United States Patent

[11] 3,536,071

[72] Inventor **Juan Vilarrubis Ferrando**
Barcelona, Spain

[21] Appl. No. **732,287**
May 27, 1968
[45] Patented **Oct. 27, 1970**

[73] Assignee **Nemrod-metzler, S.A.**
Barcelona, Spain,
a corporation of Spain

[54] **UNDERWATER SAFETY GEAR**
10 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **128/142.5,** 2/2.1, 128/142.4
[51] **Int. Cl.** **A62b 7/00**
[50] **Field of Search** ..... 128/141, 142, 143, 144, 462, 522; 2/2, 2.1, 2.2—2.6

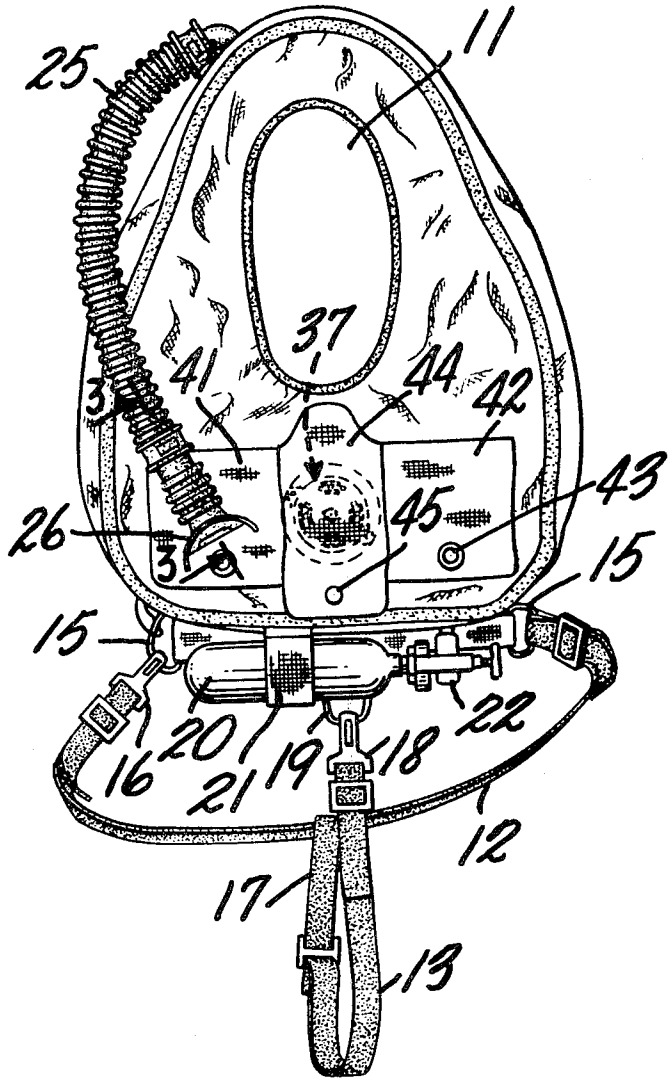
[56] **References Cited**

UNITED STATES PATENTS

3,138,155	6/1964	Bould	128/142.5
932,880	8/1909	Meikle	128/142
1,202,197	10/1916	Lippincott	128/142
2,077,054	4/1937	O'Leary	128/142.6
3,135,098	6/1964	Root	2/2.1

Primary Examiner—Adele M. Eager
Attorney—Brumbaugh, Graves, Donohue & Raymond

ABSTRACT: An inflatable vest equipped with a supply of compressed air for inflating the vest, a breathing tube having a hand actuated valve which can be opened to regulate buoyancy and permit the user to breathe the air within the vest and an automatic decompression valve which exhausts air automatically from the vest to limit the pressure inside the vest in relation to the external pressure.



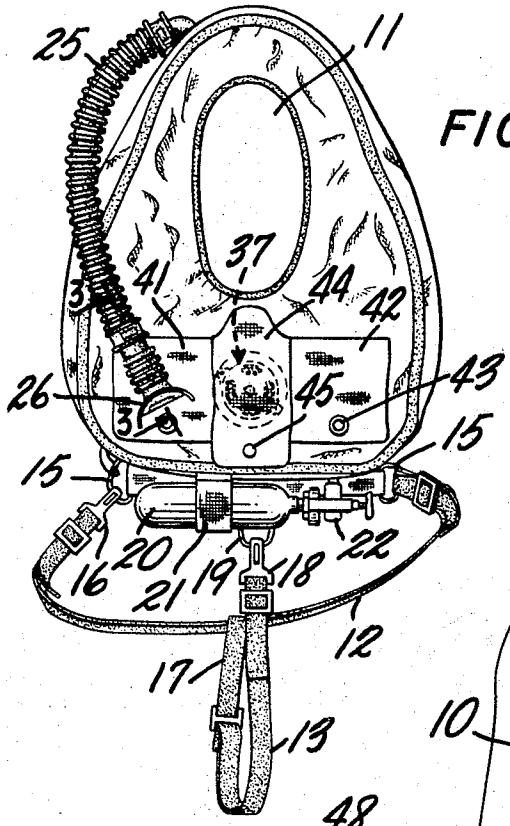


FIG. 1

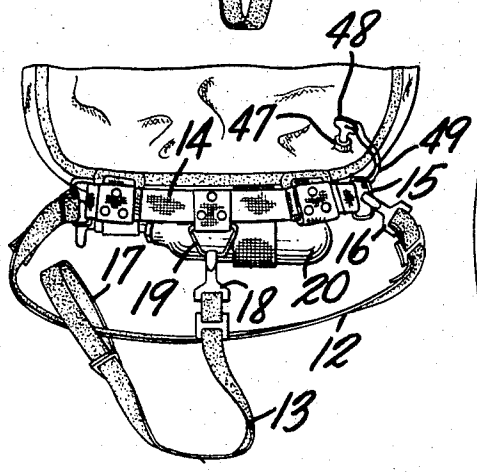


FIG. 2

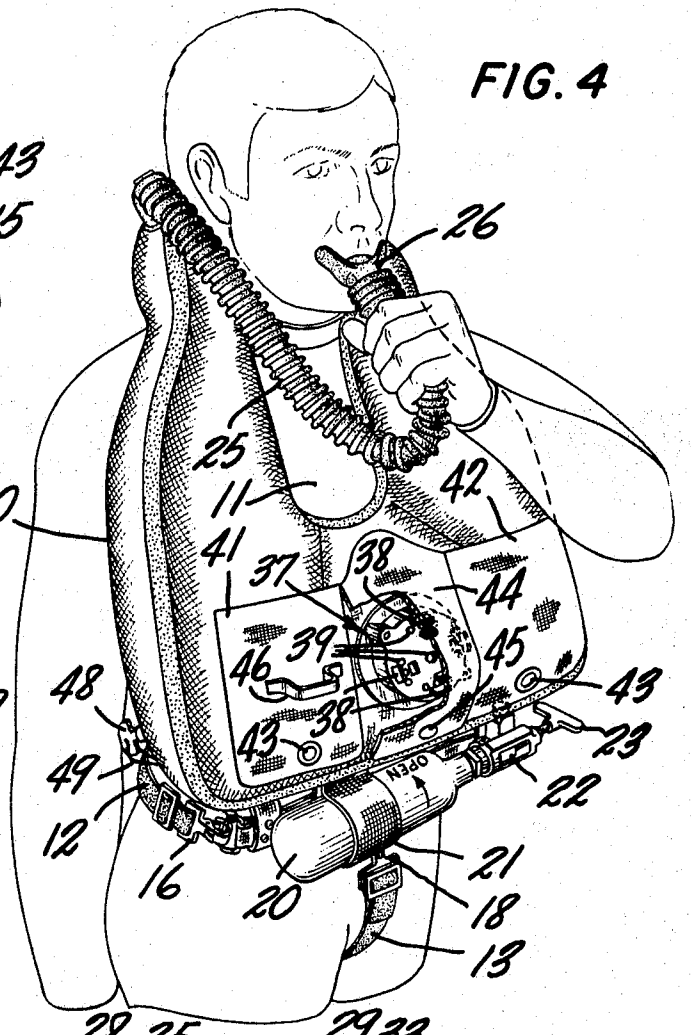


FIG. 4

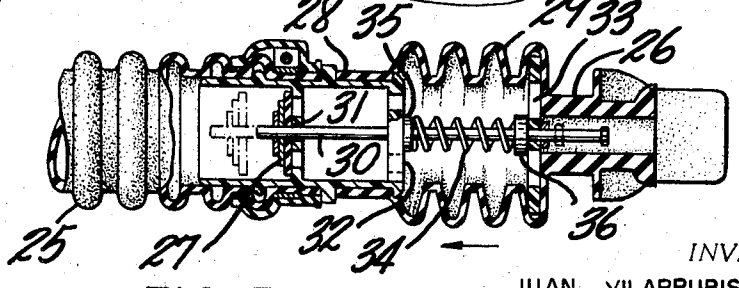


FIG. 3

INVENTOR.
JUAN VILARRUBIS FERRANDO
BY
Brumbaugh, Free, Graves & Donohue
his ATTORNEYS

UNDERWATER SAFETY GEAR

This invention relates to a vest which is inflatable under water from a supply of compressed air to regulate the buoyancy of the diver and to surface the vest with or without the diver.

A feature of the inflatable vest of the present invention is that it is equipped with a breathing tube which permits the diver to breath the air from the interior of the vest in the event that the diver's regular air supply is exhausted or not functioning properly. The breathing tube is provided with a hand-actuated valve which can be opened to permit the diver to inhale the air within the vest and closed to prevent loss of the air through the breathing tube. The hand-actuated valve also permits the diver to discharge air from the inflated vest while under water so that he can regulate his buoyancy in accordance with the depth of his dive.

Another feature of the present invention is that the vest is equipped with an automatic decompression valve which discharges air from within the vest when the pressure within the vest exceeds the external or ambient pressure by more than a predetermined amount. Thus, for example, if the vest is inflated in deep water where the external pressure is high, air will be discharged automatically from the vest as the diver rises and the external pressure decreases, thereby preventing damage to the vest.

The underwater vest of the present invention is not only a convenience which enables the diver to regulate buoyancy or to surface articles under safe conditions, but it is a life-saving device which is capable of bringing him safely to the surface of the water with an auxiliary air supply under emergency conditions.

These and other advantages of the present invention will be apparent from the detailed description which follows and from the accompanying drawings in which:

FIG. 1 is a front view of the underwater safety vest of the present invention;

FIG. 2 is a rear view of the lower region of the underwater safety vest;

FIG. 3 is a view taken along the lines 3–3 of FIG. 1 looking in the direction of the arrows; and

FIG. 4 is a perspective view of the underwater safety vest as worn by an underwater swimmer.

The underwater safety vest **10** is essentially a hollow, inflatable container made of flexible, waterproof material, such as a rubber backed nylon fabric. The vest has an opening **11** which forms a collar when worn by an underwater swimmer in the manner illustrated in FIG. **4**.

The underwater vest is secured to the wearer by a harness which includes a waist belt **12** and a crotch belt **13**. A short apron **14** hangs from the bottom of the vest and carries loops **15** at both ends. One end of the waist belt **12** is anchored to one of the loops **15**, and the opposite end carries a releasable clasp or buckle **16** which can be fastened to the other loop **15**. The back end of the crotch belt **13** has a loop **17** through which the back portion of the waist belt **12** passes, and the front end has a releasable clasp **18** which is secured to a loop **19** depending from the center of the apron **14**.

The underwater vest is inflated by air discharged from the compressed air cylinder **20** carried in a cylinder holding loop **21** depending from the lower end of the vest. The air cylinder communicates with the interior of the inflatable vest through a conduit **22**. The flow of air can be turned on and off by the operation of a valve handle **23** which controls a valve at the discharge end of the air cylinder.

One end of a flexible and extensible breathing tube **25** communicates with the upper region of the vest. The other end is equipped with a mouthpiece **26** to permit the diver to breathe the air inside the vest. Thus, in case of emergency when the diver's regular air supply is exhausted or not functioning properly, the diver has available an auxiliary air supply.

To prevent the loss of air from the vest through the breathing tube, the breathing tube is provided with a normally closed valve **27** (see FIG. **3**) which is accommodated within a rigid housing **28**. The housing **28** forms a section of the breathing tube and is separated from the mouthpiece **26** by an extensible and compressible bellows section **29**. The valve **27** is supported on a rod **30** guided for longitudinal movement within the breathing tube by apertured disks **31**, **32** and **33**. The front face of the apertured disk **31** serves as a valve seat, and the valve is held in closed position against the valve seat by a spring **34** accommodated on the rod and acting between a spring retainer **35** fixed to the apertured disk **32** and a spring retainer **36** carried by the rod. The spring retainer **35** also serves as a guide for the rod **30**.

When the rigid valve housing section **28** of the breathing tube is held by the diver and the mouthpiece **26** is inserted in his mouth, as shown in FIG. **4**, the diver can open the valve to breathe air by pushing the housing section **28** toward his mouth and collapsing the bellows section **29**. This action moves the spring retainer **36** in contact with the apertured disk **33**, compressing the spring **34** and moving the valve relative to the valve seat to open position shown in phantom lines in FIG. **3**.

Incidentally, the breathing tube **25** can also be used to inflate the vest by blowing into the breathing tube with the valve **27** open. Thus, even after the supply of compressed air is exhausted the diver can keep the vest inflated to keep himself afloat.

The underwater vest is also provided with an automatic decompression valve **37** which permits automatic decompression of air therein to limit the pressure inside the vest in relation to the external or ambient pressure. The valve is a relief valve normally urged closed but opens to exhaust air from the interior of the vest to prevent damage thereto when the pressure within the vest exceeds the ambient pressure by more than a predetermined amount. For example, if the diver inflates the vest under water, as he rises toward the surface the ambient pressure decreases, endangering the vest, unless the pressure within the vest is relieved. The automatic relief or decompression valve opens automatically under these conditions to establish a maximum pressure within the vest in relation to the external or ambient pressure.

The outer face of the decompression valve housing has a series of outwardly extending formations **38** thereon and a series of openings **39** therein. The formations **38** keep the face of the valve clear so that the valve will be in communication with the external pressure through the openings **39**.

The front of the vest is equipped with a pair of pockets **41** and **42**, each having a water discharging opening **43** in the bottom. A flap **44**, having a snap closure **45**, is provided to cover the decompression valve when the cover flap is snapped in closed position. The raised formations **38** on the front face of the decompression valve also keep the flap raised from the outer face of the valve to insure that the external or ambient pressure will be in communication therewith even when the flap is closed.

The pocket **41** is provided with a resilient holding strap **46** for holding the mouthpiece end of the breathing tube when the vest is not inflated.

In the event water enters the vest, it can be removed from a drain plug **47** (see FIG. **2**) which is normally closed by an insertable plug **48**. The plug **48** is tied to one of the belt loops **15** by a line **49** to prevent loss.

The vest in deflated condition is not cumbersome and leaves the diver's arms free so as not to impede underwater swimming. While under water, the diver can regulate his buoyancy either positively or negatively in accordance with his requirements by partially or fully inflating the vest or by deflating it. Because the breathing tube connects with the upper portion of the vest, air can be exhausted from the vest under water by opening the mouthpiece valve. This is possible because the difference of pressure of the water column between the lower and upper regions of the vest provides the necessary deflating pressure. Thus, the diver can use the vest to increase or decrease his buoyancy in accordance with the depth at which he is diving.

The vest can also be used as a lift bag to lift objects to the surface of the water to relieve the diver of the necessity of surfacing. If the diver wishes to use the vest as a lift bag he can simply remove and inflate the vest and tie the object to it. The vest will float to the surface, the automatic decompression valve exhausting sufficient air as the vest rises to prevent the vest from bursting.

More importantly, in the event of emergency, the diver can use the vest to rise to the surface of the water while at the same time using the air inside the vest as an emergency air supply. The vest is designed so that in the event the diver passes out or loses consciousness his head will be perfectly centered and lifted above the surface of the water.

The air tank **20** can be a relatively small size. For example, a tank having a capacity of .36 liters filled to 150 kg/cm2 of pressure can store 54 liters of air under normal conditions. This quantity of air permits filling a vest at a depth of 60 meters.

The invention has been shown and described in a single preferred form and by way of example only, and obviously many other modifications and variations are possible within the spirit of the invention. The invention, therefore, is not to be limited to any single form or embodiment except in so far as such limitations are expressly set forth in the claims.

I claim:

1. Underwater safety gear for underwater divers comprising a hollow inflatable vest made of flexible, waterproof material, said vest in its deflated condition permitting the underwater diver to descend underwater until the diver desires to increase the buoyancy of the vest, a supply of compressed air carried by the vest, a decompression valve for exhausting air from the vest when the pressure therein exceeds the external pressure by more than a predetermined amount, means controlled by the diver for establishing communication between the supply of compressed air and the interior of the vest for inflating the vest to increase the buoyancy thereof, a breathing tube in communication with the interior of the vest to permit the diver to breathe the air inside the vest and an automatic pressure-responsive valve in the passage of the breathing tube and responsive to the breathing of the diver for preventing the waste of air while opening when the diver inhales.

2. Underwater safety gear as set forth in claim **1** in which the breathing tube includes a collapsible bellows section and a valve housing section, the valve housing section accommodating the said valve and a valve seat therefor and including means controlled by the collapsing of said bellows section for imparting relative movement to the valve and valve seat to open and close the valve.

3. Underwater safety gear as set forth in claim **1** including a mouthpiece at the free end of the breathing tube, a relatively rigid valve housing forming a section of the breathing tube and accommodating the valve and a valve seat therein for relative movement, a bellows forming a section of the breathing tube intermediate the valve housing and the mouthpiece, an actuating rod for imparting relative movement to the valve and valve seat and extending longitudinally through the breathing tube from the valve housing to the bellows section, means within the breathing tube for guiding the actuating rod longitudinally therein, a spring acting on the actuating rod to maintain the valve and valve seat in one relative position and means for displacing the actuating rod against the spring pressure to move the valve and valve seat to another relative position when the bellows section is collapsed.

4. Underwater safety gear as set forth in claim **1** in which the breathing tube is in communication with the interior of the vest at the upper region thereof so that when the diver is in upright position underwater the external pressure differential between the lower region of the vest and the upper region thereof will provide the pressure for discharging air from the vest permitting the diver to regulate his buoyancy.

5. Underwater safety gear as set forth in claim **1** including an outer housing for the decompression valve, openings therein to establish communication between the external pressure and the decompression valve, a cover flap on the exterior of the vest for covering the decompression valve housing and raised formations on the outer surface of the decompression valve housing to separate the cover flap therefrom so that the outer surface of the valve housing will be exposed to the external pressure when the flap is closed.

6. Underwater safety gear as set forth in claim **1** including a collar opening in the vest near the upper region thereof and a harness for securing the lower end of the vest to the diver, said harness including a waist belt to hold the vest against the diver and a crotch belt to prevent the vest from rising relative to the diver when the vest is inflated.

7. Underwater safety gear as set forth in claim **1** including a drain plug in the lower region of the vest to permit water to be drained therefrom and a removable plug for closing the drain plug.

8. Underwater safety gear as set forth in claim **1** including a short apron depending from the lower end of the vest and an air cylinder holder carried on said apron.

9. Underwater safety gear as set forth in claim **8** including loops carried on both ends of said apron and a depending loop carried by the apron intermediate the ends, a waist belt secured to one of the end loops, a releasable clasp at the other end of the waist belt for connection with the other end loop, a crotch belt supported at the rear of the diver from the waist belt and a releasable clasp at the front end of the crotch belt for connection with the loop intermediate the ends of the apron.

10. Underwater safety gear for underwater divers comprising a hollow inflatable vest made of flexible, waterproof material, said vest being normally deflated to permit the diver to descend underwater until the diver desires to increase the buoyancy of the vest, a supply of compressed air, means controlled by the diver for establishing communication between the supply of compressed air and the interior of the vest for inflating the vest, a breathing tube in communication with the interior of the vest to permit the diver to breathe the air inside the vest and a valve in the passage of the breathing tube which when closed prevents loss of the air and when opened permits the diver to breathe the air inside the vest.