Feb. 2, 1971 KUNIO SHIMIZU 3,559,224

AUTOMATIC LIGHTING DEVICE FOR SALVAGE

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FIG. 1

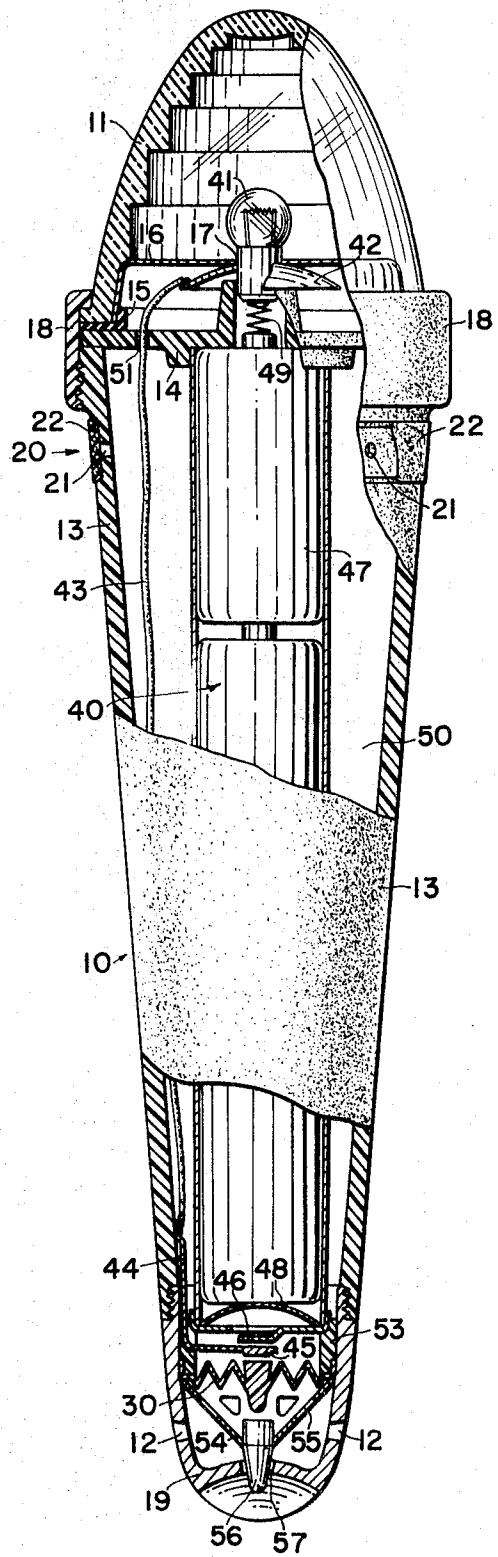

FIG. 2

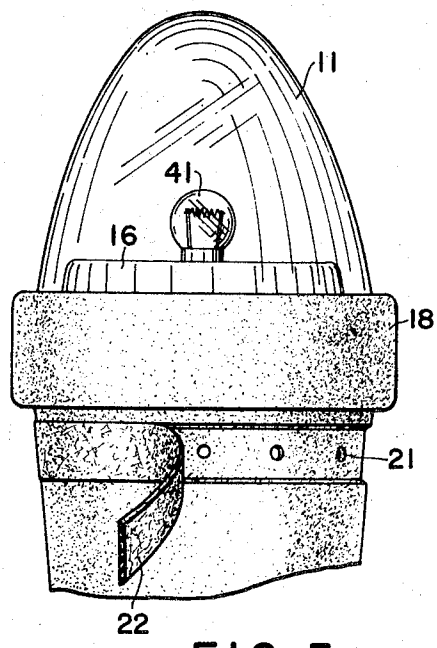

FIG. 3

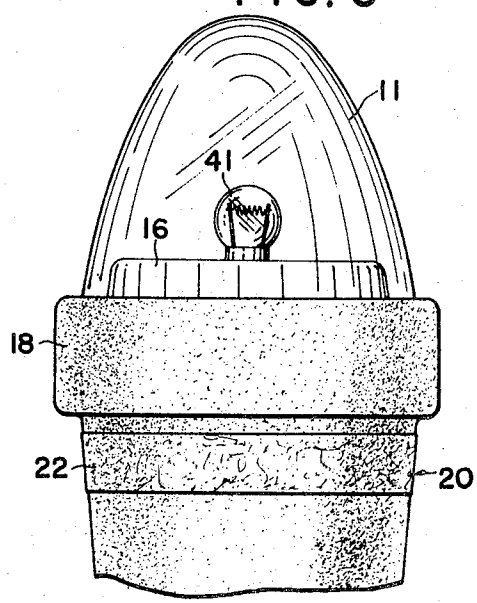

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FIG. 4

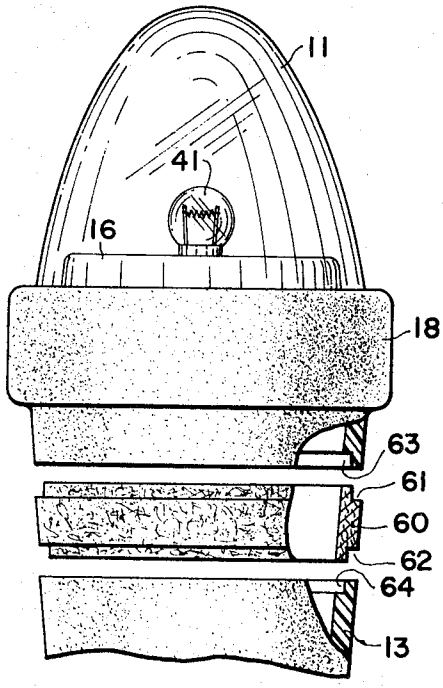


FIG. 5

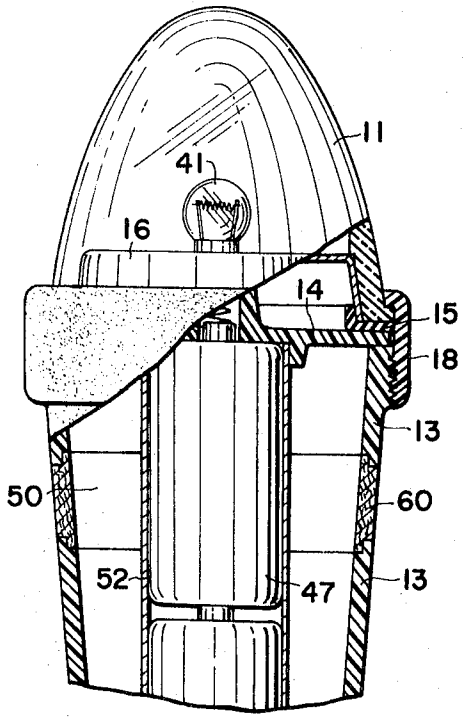
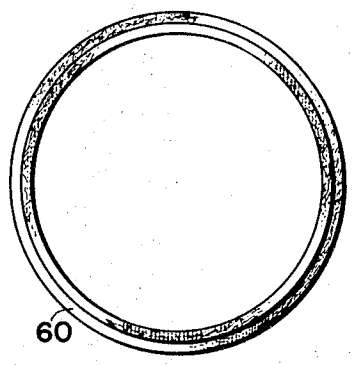


FIG. 6



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AUTOMATIC LIGHTING DEVICE FOR SALVAGE

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Int. Cl. B36b *45/00*
U.S. Cl. 9—8.3 5 Claims

ABSTRACT OF THE DISCLOSURE

A lighting device comprises a casing having openings at the lower end portion thereof, through the openings of which water enters into the casing as the lighting device floats on the water while revealing the top portion thereof above the surface of water, a diaphragm watertightly fixed within the casing so as to be pushed up by the water entered therein, and an electric circuit including a contact assembly for lighting the lighting device to be switched on by means of the diaphragm pushed up. Around the upper portion of the casing and above the surface of the water, there is provided a material permeable by gas but impervious to water to separate a sealed inner chamber from the outer air, and thereby balancing the inner air pressure with the outer air pressure through the material.

This invention relates to an automatic lighting device and more particularly to an automatic lighting device for salvage used to show the place of a sea disaster as the lighting device carried in an airplane, a ship or a yacht is automatically lighted by hydraulic pressure when thrown to the sea at the accidental sea disaster.

A conventional lighting device of this type comprises a swelled lens at the top thereof, an elastic diaphragm fixed water-tightly to the inside of bottom openings of a casing, and a bulb lighting means including a movable and a fixed contact points and mounted into a sealed chamber formed between the diaphragm and the casing. When the diaphragm is displaced by inflow of sea water through the bottom openings of the casing, the diaphragm pushes the movable contact point toward the opposite fixed contact point to come into contact with each other, so that the bulb is lightened.

Whereas, such a structure increases an inner air pressure of the sealed chamber by heat generated due to lighting of the bulb for a long period, In addition, a gas generated through cells in the chamber also increases the inner air pressure of the chamber. The increased air pressure acts on the diaphragm to separate the both contact points from each other, so that lights may be put out while in use or may not light when desired. Moreover, such a lighting device may light during preservation thereof due to pressure difference between the inner pressure and the outer pressure of the sealed chamber.

Such a disadvantage may be resolved by always balancing the inner pressure with the outer pressure of the chamber, for example by forming a fine vent hole through the top of the swelled lens fixed to the top of the casing. Though little, the fine vent hole may allow the sea water to enter into the casing while the lighting device thrown and sunk to a relatively deep point of the sea is refloated. The entered water stays on the surface of the diaphragm while the lighting device is floating and may push down the diaphragm to separate the both contact points from each other, resulting in bad affection to accurate operation of lighting.

An object of the present invention is to provide an automatic lighting device of easy construction and of accurate operation wherein vent holes are provided to always balance the inner pressure of the casing with the outer pressure thereof to prevent any water from entering into the casing.

For a better understanding of the invention, as well as further objects and features thereof, reference is made to the following detailed description to be read in conjunction with the accompanying drawings, wherein like figures are represented by like reference numerals.

In the drawings:

FIG. 1 is a side elevation view showing, in partial section, a lighting device according to the invention,

FIG. 2 is a fragmentary side elevation view of a top portion of a casing in FIG. 1, showing an elongated band permeable by gas but impervious to water covering over vent holes,

FIG. 3 is a side elevation view showing the completed state of air pressure balance means in FIG. 2,

FIG. 4 is a fragmentary side section of a top portion of a casing according to a second embodiment, showing the state prior to its assembly,

FIG. 5 is a side section showing the completed state of air pressure balance means in FIG. 4, and

FIG. 6 is a plan view of the annular body permeable by gas but impervious to water in FIG. 4.

My lighting device consists in one form essentially of a casing **10** having a swelled lens **11** at the top and openings **12** at the bottom portion thereof, air pressure balancing means **20** provided at the upper circumferential portion of the casing **10**, the means being impervious to water, an elastic diaphragm **30** fixed airtightly within the casing **10** near the openings **12**, and bulb lighting means **40** including a movable contact point **45** and a fixed contact point **46** which are mounted within the casing **10** at the opposite side of the openings **12** relative to the diaphragm **30**.

According to this embodiment, the casing **10** has a frustoconical body portion **13**. Upon the top end of the body portion **13**, there are placed in turn a bulb fixing plate **14**, a packing **15** and a lens **11** fitting a reflecting cap **16** therein, and these are fixed in position by a lens holder **18**. At the bottom end of the body **13**, there is screwed a metal cap **19** which serves as a weight. The openings **12** are formed on the side wall of the cap **19** and the diaphragm **30** is fixed to a predetermined position inside of the cap **19**. A push button **56** is urged outwardly by a plate spring **54** so that a head portion of the button may be exposed through a central hole **57** of the cap **19**, the plate spring **54** with holes **55** being superimposed upon the surface of the diaphragm **30** at the side of the openings **12**.

Air pressure balancing means **20** impervious to water comprises a plurality of vent holes **21** formed around the upper circumferential portion of the body **13** and a thin band **22** adhered in annular shape to cover the vent holes **21**. The thin band **22** is made of a material permeable by air or gas but impervious to water, such as a tanned leather or a synthetic resin like polyethylene.

Lighting means **40** are constructed as described hereinafter. A bulb **41** is fixed into a central hole **17** of the reflecting cap **16** at a bulb base thereof and is prevented from falling out by a holder **42**. A conductive wire **43** connected to the holder **42** at one end thereof is connected at the other end thereof to an elongated, L-shaped metal plate **44** through a hole **51** of the bulb fixing plate **14**, the metal plate **44** being fixed to the inner surface of the body **13** and forming the movable contact point **45** at the free end thereof. The free end is elastic to be movable along the lengthwise direction of the casing **10**.

The fixed contact point **46** is tightly fitted in a receiving member **53** within the cap **19** and is opposite to the movable contact point **45**. The fixed contact point **46** is

also tightly fitted to one open end of a plastic cylindrical tube **47**, which inner diameter is almost the same as the outer diameter of a dry cell. The other end of the tube **47** is removably fitted to the bulb fixing plate **14**.

After removal of the bulb fixing plate **14**, a plurality of dry cells **40** is inserted into the tube **47** in turn so as to be in series. A negative terminal of the dry cell at the bottom is electrically connected to the fixed contact point **46** through an inwardly curved plate spring **48**, while the positive terminal of the dry cell at the top is electrically connected to the bulb **41** through a helical spring **49**.

An air chamber **50** is formed between the body **13** and the tube **52** to be gradually increased in space as it comes toward the lens **17**.

Normally the parts are in the positions shown in full lines in FIG. 1, whereby an electric circuit formed through, in turn, the movable contact point **45**, the conductive wire **43**, the bulb holder **42**, the bulb **41**, the helical spring **49**, the dry cells **40**, the plate spring **48**, and the fixed contact point **46** is opened and, therefore, the bulb **41** is not lighted.

When the lighting device is thrown into water, it is sunk by kinetic energy thereof to a certain depth, but soon refloated due to buoyancy of the air chamber **50**, directing the lens **11** to the top and the metal cap to the bottom to form substantially an upright posture. The lighting device then comes up to the surface of the water and keeps floating, revealing the lens **11** and the thin band **22**, which band is permeable by gas but impervious to water, above the surface of the water.

At the same time, the diaphragm **30** is pushed up by water entered through the openings **12** of the cap **19** and the holes **55** of the plate spring **54**, so that the movable contact point **45** comes into contact with the opposite fixed contact point **46**. The contact between them is maintained while the lighting device floats in the water as the diaphragm **30** within the cap **19** in the water receives the hydraulic pressure, thereby the bulb is kept lighting. The light of the bulb shines in wide angles through the lens **11** by effect of the reflecting cap **16** and the lens **11**.

When the air in the air chamber **50** is expanded due to heat caused by lighting for long periods, the air is released to the outside of the air chamber through the vent holes **21** and the band **22** which is permeable by gas but impervious to water, so that the diaphragm **30** does not receive a special force enough to push down the diaphragm. Further, as the air pressure in the air chamber **50** is balanced with that of the outside of the chamber while preservation of the lighting device, the diaphragm **30** also does not receive the special force enough to push down the diaphragm.

While the lighting device thrown into a certain deep point of the sea refloats up to the surface of the sea and while the lighting device floats in the waves, the water is prevented from entering through the vent holes **21** as the band **22** is of material impervious to water.

The push button **56** serves to examine the degree of consumption of the dry cells while not in use or to give an optical signal such as marine signal or Morse signal.

Referring to a second embodiment shown in FIGS. 4, 5 and 6, an annular member **60** made of a material permeable by air but impervious to water and constituting a part of the body **13** is provided in place of the vent holes **21** and the band **22** in the first embodiment. The annular

member **60** has annular shoulder portions **61** and **62** at both sides thereof and the annular shoulder portions are fixed to annular grooves **63** and **64** provided inside of the body **13** by a watertight binding agent to be integral with each other.

Various changes in the size and shape of the different parts, as well as modifications and alternations, may be made within the scope of the appended claims.

What is claimed is:

1. A lighting device comprising a casing having a swelled lens at the top and openings at the bottom portion thereof, air pressure balancing means provided at the upper circumferential portion of the casing to balance gas pressure in said casing with atmospheric pressure, said means being permeable by gas but impervious to water, an elastic diaphragm fixed airtightly within the casing near the openings and in communication with said air pressure balancing means, and a bulb lighting means having dry cells as an electric power, said bulb lighting means including a fixed contact point and a movable contact point opposite to said fixed contact point, said movable contact point being moved toward the fixed contact point by said diaphragm as the diaphragm is pushed by water entered through said openings.

2. A lighting device as claimed in claim **1**, wherein said air pressure balancing means comprises a plurality of vent holes formed on the upper circumferential portion of the casing and an annular band covering over said vent holes, said band being made of a material permeable by gas but impervious to water.

3. A lighting device as claimed in claim **1**, wherein said air pressure balancing means is an annular member constituting a part of said casing and made of a material permeable by gas but impervious to water.

4. A lighting device as claimed in claim **1** further comprising a hole formed at the center bottom of the casing, a push button partially projected through said hole and opposed to said diaphragm, and a plate spring provided between said bottom hole and said diaphragm and urging said push button to the hole, said plate spring having holes to allow water to come to the diaphragm, thereby the movable contact point comes into contact with the fixed contact point by pushing the push button from the outside of the casing toward the diaphragm.

5. A lighting device as claimed in claim **1**, wherein said casing comprises a frusto-conical body portion increased in diameter toward the top portion thereof and a metal cap screwed to the lower end of said body portion, said metal cap serving as a weight to make the lighting device float uprightly.

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