United States Patent

Walters

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[54] BUOYANCY ADJUSTMENT BACK PACK

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[52] **U.S. Cl.** .....**61/69,** 114/16 R
[51] **Int. Cl.** **B63c 11/30**
[58] **Field of Search**.....61/69, 70; 114/16 R, 16 T; 224/5

[56] **References Cited**

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[57] **ABSTRACT**

A buoyancy adjustment back pack for use by divers. The back pack is capable of supporting a usual air tank or tanks but also includes a compartment containing a pelleted or fluent mass which can be partly jettisoned to adjust the buoyancy of the diver, or completely jettisoned in an emergency.

5 Claims, 7 Drawing Figures

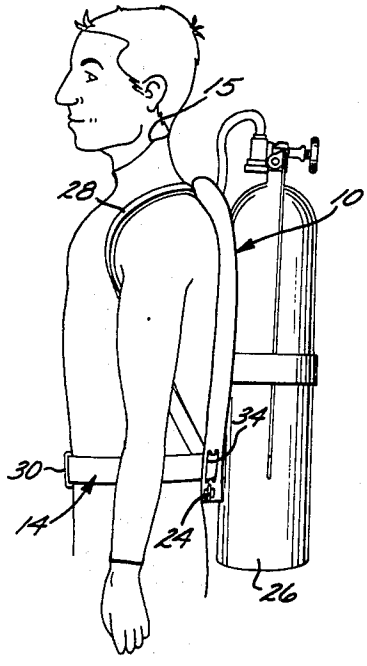


FIG. 1

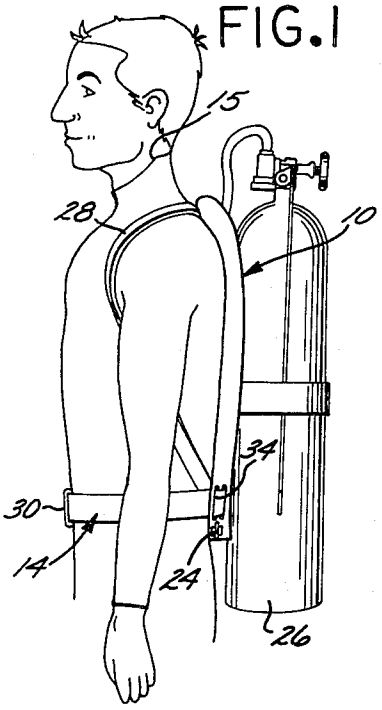


FIG. 2

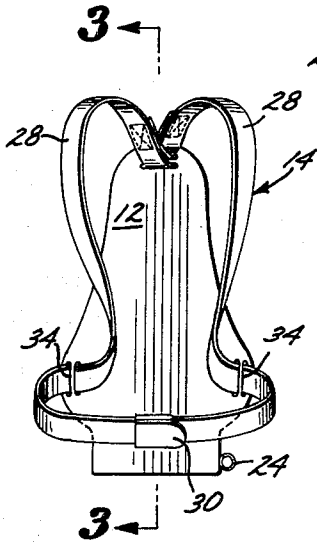


FIG. 3

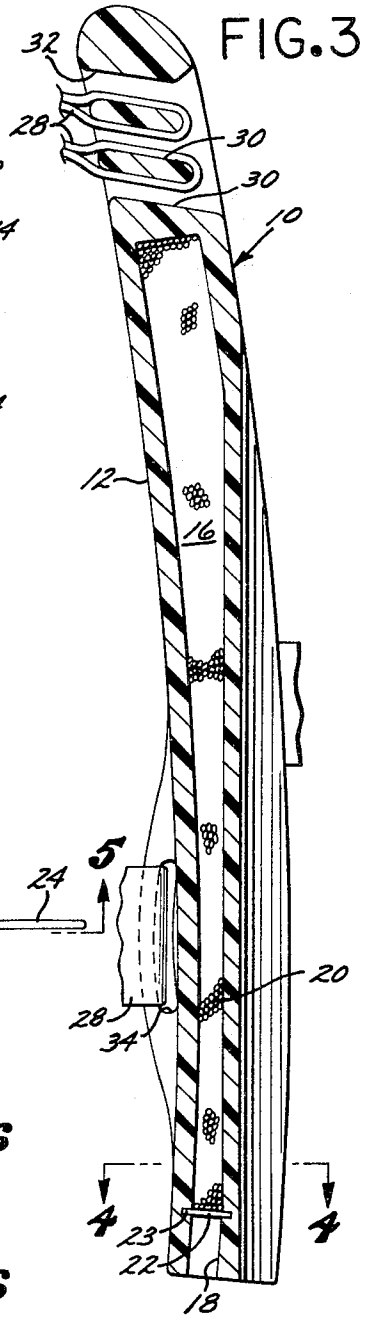


FIG. 4

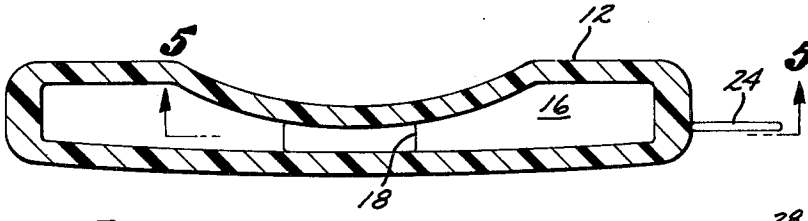
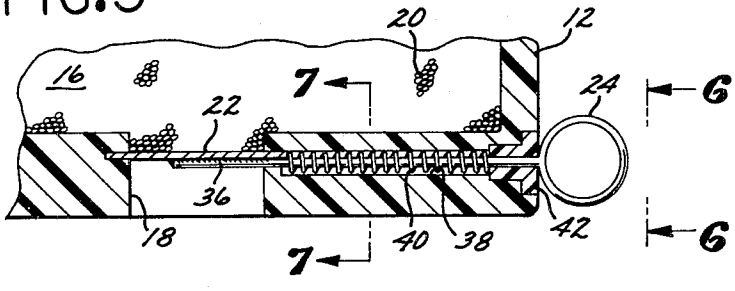


FIG. 5



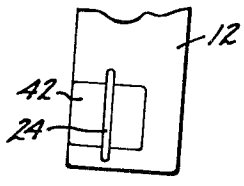


FIG. 6

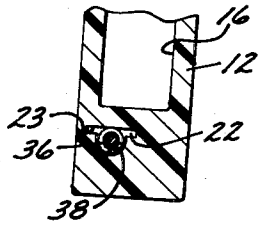


FIG. 7

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BUOYANCY ADJUSTMENT BACK PACK

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a back pack for a diver and more particularly to a back pack for adjustment of the buoyancy of the diver.

2. Description of the Prior Art

A "SCUBA" diver usually wears a back pack strapped to his person to provide a means for supporting an air tank or tanks. The back pack is easily unstrapped so that the diver can quickly surface without the tank if necessary. In addition, the diver normally wears a weight belt to overcome his natural positive buoyancy and to enable him to dive without extra effort. It is important that the weight belt be strapped on after the back pack and other equipment is donned so that the weight belt can be quickly jettisoned in case of an emergency.

In addition to the weight belt it is common for a diver to also wear an inflatable life vest. Although the life vest is useful to float the diver on the surface in an emergency, and is useful to a limited extent to aid the diver in reaching the surface, it is particularly useful in adjusting the buoyancy of the diver during a dive. That is, it is not always possible to accurately predict the amount of weight which a diver must wear in order to achieve neutral buoyancy, or slightly positive buoyancy, as preferred, so the diver uses his life vest to adjust his buoyancy by merely inflating the life vest to overcome any tendency to negative buoyancy. Such negative buoyancy may be present for a number of reasons, such as a gain in weight of the diver since the last dive; too much weight on the weight belt; or compression of the foam cells in the diver's wet suit at diving depths.

The use of a weight belt is a nuisance because it is heavy and difficult to handle, the weights are in a poor position for hydrodynamic stability of the diver, and the belt cannot be jettisoned in an emergency if the hapless diver has buckled anything over the belt. In addition, the cast lead weights are relatively expensive and, because of their size, only approximate the buoyancy adjustment usually needed. A finer buoyancy adjustment is possible with the inflatable life vest, but such a vest is quite expensive and, if one is not careful, the vest becomes partially filled with water when inflated under water.

SUMMARY

According to the present invention a buoyancy adjustment back pack is provided which is capable of supporting an air tank for a diver, and which is also capable of providing the buoyancy adjustment functions of both a usual weight belt and an inflatable life vest.

More particularly, the back pack includes a harness system for attachment to the diver's body, and further includes a compartment containing a fluent or pelleted mass such as inexpensive lead bird shot. The compartment is filled sufficiently with these little pellets to provide an approximation of the desired buoyancy condition for the diver. By virtue of their size, the pellets permit this approximation to be quite precise. The container extends up over the small of the diver's back so that the weight of the pelleted mass may more easily be borne by the diver, as compared to a cumbersome weight belt worn at the waist.

The lower extremity of the compartment is normally closed by a gate which is movable by the diver, by means of a lanyard or the like, to allow the lead shot to flow or fall out of the compartment under the influence of gravity. By opening and closing the gate at the proper time a submerged diver can obtain a very good adjustment of his buoyancy from negative to neutral or even to positive. In this regard, the gate can be held open, or pulled away altogether, to jettison all of the fluent mass. This has the same effect as the jettisoning of a conventional weight belt in an emergency.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevational view of a buoyancy adjustment back pack according to the present invention, the back pack being illustrated as it would be used by a SCUBA diver to support an air tank;

FIG. 2 is a front elevational view of the back pack of FIG. 1;

FIG. 3 is an enlarged sectional view taken along the line 3—3 of FIG. 4;

FIG. 4 is an enlarged sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is a view taken along the line 6—6 of FIG. 5; and

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, there is illustrated a buoyancy adjustment back pack **10** comprising a generally vertically elongated pack structure **12** configured to fit upon the back of a diver and including a harness **14** for mounting the pack structure **12** to the diver's body over his wet suit **15**. The pack structure **12** is hollow to define a compartment **16** generally coextensive with the structure **12** and having an outlet **18** in its lower portion. A pelleted or fluent mass consisting of lead shot **20** is located in the compartment **16** to impart negative buoyancy to the pack structure **12**. The lead slot **20** is maintained in the compartment **16** by a laterally slidable closure or gate **22** which normally closes the outlet **18**. The gate **22** is slidable in a complemental slot **23** by pulling upon a release ring **24** so that all or a portion of the lead shot **20** can be released or jettisoned from the compartment **16**.

The pack structure **12** is preferably molded of a suitable plastic material and is adapted to support a usual air tank **26** with its associated air regulator apparatus. Since any suitable means may be used for mounting the air tank **26** upon the pack structure **12**, as will be apparent to those skilled in the art, details concerning mounting structure for this purpose are omitted for brevity. Likewise, the particular construction of the harness **14** is not important to the present invention since any harness **14** suitable to mount the air tank and associated apparatus in position is satisfactory. The harness **14** illustrated comprises a pair of straps **28** adapted to extend over the diver's shoulders and about his waist. The free extremities of the straps **28** may be detachably secured together by a clamp or buckle **30**, while the opposite or fixed extremities of the straps **28** are disposed through a series of slots **32** provided in the upper portion of the pack structure **12**. The strap ends are stitched as illustrated to secure them to the pack structure **12**.

The waist portions of the straps **28** are oriented for disposition about the waist by disposition of the straps through pairs of slots **34** at the sides of the pack structure **12**.

The pack structure **12** is contoured to the natural shape of the diver's back and extends from the small of his back downwardly to his hip region. The structure **12** generally widens from top to bottom, except that the lowermost portion which mounts the gate **22** and its associated release system is somewhat reduced in width, as best viewed in FIG. **2**. This configuration provides a comfortable pack structure wide enough in the region of the diver's waist to accommodate the straps **28** and offer lateral stability for the tank **26**, and yet otherwise small enough not to be cumbersome.

As best seen in FIGS. **3** and **5–7**, the gate **22** comprises an elongated, transversely oriented plate which is welded to an elongated, transversely oriented rod **36**. The rod **36**, which is integral with the release ring **24**, extends through a transverse bore **38** provided in the lower wall portion of the pack structure **12** and opening into the gate slot **23**. Both the gate slot **23** and bore **38** extend laterally outwardly, as best illustrated in FIGS. **5** and **7**.

A bias means or compression spring **40** is also located in the bore **38**, being disposed about the rod **36** and bearing at its op-

posite extremities against the gate 22 and a retainer block or plug 42.

The plug 42 is releasably fitted or adversely bonded within a complemental opening provided in the side of the pack structure 12 at the outer terminii of the bore 38 and gate slot 23. The manner of securement or bonding is such that the securement or adhesive bond normally securely retains the spring 40, rod 36, and gate 22 in position interiorly of the retainer plug 42. However, the securement or bond fails under a deliberate, forcible pull by the diver upon the ring 24. This enables the plug 42 to disengage or separate from the pack structure 12 so that continued pulling upon the ring 24 pulls the rod 36, spring 40, and gate 22 completely out of the pack structure 12. If desired, the plug 42 may be made of a light polystyrene foam or the like so that it will itself fail upon forcible pulling upon the release ring 24, and thereby enable separation of the gate 22 from the pack structure 12.

In operation, the diver uses the harness 14 to strap the back pack 10 and air tank 26 in position in the usual manner, except that he does not use a weight belt. As previously indicated, the back pack 10 incorporates a sufficient quantity of the lead shot 20 in the compartment 16 to compensate for the diver's natural positive buoyancy. It is also unnecessary for the diver to utilize an inflatable life vest for buoyancy adjustment during the diving operation since, as will be seen, the back pack 10 enables such adjustment by jettisonment of a portion of the lead shot 20.

Once the diver dons his self-contained underwater breathing apparatus, including the air regulator and tank 26, he descends in the usual manner. Assuming that the weight of the lead shot 20 has already been adjusted so that his buoyancy is approximately neutral, the diver will soon experience an apparent negative buoyancy as the air cells in his wet suit 15 compress and the wet suit 15 displaces less water. This condition is usually undesirable because it means the diver must continually exert an effort to stay off the ocean bottom, for example.

The diver may reestablish a state of neutral buoyancy by jettisoning part of the lead shot 20. This is done by pulling laterally outwardly on the ring 24 until the gate 22 uncovers a small portion of the opening 18 to allow some of the lead shot 20 to fall out of the compartment 16. When the diver experiences the condition of buoyancy desired, he releases the ring 24. The bias of the spring 40 acts against the gate 22 and urges it to the closed position illustrated in FIG. 5.

In an emergency situation it is desired to jettison all of the lead shot 20 in order to reach the surface quickly, the diver may pull the ring 24 outwardly and keep it pulled outwardly against the bias of the spring 40 until all of the lead shot 20 drops out of the compartment 16. Alternatively, the diver can forcibly pull upon the ring 24 to tear the plug 42 out of its seat in the pack structure 12. This enables the whole assembly of the gate 22, rod 36, and spring 40 to slide out of the bore 38 and the slot 23 so that the compartment outlet 18 is completely uncovered. All of the lead shot 20 then pours out of the compartment 16 without further attention of the diver.

The back pack 10 has been described in connection with a "SCUBA" diving operation, but it is similarly applicable to other types of diving as well, such as "free" diving and "hard hat" diving.

The lead shot 20 is merely exemplary of a fluent mass which works satisfactorily with the back pack 10. The term "fluent" is intended to include any form of mass which comprises sufficiently small pellets or bodies that they pour or flow out of the compartment outlet 18 in a continuous stream that can be cut off at any point by the gate 22 to obtain a fine adjustment of buoyancy.

The disposition of the lead shot 20 throughout a substantial portion of the back pack, particularly that portion which normally is located above the diver's waist, provides improved hydrodynamic stability. There is no undesirable concentration of weight at the waist, as in the case with a conventional weight belt.

In addition to eliminating the usual weight belt, it will be apparent that the back pack 10 also eliminates any need to use an inflatable life vest to periodically adjust diver buoyancy during a diving operation, since small quantities of the lead shot 20 can be jettisoned at any time desired. This is particularly useful at the greater diving depths where the tendency toward negative buoyancy is more pronounced because of the compression of the diver's wet suit.

Various modifications and changes may be made with regard to the foregoing detailed description without departing from the spirit of the invention.

I claim:

1. A buoyancy adjustment back pack comprising:
   - a pack structure configured to fit upon a diver's back and including harness means for mounting of said pack structure to the diver's body, said pack structure further including a compartment having an outlet in its lower portion;
   - a mass of solid elements having a specific gravity greater than water and located in said compartment for imparting negative buoyancy to said pack structure to establish the overall buoyancy of the diver and his equipment; and
   - gate means having a closed position for normally closing said outlet to retain said solid elements in said compartment, said gate means including release means operable for moving said gate means to an open position to open said outlet whereby said solid elements are enabled to flow out of said outlet, and for moving said gate means to a closed position to close said outlet whereby further flow of said solid elements out of said outlet is prevented.

2. A buoyancy adjustment back pack according to claim 1 and including bias means operative to bias said gate means toward said closed position.

3. A buoyancy adjustment back pack according to claim 1 wherein said pack structure is vertically elongated and said compartment extends between the upper and lower extremities of said pack structure whereby at least a portion of said mass is located in the upper portion of said pack structure for improved weight distribution during a diving operation.

4. A buoyancy adjustment back pack according to claim 1 wherein said pack structure and said gate means are releasably interengaged whereby forcible operation of said release means disengages said gate means and said pack structure to jettison all of said mass.

5. A buoyancy adjustment back pack according to claim 1 wherein said mass of solid elements comprises lead shot.

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