silk, firmly stitched at 18 to the upper edge of the suit, and then folded down inside to form a smooth inner facing 19 over the eyelets, being thus well adapted to efficiently close the upper end of the suit when the puckering cord is drawn, and also being adapted to fit closely and comfortably around the neck of the wearer when the upper portion of the suit is folded down upon the wearer's shoulders to leave the head exposed. In closing the suit over his head, an unpractised wearer may sometimes have some trouble in effecting a sufficiently tight closure, because of the tendency of the marginal portions of the fabric to fall inwardly and bind the drawstring, besides preventing proper mating of the closure margins. To obviate this, stiffening members 20, similar

to light corset steels for instance, may be embedded in or otherwise secured to the fabric. These are not strictly necessary, as a sufficiently tight closure may ordinarily be effected without much trouble when no stiffening means are employed; but they afford additional security and convenience.

After the upper end of the suit has been closed, the drawstring may be held firmly in place by means of a retaining device indicated generally by 20^a, of such nature as to grip the doubled drawstring firmly enough to prevent its being accidentally loosened, while at the same time the drawstring can easily be released by a simple pull on said device with one hand, when the wearer desires to open the suit for air or other purposes. It is to be noted that the wearer has to reach up over his head to loosen the device holding the drawstring, and that the device is out of his sight. The importance of having the device of such character that it can be readily grasped and operated by the wearer, even with hands incased in the mitts, is evident. A desirable form of the device is shown in Fig. 7 where the round body 20^b is recessed to receive a frictional member 20^c, such as a piece of rubber, held in place by keeper 20^d, both the body 20^b and member 20^c being apertured to permit controlled movement of the doubled drawstring therethrough.

The suit here shown is provided with a hood or cap member 21, of rubberized silk or the like, secured as at 22 to the rear side of the suit near the top in such manner that it can be turned back out of the way when not in use. This hood or cap performs two functions. It serves either as a protecting cover for the drawstring closure to further guard against entry of water into the suit, or as a hood proper to cover the wearer's head when he folds the upper part of the suit down around his shoulders, the hood leaving the face exposed and fitting closely therearound by means of an elastic margin. While this hood is a convenient and desirable accessory, it is not indispensable.

Just below the arms, the suit is provided with buoyant means in the form of an inflatable tube or belt 23 encircling the body. Most desirably this is formed by making the body of the suit double walled at this locality, a method which is very simple and entirely satisfactory where a suitably high grade of rubberized fabric is employed. The belt may be inflated by the wearer blowing through the inflating tube 24, which is arranged inside the suit and whose lower end 25 engages an inlet opening provided with a check valve opening inwardly. The inflating tube is held upright, with its mouthpiece 26 conveniently adjacent the wearer's mouth, by means of a fabric casing 27, secured to the inside of the suit. This casing is of such form and is so arranged that it prevents the occurrence of sharp bends in the inflating tube. It will be noticed especially, however, that access may be had to the lower end of the tube for disconnecting it whenever desired for adjustment of the inlet valve, or for any other reason. The pneumatic life belt is also provided with a relief valve 28, for a purpose which will appear later.

Most desirably the pneumatic belt is not symmetrical, but on the contrary is of greater capacity in front than at the back, as shown. This gives somewhat greater buoyancy in front, so that in actual use, the tendency of the suit is to assume a position in which the wearer is automatically tipped slightly backward with his face out of the water. This is of great importance because it sometimes happens that, after donning the suit and jumping into the water, the user becomes temporarily unconscious from shock or otherwise, and if he happened to float face down, as is possible where no special provision is made to prevent this, the breathing device to be hereinafter described would be submerged, and suffocation might ensue before the wearer recovered and righted himself. Furthermore, the described unequal distribution of buoyancy is also useful, in conjunction with the small cork pillow 29, which may be provided in a pocket 30 back of the user's head, to insure his being able to assume a comfortable reclining position in the water.

As an added measure of safety, a thin cork belt 31, may also be provided, this cork belt being sufficient to float the suit and its wearer even though he should forget to inflate the air belt 23. As here shown, the cork belt is arranged outside the air belt, and therefore also serves as a protecting cover or guard.

The breathing device hereinbefore mentioned is located at 32, somewhat below the usual window 33, which may be made of celluloid, unbreakable glass, or the like. The device is of such character that it effectively prevents entry of any substantial quantity of water into the suit during the comparatively brief period of submersion following a jump from the deck of a vessel or some similar height, or where the wearer has been sucked under by a sinking vessel or caught by wreckage. But the device permits entry of air when the upper part of the suit has emerged from the water. As here shown, the device in its preferred form comprises an inner plate 34, with a central opening 35; a hollow cylindrical member 36, between whose flange 37 and the plate 34, the suit material is clamped; and the outer cup or guard 38, telescoping over member 37, and longitudinally movable thereon by virtue of the two pin and slot connections 39—40, above and

below. A resilient member 41, such as a rubber band or the like, stretched between pins or wires 42 and 43, pulls the cup 38 inwardly and slightly compresses an absorbent material such as sponge 44, with which the expansible chamber is filled. The outer cup member 38 has a comparatively large central opening 45 for admission of air, and surrounding perforations 46 for water drainage. As shown, the slots 40 make two right angle bends near the outer edge of member 36 and are open at said edge as indicated at 47, thus forming a bayonet connection whereby the outer member may be readily removed when it is necessary to change the sponge, for example. The operation of this breathing device will be hereinafter explained.

In order to aid in maintaining an upright position in the water, it is of course desirable not to have the lower portions of the suit particularly buoyant. But in a very loose fitting suit, such as is here in question, a rather large volume of air is trapped in the trousers after the life belt is inflated and thereby pressed closely around the body of the wearer. Means are therefore best provided to expel upwardly from the trousers the greater part of the air prior to inflating the life belt; and it is particularly desirable that such means be operable very rapidly and easily, preferably by a single movement, such as a straight pull, by the wearer. In the present example this is accomplished by means of cords 48, one for each trouser leg, each cord being fastened at its lower end 49, to the fabric, and being laced upwardly zigzag fashion through rings or eyelets 50, and finally through an automatic clasp or retaining device 51 of any appropriate construction secured to the fabric, which will permit the cord to be drawn upwardly with ease, but which resists movement of the cord in the opposite direction. At the ankles, the angle of lacing is sharper, as indicated at 52, than it is higher up. As a result, an upward pull on cord 48 tends to gather the trousers at the ankle first, the trouser thus being drawn or wrapped around the wearer's leg progressively from the ankle up, which favors efficient expulsion of the air.

In conjunction with the main life belt 23, there may be employed an auxiliary buoyant device which is useful, not only by reason of the increased buoyancy which it may give the suit, but also by reason of another function, as will presently appear. This auxiliary buoyant device is here shown as an inflatable apron-like tube or air bag 53, firmly secured to the suit substantially along the lower edge of the belt 23, and desirably of somewhat greater capacity than said belt. This auxiliary belt is best secured to the suit along a single line or narrow band, leaving the major part of its surface entirely free, as shown, which permits the auxiliary belt, when inflated, to swing upwardly and outwardly from the body of the suit to a limited extent. Normally, or at least when the suit is first donned, the air bag 53 is usually in deflated condition and simply hangs down like an apron as shown in Figs. 1 and 2. It is provided with an inflating valve 54, through which it may be inflated by means of a hand pump 55, carried in an inner pocket 56, of the suit. When used either in conjunction with belt 23, or alone, its large size gives a much enhanced buoyancy and adds materially to the wearer's comfort and sense of security. The auxiliary bag can of course be inflated at leisure with the pump, while the primary belt 23 is intended to be blown up quickly through the mouth tube by the wearer when he puts the suit on, though it may also be blown up through the relief valve 28, which, like valve 54, may be of the ordinary inner tube tire valve type. The auxiliary air bag may be employed in another way, however, to contribute to the comfort and convenience of the wearer. It will be noted that when the air belt 23 is blown up, it hugs the body closely, making the lower part of the suit interior inaccessible to the wearer. On sanitary grounds this is obviously objectionable, but the provision of the auxiliary air bag here shown obviates this objection. In case of necessity, the auxiliary air bag is first blown up tight by means of the pump, the wearer floating on his back so as to expose the inlet valve during the operation. The primary air belt 23 is then deflated through valve 28. When the wearer again assumes an upright position, conditions are substantially as shown in Fig. 3, the auxiliary air bag now acting to draw the suit away from the mid-body region, leaving considerable space there. As the arm holes of the suit are of ample size and cut sufficiently low, the wearer may withdraw a hand and arm from the sleeve and pass a receptacle 57 from the pocket 56 downwardly into the lower part of the suit, subsequently withdrawing it, and passing it out through the top of the suit. It will be understood that the top of the suit is usually opened by the wearer after he has come to the surface after jumping, which is then usually left open except in case of heavy weather.

The suit may be provided with other convenient accessories, such as inside pocket 58 for food, and outside pocket 59 for a canteen. The pocket 58 may also contain a whistle 60 for signaling purposes. An electric light may also be provided if desired.

The method of employing the life saving suit here illustrated is sufficiently obvious from the foregoing description, but will be again briefly summarized. When necessity arises for using the suit, the person who is to wear it enters the same at the wide open-

ing at the upper end, pulling the suit on over his body as he would when getting into a pair of trousers, and working the suit up over his body and thrusting his hands and arms into the sleeves. He now pulls the cords or drawstrings 48 up until the ankles and legs of the trousers are snugly gathered about his legs. The next step is to inflate the primary air belt 23 by blowing through the inflating tube 24. The belt should be blown up to a reasonable degree of inflation, such as will make the belt fit snugly around the body. The upper part of the suit is then pulled up above the head and the opening at the top is closed by pulling on the drawstrings, the fastening device 28 being pushed firmly up against the puckered or gathered top of the suit to hold the drawstring securely in position. The hood member 21, if used, is then placed in position over the gathered top of the suit as a further protection against possible entry of water. Having thus donned the suit, the user is ready to jump into the water. Should he have forgotten in his excitement to blow up the belt 23, the emergency cork belt 31 will buoy him up sufficiently to prevent sinking, and he can blow up belt 23 after he is in the water.

If the wearer leaps from any height above the water, he will of course go under for a distance depending upon the height. The period of submersion is relatively short in any event, ordinarily not exceeding 5 to 10 seconds, and the air contained in the loose fitting suit is quite sufficient to support breathing for a much greater time. The buoyancy of the suit is so distributed that the user comes to the surface in a more or less upright or erect position, there being a slight tendency to assume a somewhat inclined position with the face up. During the submersion, entry of water through the breathing device is prevented by the sponge, which of course takes up water to the saturation point but practically blocks the passage of any substantial amount of water through the air apertures into the suit. At the same time, the sponge swells somewhat, so that when the head of the wearer emerges from beneath the surface of the water the tendency is for the outer cup member of the telescoping breathing device to be pushed outward slightly by the sponge expansion. At the same time, the pores of the sponge increase in size as it expands, and passage of air through the sponge, even though the sponge be still very wet, is thereby much facilitated. Consequently, even though the wearer may have become unconscious by shock or otherwise, he is automatically supplied with air through the breathing device as soon as his head emerges from below the water. In this connection, the importance of adjusting the suit buoyancy so as to insure its coming to the surface with the face portion up, is very apparent. If the wearer is conscious, as is usually the case, he can obtain a still freer supply of air by pulling out the outer telescoping member to the full extend permitted by its pin and slot connection to the inner member. This greatly increases the volume of the sponge chamber, the sponge thereafter continuing to act simply as a baffling member to prevent sudden rush of water into the suit, while permitting free entry of air.

If the water is very rough, and the weather bad, the suit may be worn continuously with the upper portion gathered about the head of the wearer as at first. But if weather conditions permit, it is more comfortable to have the face exposed, and to this end the wearer may simply reach up with one hand and pull the clamping or retaining member 20^a downwardly to release the draw string. After opening the upper end of the suit he may draw the upper portion down around his shoulders and fit the soft flexible margin closely around his neck. If the hood member 21 be employed, the hood may now be drawn over the head, leaving only the face exposed, the elastic margin of the hood making sufficiently good contact with the head to exclude water.

Fig. 9 illustrates another form of breathing device which may be employed in lieu of the one above described, although it is ordinarily not so desirable. This form of device consists simply of a flexible tube 61 extending through the front wall of the suit, as shown, in convenient proximity to the face of the wearer. In use, the wearer simply places this tube in his mouth just before jumping into the water, closing the tube by holding it firmly between his teeth. He continues to hold the tube thus until he rises to the surface, whereupon he can draw air in as desired from the outside. This form of device depends for its success upon the presence of mind of the wearer, and hence lacks the desirable automatic action of the device heretofore described. If desired, a cork 62 may be placed in the end of the tube before the wearer jumps into the water, the cork being removed by him after he has come to the surface. This of course presupposes that the wearer does not lose consciousness. Ordinarily this simplified form of device works well in practice because it is seldom that the wearer loses consciousness or presence of mind to such an extent as not to perform the simple operations necessary to proper use of the device. As an additional element of safety, a plug of absorbent material 63 such as sponge, may be inserted in the tube as a barrier to the entrance of water.

While the particular suit here chosen for purposes of illustration is a complete

life saving suit designed to envelop the entire person of a wearer, it is not intended thereby to limit the invention strictly to such suits. Hunting and fishing suits, and sportsman's protective suits generally, as well as swimming suits and the like, may be constructed in accordance with the invention although not necessarily including all the features described in connection with the complete life saving suit. The invention is therefore to be understood as not limited except as defined in the accompanying claims.

What I claim is:

1. In a life saving suit of the character described, having an opening adapted to be closed above the head of a wearer, a drawstring near the edge of said opening and operable to close the same, and stiffening means for the suit fabric adjacent said drawstring.

2. In a life saving suit of the character described, having an opening adapted to be closed above the head of a wearer, a drawstring near the edge of said opening and operable to close the same, and stiffening ribs for the suit fabric adjacent said drawstring.

3. In a life saving suit of the character described, the combination, with the upper portions of the suit, of a breathing device comprising an air duct extending through the suit wall and containing a body of absorbent material.

4. In a life saving suit of the character described, the combination, with the upper portion of the suit, of a breathing device comprising an air duct extending through the suit wall and containing a body of absorbent material under pressure, and means for releasing such pressure.

5. In a life saving suit of the character described, the combination, with the upper portion of the suit, of a breathing device comprising a container having telescoping sections of which one is secured to the edges of an aperture through the suit wall, a body of expansible absorbent material in said container, and yielding means forcing said telescoping sections toward each other to compress said absorbent material, said container being suitably apertured to permit passage of air between the exterior and interior of said suit, and also to permit drainage of water from the container.

6. In a protective suit of the character described, the combination, with a voluminous loose fitting suit adapted to envelop the body of the wearer, of unitary means for gathering the trouser portions around the ankles and legs of a wearer to expel the contained air upward, such gathering means comprising an operating portion which is supported at a convenient location to be grasped by the wearer.

7. In a protective suit of the character described, the combination, with a voluminous loose fitting suit adapted to envelop the body of the wearer, of a drawstring secured at one end to the outside of a trouser leg near the ankle, and slidably connected to higher points on the trouser leg, the arrangement being such that an upward pull on said drawstring operates to gather the trouser leg against the leg of the wearer.

8. In a protective suit of the character described, the combination, with a voluminous loose fitting suit adapted to envelop the body of the wearer, of a drawstring secured to the outside of a trouser leg near the ankle, and slidably connected to higher points on the trouser leg, the arrangement being such that an upward pull on said drawstring operates to gather the trouser leg against the leg of the wearer, and means for automatically retaining the drawstring in position after it has been pulled up.

9. In a protective suit of the character described, the combination, with a voluminous loose fitting suit adapted to envelop the body of the wearer, of drawstrings, each secured at its lower end to the outside of a trouser leg near the ankle, and rings secured to the leg through which the drawstring is laced zigzag upwardly.

10. In a protective suit of the character described, the combination, with a voluminous loose fitting suit adapted to envelop the body of the wearer, of drawstrings, each secured at its lower end to the outside of a trouser leg near the ankle, and rings secured to the leg through which the drawstring is laced zigzag upwardly, the angle of lacing being more acute near the ankle than higher up.

11. In a protective suit of the character described, the combination, with an inflatable buoyant member, of an inflating tube detachably connected therewith, inside the suit, and a casing attached to the suit for holding the free end of the tube in a position conveniently adjacent the wearer's face and preventing sharp bends in said tube, said casing leaving the connected end of said tube accessible for adjustment.

12. In a life saving suit, the combination, with a protective waterproof envelop of ample proportions to cover the entire person, of collapsible buoyant means normally engaging the body of the wearer below the arms, and means operable to separate said buoyant means, when collapsed, from the body to a desired extent.

13. In a life saving suit, the combination, with a protective envelop of ample proportions to cover the entire person, of an inflatable air bag adapted to encircle the body closely a short distance below the arms, and a second inflatable air bag secured to the suit substantially immediately below the first air bag, the attachment of the second

bag permitting limited movement thereof, relatively to the first bag.

14. In a life saving suit, the combination, with a protective waterproof envelop of ample proportions to cover the entire person, of an inflatable air bag adapted to encircle the body closely a short distance below the arms, and a second inflatable air bag secured substantially only along the lower edge of the first air bag, and arranged, when inflated, to exert an outward pull on the first air bag.

15. In a life saving suit of the character described, having a window in the upper part thereof and an opening adapted to be closed above the head of a wearer, the combination with means for closing said opening, of a hood or cap secured to said suit and adapted to be placed over the closed opening as a cover without covering said window, said hood also being adapted and arranged to fit directly upon the head of the wearer when the upper part of the suit is folded down upon the shoulders.

In testimony whereof I hereunto affix my signature.

JESSE E. DADE.

