May 14, 1968 J. L. BOSCOV 3,382,514

POSITIVE SCUTTLING BUOY

Filed Oct. 19, 1966

FIG. 1

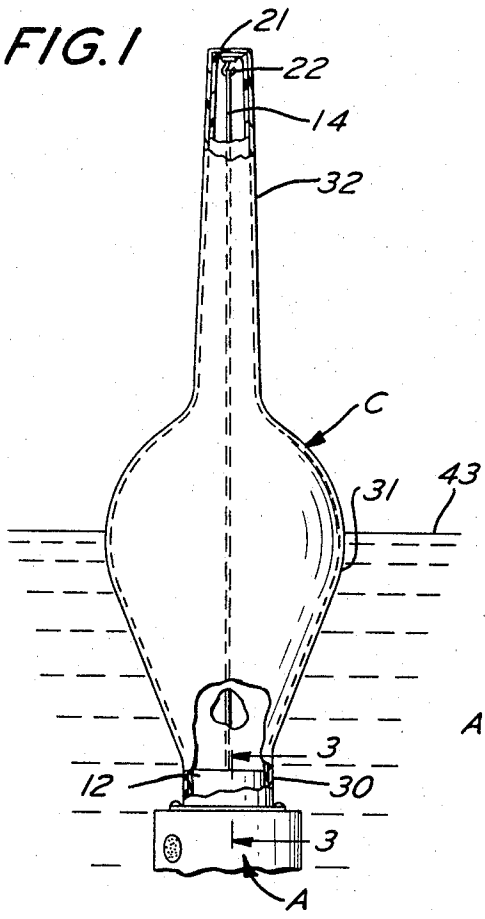


FIG. 3

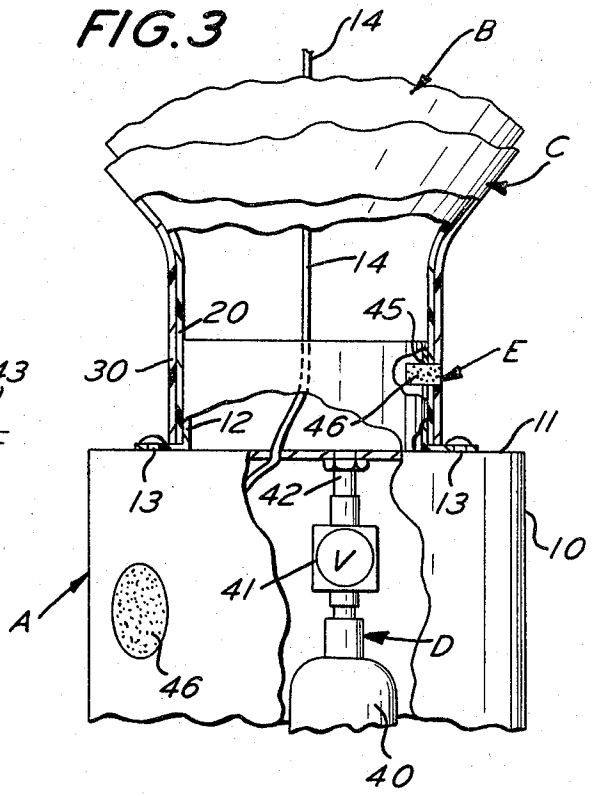
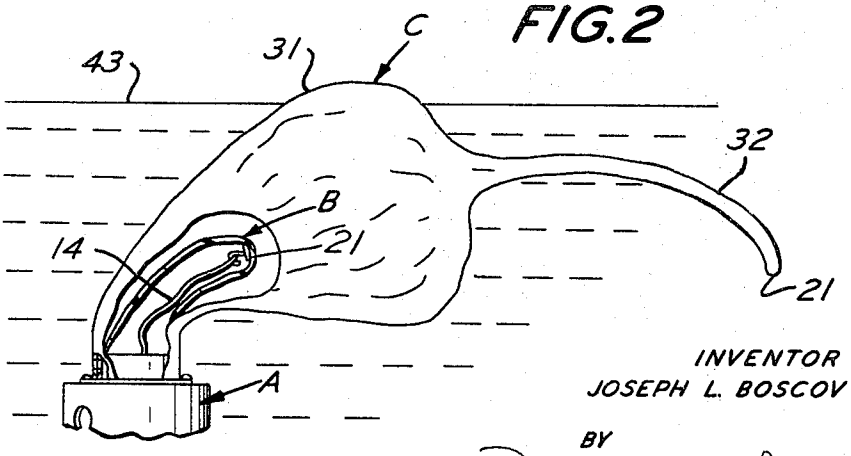


FIG. 2



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POSITIVE SCUTTLING BUOY

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ABSTRACT OF THE DISCLOSURE

Positive scuttling of devices such as buoys is obtained by providing an outer air-permeable shape-defining envelope and an internal balloon made of resilient elastic material. On inflation with flotation fluid, the balloon expands to fill the envelope, storing energy in its tensioned material, and the device is rendered buoyant. When, after a predetermined interval, the balloon is vented, its contraction and consequent release of stored energy cause positive expulsion of flotation fluid, so that buoyancy is lost.

This invention relates to positive scuttling buoys which float on a supporting liquid for a predetermined time and then sink. More particularly, it relates to inflatable disposable buoys which find wide military and civilian applications. These include, for example, submarine detection, underwater sound ranging and marine seismic prospecting.

Several types of inflatable scuttling buoys are described in the prior art which are suitable to be dropped from an airplane in a compact, deflated form. Upon hitting the water, automatic inflation means go into operation to cause the buoy to assume its inflated flotation contour. After a predetermined time, during which the buoy has performed its stated function (e.g., the support of an electronic instrument package) the buoy, at least in theory, scuttles itself. The reason for such scuttling is to make the instrument package unavailable to unauthorized personnel and to clear the surface of the water so as to leave no trace of the buoy's presence.

The self-scuttling devices of the past have, on many occasions not operated as intended to fully sink the buoy. Most of these devices involved a time-delayed means for permitting water to enter the buoy and physically displace the flotation fluid (e.g., gas) contained therein. Sometimes, however, this displacement was not complete and a trapped pocket of gas remained which could not be displaced by the liquid. This remaining gas pocket often proved large enough to prevent the buoy from sinking.

The existence of this problem was recognized and a solution thereto presented in U.S. Patent No. 3,081,466 which was assigned on its face to the Secretary of the Navy. The general approach taken in that patent is to vent the top of a constant volume buoy to the atmosphere while allowing liquid to enter the bottom so that liquid is free to rise up in the buoy without creating a trapped pocket of gas. Naturally, this involved elements of structure which would not otherwise have been necessary.

This invention takes a totally different approach to the solution of the same problem. It achieves a positive mechanical expulsion of flotation fluid from the buoy as distinguished from the mere displacement of the gas by the supporting liquid.

Accordingly, it is an object of the invention to provide an inflatable buoy, which is scuttled after a predetermined time, by the positive expulsion of flotation fluid into the liquid on which the buoy floats.

It is a further object of the invention to provide a flotation device which includes an outer envelope, and

an inner resilient balloon which, when inflated with a flotation fluid, renders the device buoyant and which, when deflated, positively contracts to a size insufficient to hold enough flotation fluid to keep the device buoyant.

Another object of the invention is to provide a buoy, suitable for use in air-drop applications, which will be positively self-scuttling after a predetermined time without requiring a plurality of moving parts or expensive components in order to insure such operation.

An additional object of the invention is to provide a device of the character described wherein the inflation pressure of the flotation fluid is used to store energy in a resilient member and where, during deflation, this energy is released to cause positive expulsion of the fluid.

It is also an object of the invention to provide a positive scuttling device for flotation on a supporting liquid which is rugged in construction, easily and inexpensively manufactured, highly reliable and efficient in use and which, while representing an improvement over the prior art devices, achieves the improvement with a simplification in structure.

These and other related objects of the invention will be apparent to those skilled in the art from a consideration of the description which follows.

The various features and details of construction of the invention are fully set forth herein with reference to the accompanying drawing, in which like reference numerals designate like parts and in which:

FIGURE 1 is a fragmentary perspective view, partly cut away, showing a buoy of the invention in its inflated buoyant condition on a body of supporting liquid.

FIGURE 2 is a fragmentary perspective view, partly in section, showing the buoy of FIGURE 1 as it sinks in its deflated non-buoyant condition.

FIGURE 3 is an enlarged fragmentary perspective view, partly in section, showing details of construction of portion of the buoy of FIGURE 1.

Briefly stated, the embodiment of the positive scuttling devices of the invention disclosed herein comprises an instrument package housing A which is adapted to be rendered buoyant by an attached resilient balloon B. The balloon is protected by a contour-defining outer envelope C which may also be attached to housing A. Balloon B is inflated by inflation means D, preferably located in housing A. Time-delayed vent means E, operating sequentially after the inflation means D, cause postitive scuttling of the total device.

Instrument package housing A may be of any shape or size, dependent upon its function. Its center of gravity, shape, and weight all determine the buoyancy required to keep it afloat and therefore determine the size and other parameters of balloon B. As shown in FIGURE 1, housing A may be generally cylindrical and include walls **10** and a top **11**. Mounted on top **11** is a hollow neck member, generally **12**, which is provided with a radially extending bottom flange **13**. Flange **13** is utilized to attach the neck **12** to the top **11**. The contents of the instrument package may include a radio transmitter, in which case a flexible transmitting antenna **14** is provided which extends upwardly through top **11** and neck **12**. Where the antenna penetrates top **11**, appropriate means may be utilized for making the point of penetration gas-tight (e.g., a sealant, a rubber grommet, etc.).

Resilient balloon B may include an open mouth **20** and a closed end **21**. Particular applications may require further modifications in construction. Thus, for instance, in the embodiment shown, an internal hook **22** is cemented to end **21** and the terminal end of the antenna **14** is attached thereto.

Balloon B is made of any resilient material, impermeable to flotation fluids such as gases like air, carbon di-

oxide and the like. Its essential characteristic, however, is a resilient elasticity which will allow it to be stretched and tensioned when filled with, or inflated by, the flotation fluid until it fills out and assumes the contour of envelope C. In fully inflated condition (i.e., as shown in FIGURE 1) the energy of inflation is stored in the balloon's walls in the form of tension and, once means are provided for escape of the flotation fluid, this tension causes contraction of the balloon, from the size shown in FIGURE 1 to substantially its original size, as shown in FIGURE 2. The balloon may derive its ability to conform to the contour of envelope C from having been shaped in a particular pattern or, alternatively, it may get this ability by virtue of the moldability of the material from which it is made and its consequent ability to assume the configuration of any shape within which it is confined. Suitable materials for such balloons include natural rubber, silicone rubber, and those plastic films which have an elastic "memory."

Balloon B is attached to package A by fitting mouth **20** over neck **12**. Preferably it should be cemented in place although, if desired, a wide variety of clamping means may be utilized. It should be realized that the elasticity of the material from which the balloon is made contributes to the retention.

The shape of the balloon and the visible appearance of the device, when floating, is a function of the contour of outer envelope C. This envelope may be made of any flexible, gas-permeable material such as canvas, cloth, plastic-derived fabrics (e.g., those derived from long-chain polymeric amides, polyesters, etc.) or similar materials which, while rugged enough to survive physical handling including an air drop, are porous enough to permit passage of air. The envelope is preferably formed with an open mouth **30**, an intermediate bulbous section **31** and, for an application involving radio transmission or reception, a frusto-conical terminal portion **32** which extends upwardly into the atmosphere. The specific shape of the envelope is a function of the character of the instrument package A and the desired center of gravity of the device when in flotation condition. The envelope, in and of itself, need have no buoyancy and should be of a material which can be readily folded or crumpled, such as the materials described above, so that as originally packaged for dropping from an airplane it occupies a minimum volume. Coloration and contour may be selected to either increase or decrease visibility dependent upon the application involved. The use of radio wave reflecting coatings to permit radar location of the envelope is within the contemplation of the invention.

Inflation means D are located within housing A. In fact, in certain applications, where the device functions merely as a buoy, the inflation means could constitute the total contents of the housing. In this particular embodiment, however, instruments including a radio transmitter (not shown), the output of which is coupled to resilient antenna **14** are also included. The electronic contents of the housing form no part of the instant invention.

The inflation means includes a cartridge **40** containing compressed inflation fluid. This may be, for instance, a cartridge of compressed gas such as, for example, carbon dioxide or compressed air. Other materials such as freon which, upon release of pressure, undergo a change in state are also suitable as long as the fluid entering the balloon has a density less than that of the supporting liquid. Regardless of the specific contents of cartridge **40**, the objective is to store therein a flotation fluid which can inflate balloon B and thus render the device buoyant. Linked to cartridge **40** is an automatic valve **41**. These valves, which are well known in the prior art and are permanently opened by a trigger mechanism, are readily available. Trigger mechanisms may be had which are responsive to the impact of the device hitting the water when dropped from an airplane, to a chemical reaction caused by the action of salt water, or to timer-initiated detonation of a squib. Until valve **41** opens, balloon B remains uninflated. When the valve does open, inflation fluid travels under pressure through conduit **42** to the interior of the balloon.

When the balloon is inflated the device rides upon a body of supporting liquid **43** as shown in FIGURE 1. The liquid is generally water, most often sea water. For such applications carbon dioxide has been found to be a most suitable flotation fluid and inflation pressures within the balloon when it is used are on the order of four to eight p.s.i.g. This pressure is sufficient to cause the balloon to fill the totality of envelope C, and to result in the erection of flexible antenna **14** which, as the unit is packaged prior to inflation, may be conveniently coiled up within neck **12**.

Vent means E are time-delayed and operate only after the inflation, described above, has occurred. These means include a passageway **45** which extends from the interior of balloon B, seriatim, through neck **12**, mouth **20**, and mouth **30** to the exterior of the assembly. The passageway is blocked by a plug **46** made of material which is slowly soluble in supporting liquid **43** (e.g., a salt composition). Alternatively, the plug may be metallic and may dissolve due to the electrolytic action caused by battery leakage onto it. Once the plug has dissolved the passageway is open.

Were one dealing with the prior art buoys, where the container for flotation fluid had a substantially constant volume, the only pressure gradient which would ever cause displacement of flotation fluid by supporting liquid would be the difference between the fluid pressure inside the buoy and the static head of supporting liquid above the venting point. However, in the instant invention, flotation fluid can be expelled (as distinguished from merely displaced) not only because of the initial gradient caused by the pressure of the flotation fluid but also because of the reduction in ballon volume as restoring forces relieve tension and cause it to return to a small size.

Referring to the figures, it will be observed in FIGURE 2 that the device is sinking because balloon B has substantially regained its initial dimensions and does not contain sufficient flotation fluid to make the device buoyant. Further, envelope C, because it is made of air-permeable material cannot serve to retain fluid under pressure and add buoyancy. In some embodiments of the invention, particularly those where the housing A contains instrumentation and voids it may be desirable to provide an additional plug **45** in wall **10** to flood the housing. In designs where inflation fluid is permitted to enter the housing as well as the balloon, a plug in the wall of the housing would serve as a vent for both.

Although the invention has been described in considerable detail, such description is intended to be illustrative rather than limiting since the invention may be variously embodied. Consequently, its extent is to be determined by the appended claims.

Having described by invention, I claim:

1. A positive scuttling device for flotation on a supporting liquid comprising:

(a) a flexible, air-permeable, shape-defining outer envelope;

(b) a balloon made of resilient elastic material located within said envelope which, as it is inflated with a quantity of flotation fluid sufficient to render said device buoyant, expands from its original size to fill said envelope and assume its configuration, said resilient elastic material being tensioned during inflation to store energy and the balloon, when subsequent deflation occurs, contracting to a size insufficient to hold enough flotation fluid to keep said device buoyant, the stored energy in said tensioned material being utilized to positively expel flotation fluid from the balloon as it contracts, and

(c) inflation means supported by said device and oper-

atively associated with said balloon for inflating it with a flotation fluid, and

(d) time delayed vent means, operatively associated with said balloon and operating sequentially at a predetermined interval after said inflation means, to establish an open passage between the interior of said balloon and the supporting liquid on which said device floats,

the ensuing expulsion of flotation fluid from the interior of said balloon continuing until said balloon ceases to contract.

2. The device of claim **1** wherein said outer envelope includes a bulbous lower section extending below the level of the supporting liquid and an upper section extending into the atmosphere.

3. The device of claim **1** wherein said time delayed vent means comprises a plug of material which is soluble in the supporting liquid, said plug being located in an area in contact with the supporting liquid when the device is floating and said flotation fluid being expelled into the supporting liquid when said vent means becomes operative.

4. The device of claim **1** wherein said envelope has a mouth, said balloon has a mouth and the device further includes a hollow neck member, the mouth of said envelope and the mouth of said balloon being coaxially mounted on said neck.

5. The device of claim **1** wherein said vent means comprises a passageway, one end of which is in pneumatic

communication with the interior of said balloon and the other end of which is exposed to the supporting liquid when said device is floating, and a plug of material sealing said passageway which material is soluble in the supporting liquid.

6. The device of claim **5** wherein said envelope has a mouth, said balloon has a mouth and the device further includes a hollow neck member, the mouth of said envelope and the mouth of said balloon being coaxially mounted on said neck.

7. The device of claim **6** wherein said vent means is located in said neck.

8. The device of claim **4** which further includes an instrument package housing on which said neck is mounted, said housing containing within it said inflation means.

9. The device of claim **6** which further includes an instrument package housing on which said neck is mounted, said housing containing within it said inflation means.

References Cited

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