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3,510,025

FLOTATION JACKET INFLATING DEVICE

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2 Sheets-Sheet 1

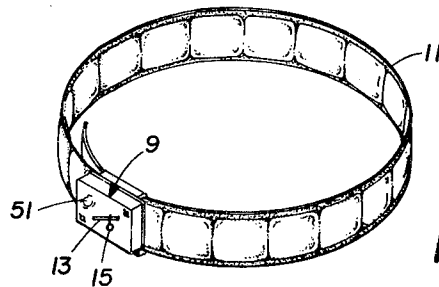


FIG. 1

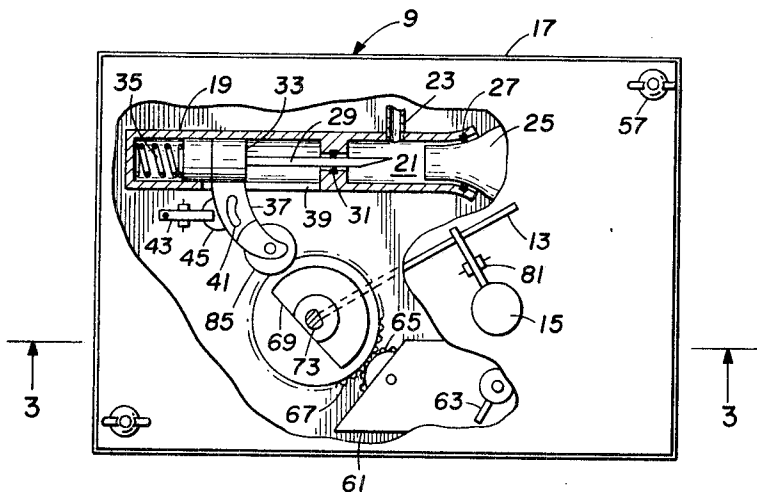


FIG. 2

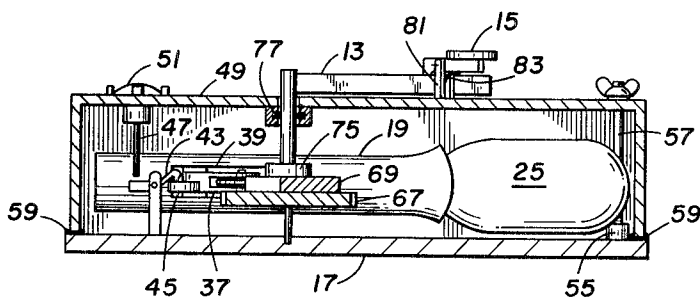


FIG. 3

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FLOTATION JACKET INFLATING DEVICE

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10 Claims

ABSTRACT OF THE DISCLOSURE

A timer valve for controlling the pressurization of a flotation jacket with compressed gas; the valve includes a spring biased piston driving a puncturing element into a cylinder of compressed gas. The spring driven piston is restrained from driving the puncturing element into the cylinder of compressed gas during a predetermined time interval by means of a timer mechanism. After the predetermined time delay, the piston is released and moves at a speed sufficient to drive the puncturing element into the cylinder end. The piston starts from a cocked position after disengaging a latch from a handle mechanism.

BACKGROUND OF THE INVENTION

This invention relates to a flotation jacket inflating device, and more particularly to a timer valve for controlling the pressurization of inflatable jacket from a cylinder of pressurized gas.

A number of inflating devices for inflatable life jackets have been developed that operate after the occurrence of a predetermined condition. One such device is fired from a launcher and actuated by forces produced upon impact, another includes a sensor responsive to a given pressure, and still another relies on a sensing mechanism responsive to water to actuate an inflating valve. These devices all have two things in common: (1) once actuated they cannot be stopped from inflating the life jacket; and (2) they act instantaneously or within a very short period of time. There are, however, various applications where a preset time delay would be desirable before the flotation jacket is pressurized. Also, it would be advantageous in some applications to interrupt the operation of the actuating mechanism to prevent the life jacket from becoming inflated.

Thus, an object of this invention is to provide a flotation jacket inflating device having a predetermined time delay before pressurization.

Another object of the invention is to provide a flotation jacket inflating device wherein the actuating cycle may be interrupted at any time during a first timing interval.

Still another object of this invention is to provide a flotation jacket inflating device wherein the timing cycle may be preset and locked ready for instant use.

In accordance with the present invention, a puncturing element is driven into a container of compressed gas in communication with a flotation jacket after a predetermined time interval. Operation of the puncturing element is delayed for the predetermined time interval by means of timing mechanism. At any time before the expiration of the time interval, the cycle of the timing mechanism may be interrupted and reset, thereby preventing the puncturing element from being driven into the container of compressed gas.

In accordance with one embodiment of this invention, a piston is slidably positioned within a guide and coupled to a puncturing element aligned to be driven into a cylinder of compressed gas in communication with an inflatable life belt. A spring generates the force required to drive the puncturing element into the cylinder of com-

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pressed gas after a predetermined time interval that is controlled by a timing mechanism. The timing mechanism includes a spring motor driving a cam which engages a follower attached to the spring driven piston. At any time before the cam releases the piston, the puncturing element can be reset to its starting position by means of a cocking handle and latch mechanism.

In accordance with another embodiment of this invention, a piston is slidably positioned within a cylinder and coupled to a puncturing element aligned to be driven into a cylinder of compressed gas in communication with an inflatable jacket. The piston drives the puncturing element by means of a spring at a speed controlled by the flow of fluid through a bypass line. After a predetermined time interval, the piston moves past a fast flow passage which permits high velocity fluid flow thereby allowing the piston to attain a velocity sufficient to drive the puncturing element into the container of compressed gas. At any time before the fast flow passage is opened by movement of the piston, the puncturing element can be reset to its starting position by means of a handle and latch mechanism.

A more complete understanding of this invention and its advantages will be apparent from the following specification and claims and from the accompanying drawings illustrative of the invention.

REFERRING TO THE DRAWINGS

FIG. 1 is a perspective of an inflatable life belt and a preferred embodiment of the timer valve of this invention;

FIG. 2 is a plan view of the timer valve of this invention with the protective cover partially cut away;

FIG. 3 is a cross section of the timer valve of FIG. 1 taken along the line 3—3 of FIG. 2;

FIG. 4 illustrates in perspective a flotation jacket inflatable from a pair of valves in accordance with an alternate embodiment of the present invention;

FIG. 5 is a cross section of an inflating valve in accordance with the embodiment of FIG. 4;

FIG. 6 is a plan view of a portion of the valve of FIG. 5 to the left of the line 6—6 showing an alternate embodiment thereof; and

FIG. 7 is a cross section of the embodiment of FIG. 6 taken along the line 7—7.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring first to FIGS. 1—3, there is illustrated a timer valve 9 for inflating a life belt 11 of the type most generally used by surfers. A cocking handle 13 for pre-setting a timing mechanism is held in the ready position by means of a trip latch 15.

With particular emphasis now to FIGS. 2 and 3, there is shown a cylindrical shaped piston guide 19 mounted to a base plate 17 of the timer valve 9. The guide 19 includes a gas tight chamber 21 having a pipe 23 in communication with the life belt 11. A cylinder of compressed gas 25 fits into the open end of the chamber 21 and an O-ring 27 creates a gas tight seal with the cylinder in place. Aligned to be driven into the cylinder 25 is a puncturing element 29. An O-ring 31 creates a gas tight seal around the puncturing element 29 where it enters the chamber 21. The puncturing element 29 extends from one end of a piston 33 slidably mounted within the guide 19. A spring 35 generates the force required to drive the puncturing element 29 into the cylinder 25.

To reset the piston 33 and the puncturing element 29 in the position shown in FIG. 2, a roller support 37 is attached to the piston 33 through an elongated slot 39 in the guide 19. A finger pull 41 provides a means for moving the roller support 37 to reset the piston 33 against the spring 35. As the piston 33 moves into its reset position,

a safety latch 43 automatically engages a hook 45 as part of the roller support 37. The piston 33 is now in a safety position and will remain there until a push rod 47 extending through the timer cover 49 trips the safety latch 43. A dome-shaped rubber cover 51 forms a water tight seal to prevent moisture from entering the timer housing around the push rod 47.

The cover 49 is held in place by means of two wing-head bolts which are threaded into weld nuts, such as weld nut 55. One of the wing-head bolts 57, illustrated in FIG. 3, engages the weld nut 55 to secure the cover 49 in place. A gasket 59 located between the edge of the cover 49 and the base plate 17 provides a water tight seal when the cover is held in place by the wing-head bolts.

A spring driven motor 61 provides the motive power required to operate the timing mechanism. A spring (not shown), wound into a coiled position by means of a key 63, provides the power for rotating a gear 65. The gear 65 is part of a gear train which includes a gear 67 having a cam 69 attached to the upper surface thereof. The cocking handle 13 rotates the cam 69 and gear 67 to the position shown in FIG. 2 which is the initial present position of the timer mechanism. When the cover 49 is fastened to the base plate 17, the handle 13 will be correctly oriented with respect to the cam 69 by means of a key 73 which fits into a keyway 75. An O-ring 77 provides a water tight closure to prevent moisture from entering the valve housing around the shaft of the handle 13. The cocking handle 13 is held in the present position by means of the trip latch 15 attached to the cover 49 by means of a pivotal support 81. The trip latch 15 is spring loaded into the position shown by means of a leaf spring 83.

In operation, the piston 33 along with the puncturing element 29 are moved to the reset position shown in FIG. 2. A cylinder of compressed gas 25 is inserted into the open end of the chamber 21. As the piston 33 reaches a safety position, the safety latch 43 automatically engages the hook 45. Next, the cover 49 is placed on the base plate 17 and held in position by means of wing-head bolts threaded into the weld nuts attached to the base plate 17. Prior to securing the cover 49 to the base plate 17, the cocking handle 13 was properly oriented with respect to the cam 69 by means of the key 73 and keyway 75.

To preset the timing cycle, the handle 13 is rotated to engage the trip latch 15 and position the cam 69 as shown in FIG. 2. The push rod 47 is actuated to release the piston 33 from its safety position, thereby causing it to move forward until a roller 85 at the end of the roller support 37 engages the cam 69. The unit is now ready for operation.

The user, such as a surfer, fastens the deflated life belt 11 around his waist and proceeds into the surf. When he is at a desired distance from shore, he mounts his surfboard and begins a ride to the beach. At this time, he trips the trip latch 15; the handle 13 and the cam 69 rotate slowly by means of the drive motor 61. The roller 85 follows the cam 69 and holds the piston 33 in a cocked position. If the surfer completes a ride before the roller 85 moves past the flat surface of the cam 69, he merely returns the handle 13 to a latched position as shown in FIG. 2. However, if as a result of some unforeseen circumstance, the roller 85 is allowed to move past the cam 69, then the spring 35 will drive the puncturing element 29 into the cylinder 25. This permits the gas therein to escape through the pipe 23 to inflate the life belt 11. The inflated life belt now supports the surfer in the usual manner for such devices.

Typically, the time required for the cam 69 to rotate from the position shown in FIG. 2 to a position which allows the puncturing element to be driven into the cylinder 25 is on the order of 90 seconds. However, any desired time delay can be provided by merely sizing the gears 65 and 67 accordingly. Thus, there is provided a timer valve which inflates a life belt after a predeter-

mined time delay but which can be reset at any time prior to the expiration of the predetermined time interval.

Reference will now be made to FIGS. 4-7 where there is shown a conventional flotation jacket 10 including inflatable panels 12 and 14 having passageways coupled to inflating valves 16 and 18, respectively. In the usual manner, the flotation jacket 10 includes narrow side straps 20 and 22 and a front strap 24. A wide back strap 26 and the straps 20, 22 and 24 terminate at a waist band 28 equipped with clips to be fastened to the front strap 24. The flotation jacket 10 is worn like a vest, and in a deflated condition will be relatively flat, thus allowing freedom of movement by the wearer. To provide sufficient buoyancy to support the user, compressed gas in the valves 16 and 18 is released into the inflatable panels 12 and 14.

As illustrated in FIG. 5, the valve 16, the valve 18 being similar, includes a small compressed gas cylinder 30 contained within a housing 32. A timing mechanism cylinder 34 forms an integral unit with the housing 32 and contains a piston 36 slidably positioned therein. A pair of O-ring seals 38 and 40 contained within annular grooves on the outer surface of the piston 36 engages the inner walls of the cylinder 34 in a sealing arrangement to form three separate chambers 42, 44 and 46. These chambers are filled with a fluid such as a low viscosity oil. Attached to the housing end of the piston 36 and freely movable through an opening in the cylinder 34 and an opening in the housing 32 is a puncturing element 48. This element may have a hollow tapered end at the cylinder 30 with a series of longitudinally arranged apertures to permit the pressurized gas to escape from the cylinder 30 into the inflatable panel 12. An O-ring 50 engages the puncturing element 48 at the opening in the cylinder 34 to provide a fluid-type chamber 46. Similarly, an O-ring 52 contained in the passage of the housing 32 engages the puncturing element 48 to provide a gas-type seal, thereby preventing compressed gas from the cylinder 30 escaping to the atmosphere.

The piston 36 is biased in a direction to drive the puncturing element 48 into the cylinder 30 by means of a spring 54 in the chamber 42. To cock the timing mechanism, the spring 54 is compressed by moving the piston 36 by means of a handle 56 attached to the puncturing element 48. A latchbar 58, pivotally connected to the housing 32 and equipped with a pull ring 60, holds the piston 36 in the ready position.

Extending longitudinally through the piston 36 is a passage 62 providing an interconnection between the chambers 42 and 46. This passage contains a ball check valve 64 held in a sealing position by means of a spring 66 to seal the chamber 42 from the chamber 46, thereby preventing fluid flow between these chambers during the forward movement of the piston 36. A piping arrangement 68, external to the cylinder 34, forms a passageway that connects the three chambers 42, 44 and 46. In that section of the piping arrangement 68 opening into the chamber 42 there is included an orifice 70 for controlling fluid flow from the chamber 46 into the chamber 42.

In operation, the wearer of the flotation jacket 10 moves the handle 56 to the left, thereby forcing the piston 36 into a cocked position against the spring 54. To hold the piston 36 in this position, the latchbar 58 is rotated to engage the handle 56. A cylinder 30 of compressed gas has previously been placed in the housing 32 and the valve attached to the inflatable panel 12. The valve 18 will be preset in a similar manner thereby providing a means for inflating the inflatable panel 14. To inflate the jacket 10, the wearer pulls on the rings 60 and 72. Pulling the ring 60 disengages the latchbar 58 from the handle 56 and the piston 36 moves forward under the influence of the spring 54. The piston 36 travels initially at a speed controlled by the rate of fluid flow from the chamber 46 through the orifice 70 into the chamber 42. The size of the orifice 70 will be calculated to provide for movement of the piston 36 from a cocked position to a position such

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that the O-ring 38 passes the pipe 68a during a first pre-selected time interval, taking into consideration the fluid contained within the cylinder 34. As previously mentioned, the cylinder 34 and the piping arrangement 68 are filled with a conventional hydraulic fluid. This fluid flows from the chamber 46 through the piping arrangement 68 by movement of the piston 36. Movement of the piston 36 drives the puncturing element 48 toward the compressed gas cylinder 30.

As described, the piston 36 moves at a first speed during a first time interval under control of the orifice 70. This first time interval ends when the O-ring 38 on the piston 36 passes the pipe 68a. Fluid now flows from the chamber 36 into the chamber 42 at a rate determined by the size of the pipe 68a. This pipe is sized such that fluid flowing from the chamber 46 permits the piston 36 to attain a velocity sufficient to drive the puncturing element 48 into the cylinder 30. Puncturing the cylinder 30 causes the compressed gas stored therein to escape through a pipe 74 into the inflatable panel 12. A similar operation takes place for the valve 18 and the inflatable panel 14 is also inflated.

At any time during the first time interval while the piston 36 travels at the slow speed, the cycle may be interrupted, thereby stopping the puncturing element 48 from being driven into the cylinder 30. Assume 60 seconds has been selected for the length of the first time interval and 30 seconds of this period has elapsed, the wearer may interrupt the cycle by following the initial cocking procedure. This forces the piston 36 against the spring 54 thereby opening the ball check valve 64 against the spring 66 and fluid flows from the chamber 42 to the chamber 46. He then re-inserts the latchbar 58 against the handle 56 and the valve is re-set for another operation.

Referring to FIGS. 6 and 7, there is shown an alternate embodiment of the valve of FIG. 5 where the rate of fluid flow from the chamber 46 into the chamber 42 during the first time interval may be varied by means of a bleed valve 78 as controlled by a handle 76. The internal construction and operation of the cylinder 34 remains the same as described previously with the only modification in the piping arrangement 68. The fixed orifice is replaced by the bleed valve 78 which may be adjusted to vary the rate of fluid flow from the chamber 46. In the example shown, the flow rate may be adjusted such that the slow speed travel time of the piston 36 is variable from 50 seconds to 110 seconds, in seven calibrated steps.

An additional feature of the embodiment shown in FIG. 6 is that by turning the handle 76 to the "off" position, movement of the piston 36 will be stopped. This position could replace the latchbar 58 for holding the piston 36 in the cocked position.

When using the "off" position of the valve 78 to hold the piston 36, the wearer simply moves the handle 56 to the left. The piston 36 will not move since the ball check valve 64 prevents fluid flow through the passage 62 and the valve 78 blocks flow of fluid through the piping arrangement 68. To initiate the timing cycle, the wearer of the jacket 10 holds the handle 56 in the far left position and turns the handle 76 for the desired initial timing cycle. He then releases the handle 56 and the piston 36 moves in a manner similar to that described previously. After the time set by the handle 76 has elapsed, the piston 36 exposes the pipe 68a and the cylinder 30 is punctured by the puncturing element 48. At any time prior to the expiration of the initial timing interval, the wearer may interrupt the cycle by simply turning the handle 76 to the "off" position. It should be understood, however, that the latchbar 58 and the ring 60 may also be used to initiate the timing cycle established by the handle 76.

The valves described herein overcome a troublesome problem that has previously existed in valves for inflating life jackets. That is, the cycle may be interrupted any time during a first interval of time, thereby preventing 75

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inflation of the jacket. Previously, once the timing cycle of inflating devices had been initiated, they continued until the life jacket was inflated. On occasion, this resulted in unnecessary inflation of the jacket.

While several embodiments of the invention, together with modifications thereof, have been described in detail herein and shown in the accompanying drawings, it will be evident that various further modifications are possible in the arrangement and construction of the components without parting from the scope of the invention.

What is claimed is:

1. A time valve for inflating a flotation jacket from a puncturable container of compressed gas comprising:

a power driven puncturing element positioned to be driven into said container to release the compressed gas therefrom,

timing means for controlling said power driven puncturing element and delaying the operation thereof for a predetermined interval after initiation of a timing cycle, and

means for interrupting the timing cycle to inhibit said power driven puncturing element and resetting said timing means.

2. A timer valve for inflating a flotation jacket from a puncturable container of compressed gas as set forth in claim 1 including means for locking said timing means in a reset position.

3. A timer valve for inflating a flotation jacket from a container of compressed gas comprising:

a puncturing element operably positioned to be driven into said container to release the gas therefrom into said jacket,

means for driving said puncturing element into said container,

timing means for actuating said driving means a predetermined period after initiation of a timing cycle, and

means for interrupting the timing cycle to inhibit said driving means from actuating said puncturing element and resetting said timing means.

4. A timer valve for inflating a flotation jacket from a container of compressed gas as set forth in claim 3 wherein said driving means includes:

a cylindrical housing,

a piston slidably positioned within said cylinder and coupled to said puncturing element, and

a spring engaging one end of said cylinder and said piston for exerting a force on said piston to drive said puncturing element into the container of compressed gas.

5. A timer valve for inflating a flotation jacket from a container of compressed gas as set forth in claim 4 wherein said timing means includes:

a cam rotating at a preset speed for determining the length of said timing cycle, and

a roller attached to said piston and engaging said cam thereby holding said piston in a reset position during the timing cycle.

6. A timer for inflating a flotation jacket from a container of compressed gas as set forth in claim 5 including a safety latch for holding said piston in a safe position during the setting of said timing means.

7. A timer for inflating a flotation jacket from a container of compressed gas as set forth in claim 5 wherein said cam includes a flat portion which does not engage said roller thereby permitting said puncturing element to be driven into the cylinder of compressed gas.

8. A timer valve for inflating a flotation jacket from a container of compressed gas as set forth in claim 4 wherein said timing means includes a first piping arrangement for restricting the flow of fluid from one side of said piston to the other to establish a first piston speed, and

a second piping arrangement wherein a substantially unrestricted volume of fluid flows from one side of said

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piston to the other to allow movement thereof after a predetermined period at a speed and for a distance sufficient to drive said puncturing element into said container.

9. A timer for inflating a flotation jacket from a container of compressed gas as set forth in claim 8 wherein said first piping arrangement includes a valve for adjusting the rate of fluid flow and in turn the initial time period before said piston operates at the second speed.

10. A timer valve for inflating a flotation jacket from a container of compressed gas as set forth in claim 8 including means for compressing said spring and locking said piston in the cocked position.

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U.S. Cl. X.R.

9—318; 222—477

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,510,025 Dated May 5, 1970

Inventor(s) James G. Turner, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, line 39, "based" should be -- biased --

Col. 6, line 32, after "jacket" change . (period) to --
, -- (comma)

SIGNED AND
SEALED

SEP 29 1970

(SEAL)

Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents