July 10, 1951 B. C. GRIEB 2,559,918

MARKER BUOY FOR AIR OR SURFACE CRAFT

Filed Feb. 10, 1947 2 Sheets-Sheet 1

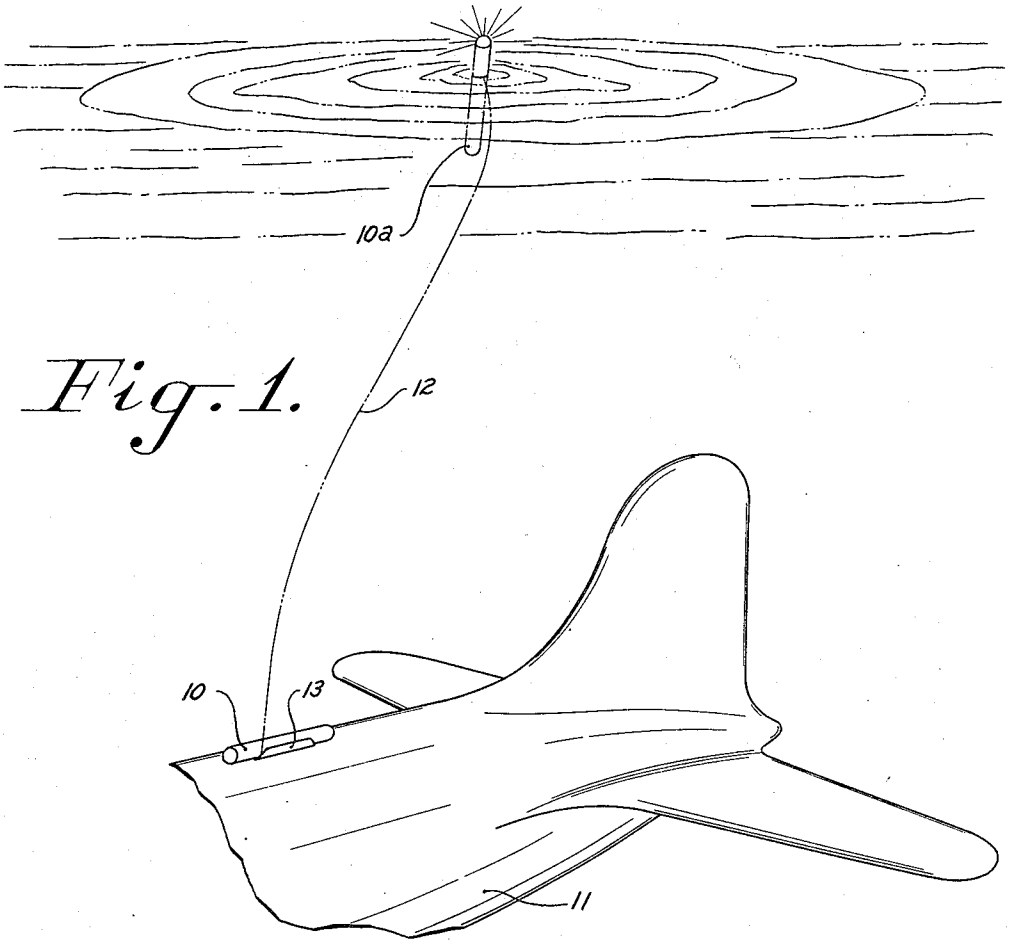

Fig. 1.

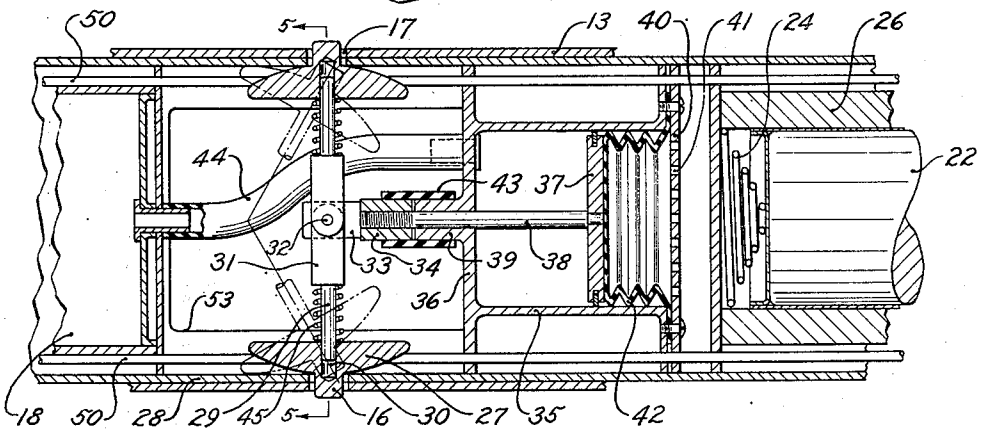

Fig. 4

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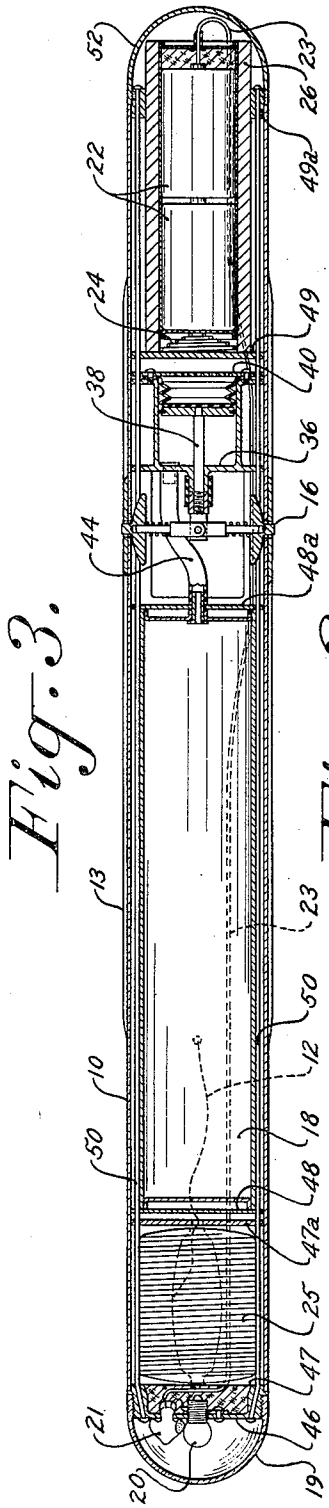

Fig. 3.

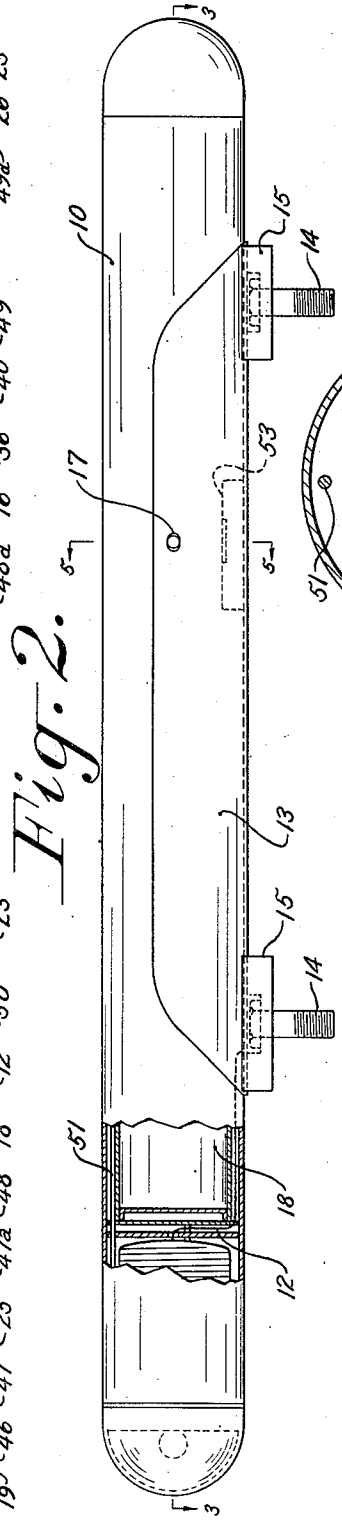

Fig. 2.

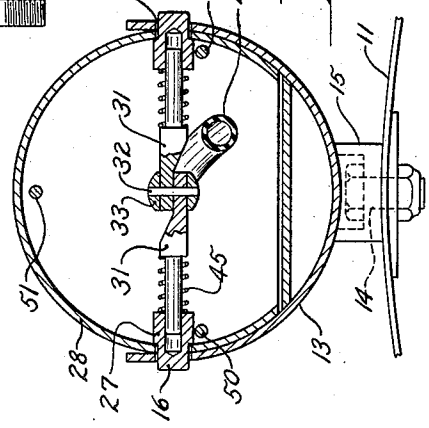

Fig. 5.

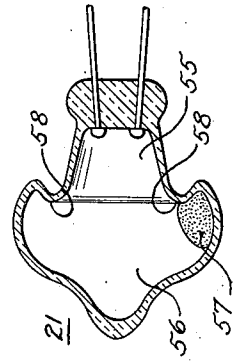

Fig. 6.

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MARKER BUOY FOR AIR OR SURFACE CRAFT

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11 Claims. (Cl. 9—9)

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This invention relates to equipment for marking the location of craft which may have sunk below the surface of the water. It is particularly applicable to surface vessels or aircraft.

It is an object of the present invention to provide an improved type of marker buoy which is automatic in operation and which may be applied to a surface vessel or aircraft.

In case of accident which causes the craft to sink, it is desirable to have the location marked so that it may be readily found and salvage operations may be undertaken with a minimum loss of time.

It is an object of the present invention to provide a buoy assembly which is mounted in position in a cradle suitable for attachment to the aircraft or other structure by means of a simple fastening such as by bolts or screws. The present construction contemplates assembly of the marker buoy in the cradle at the point of manufacture which it may be done by mechanics familiar with the construction and operation of the automatic latches and other parts of the equipment. The device may then be inspected for proper mechanical relationship of parts. The operations of setting and adjusting these parts in the field are thus eliminated and the installation of the marker buoy involves merely the mechanical attachment of the unit to the craft.

Another object of the invention is the provision of an improved latch construction and improved operating mechanism therefor.

A further object is the provision of improved apparatus for the floatation chamber and its association with the operation of the latch mechanism. In order to prevent operation of the release mechanism at any time except under the action of hydrostatic pressure upon submergence, the floatation chamber is provided with a connection to the piston chamber of the latch mechanism. Improved sealing apparatus is used to maintain the air in the two chambers at normal atmospheric pressure. Thus when the buoy mechanism is used in connection with an aircraft, normal sea level pressures are maintained in the system even at high altitudes. This avoids the possibility of actuation of the latch upon rapid descent from high altitudes. Such problems have been inherent in previously proposed constructions where leakage of the sea level pressure permitted reduced pressure in the system at altitude so that upon rapid descent the increase in atmospheric pressure could cause undesired operation of the latch mechanism. With the construction of the present invention such operation is prevented by accurate control of the release due to an increase above atmospheric such as occurs upon submergence. The pressure of a few feet of water is sufficient to cause operation of the latch.

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Another object of the present invention is the construction which provides for improved assembly operations and includes a light frame work upon which the various parts of the apparatus are mounted prior to inserting in the inclosure case.

A further object of the invention is the provision of improved apparatus for operating the light switch after release of the marker unit from the craft.

A still further object of the invention is to improve the construction and assembly of the various items of equipment associated with the marker buoy. One aspect of this improved assembly is the construction of the marker dye substance into a cylindrical unit having a hollow space within it to house the batteries used for supplying the indicator lights. This arrangement provides for greater compactness.

How the foregoing and other objects and advantages of this invention are attained will be evident from the description of the drawings in which—

Figure 1 illustrates a buoy according to the present invention and its method of operation in connection with a sunken aircraft.

Figure 2 is an enlarged view showing the assembled buoy mounted in its cradle ready for installation.

Figure 3 is a longitudinal sectional view taken in the direction of the arrows 3—3 in Figure 2.

Figure 4 is an enlarged view of the release latch and its actuating mechanism.

Figure 5 is a sectional view taken in the direction of the arrows 5—5 in Figure 4.

Figure 6 is a sectional view of the special electrical switch used with the buoy apparatus, drawn to an enlarged scale.

Referring to the drawings, it will be seen that the buoy unit 10 is adapted for attachment to an aircraft such as indicated at 11. In the particular arrangement illustrated, the buoy has been mounted on the upper portion of the fuselage of the craft in such a manner that it is free to release and float to the surface in case the aircraft becomes submerged after a forced landing on water. The location of the buoy allows it to separate itself from the aircraft without danger of becoming entangled with other parts of the ship. The buoy in released position float-

ing on the surface is illustrated at 10a in dotted outline, the buoy being attached to the sunken craft by line 12.

The detail construction with the various improvements in the present buoy unit are more clearly illustrated in Figs. 2 to 6. In Figure 2 it will be observed that the buoy unit 10 is supported in a cradle 13 which is attached to the aircraft by means of bolts 14. Bolts 14 are embedded in blocks 15 which form part of the cradle 13 and provide a simple and rapid method of attachment of the unit to the craft. The unit 10 is retained in the cradle 13 by means of a pair of cylindrical latches 16 which project through holes 17 in the cradle 13. The details for operating this latch mechanism will be described later.

The buoy unit 10 is constructed with a large cylindrical chamber 18 comprising a large portion of the volume of the buoy. This chamber is provided with walls having sufficient strength to withstand a considerable variation in the external pressure. At the upper end of the buoy there is a small water tight chamber having a transparent dome 19 as a cover. Located in this upper chamber is a light bulb 20 and a specially shaped mercury switch 21. The location of the buoyancy chamber 18 is such that the buoy tends to float in an upright position with the upper end projecting from the water. The action of swinging to the upright position causes operation of the mercury switch 21 to complete the electrical circuit and thus light the bulb 20. Batteries 22 provide the electrical energy for illumination of the bulb 20. These batteries are located at the lower end of the buoy unit in order to provide a low center of gravity for the unit. An electrical conductor 23 connects one pole of the battery unit to the mercury switch 21. The bulb 20 has one of its contacts grounded to the frame of the unit while the other pole of the battery unit 22 is grounded to the frame by means of spring 24 thereby completing the electrical circuit.

Immediately below the upper dome chamber there is located a cylindrical roll of fine line illustrated at 25. This line may be of nylon or other strong water resistant material. The cylindrical roll 25 is preferably arranged for paying out from the inside of the roll. One end of the line, which is indicated in Figures 1, 2 and 3 by the numeral 12, is attached to the cradle 13. With this arrangement the line 12 permits the buoy to rise freely to the surface without danger of fouling on either the buoy or the craft. It will be noted that since the roll of line is housed in the buoy there is no motion of the line at the craft as it extends to permit the buoy to reach the surface. Thus the danger of a moving line snagging on parts of the sunken craft or on other obstructions under the surface is obviated.

It will be seen that when the buoy reaches the surface the light 20 will be illuminated and increase the visibility of the buoy to assist the searchers to locate the sunken craft. The light will be particularly effective at night. To make the detection of the buoy during daytime easier, a soluble dye is used which produces a bright color on the surface of the water in the locality of the buoy. In the present buoy unit this marking dye is carried in the form of a cylindrical member 26 which is preferably located in the lower end of the buoy unit and in the present disclosure forms a hollow housing inside which the batteries 22 are located. Upon immersion of the craft and release of the buoy the dye in the cylindrical unit 26 gradually dissolves and produces the distinctive marking in the water which persists for a considerable length of time. Under favorable conditions the dye may be effective for several days.

The latch operating mechanism is located in the buoy in the region between the buoyancy chamber 18 and the dye unit 26. The details of this mechanism are most clearly illustrated in Figures 4 and 5. Here it will be seen that each cylindrical latch part 16 is connected to an enlarged portion 27 having an arcuate shape adapted to roll on the inner surface of the buoy casing 28. A separate cylindrical rod 29 is adapted to telescope into a suitable opening 30 in the latch member 27. Attached to the cylindrical rod 29 is an enlarged portion 31 having a rectangular shape which is adapted to cooperate with the corresponding part from the opposite latch as is clearly illustrated in Figure 5. A pivot 32 is used to connect members 31 together and at the same time attach them to a fork part 33 which is provided with a shank having an internal thread 34. A piston device is attached to the fork 33 for actuation of the latch unit.

Associated with the cylinder device is a cylindrical chamber having wall 35 and diaphragm 36. The piston member 37 is mounted in the cylinder and is connected by means of rod 38 to the fork 33, there being a male thread provided on piston rod 38 to cooperate with the internal thread 34. A cylindrical projection 39 is provided around the piston rod 38 at the point where it projects through the diaphragm 36. At the opposite end of the cylinder 35 is a diaphragm 40 having perforations 41 to allow ingress of water upon submergence. A flexible diaphragm member 42 is provided to cover the piston and the open end of the cylinder. Diaphragm 42 assures absolute tightness of the chamber while at the same time allowing free movement of the piston 37 under the action of pressure which may develop through perforations 41 against the outer side of the piston 37. A tight tubular seal 43 which may be of flexible rubber or the like is provided between the cylindrical extension 39 and the shank of the fork 33. This seal prevents the possibility of leakage past the piston rod. A tube 44 is provided to interconnect the buoyancy chamber 18 with the piston chamber 35. The purpose of this interconnection which is leakproof will be described later in connection with the description of the latch operation.

It will be noted that a spring 45 has been provided between the latch member 27 and the rod member 31. This spring tends to urge the latch into extended position so that the cylindrical members 16 project through the openings in the buoy casing 28. The spring 45 however permits the latch members to be depressed inwardly by hand for the purpose of inserting the buoy unit into the cradle 13. When the buoy is in position in the cradle 13, the latch cylinders 16 are urged under the influence of spring 45 through openings 17 to retain the buoy in the cradle.

The cylindrical shape of the present unit provides a simple and compact arrangement for the manufacture and assembly of the various parts making up the unit. In order to further simplify the manufacture and assembly of the unit the various components are assembled as separate units. Various bulkheads or diaphragms are provided for the support of the sub-assemblies as indicated clearly in Figure 3 by the diaphragm 46

on which the light and switch are mounted, the diaphragms 47 and 47a supporting the anchor line unit, the bulkheads 48 and 48a supporting the buoyancy chamber, the bulkheads 36 and 40 supporting the piston unit and the bulkheads 49 and 49a supporting the dye and battery unit. All these diaphragms or bulkheads are assembled in sequence with the units which they support upon three light rods which constitute a supporting framework. These rods or longerons are clearly illustrated in Figures 3, 4 and 5 where the side longeron rods 50 and the top longeron rod 51 may be observed. It should be noted that these bulkheads are relatively loose fitting both around their periphery and around the openings through which rods 50 and 51 pass.

After assembling the various components which go to make up the internal parts of the buoy on the framework, the complete component assembly is inserted into the cylindrical casing 28. The dome-shaped end portions 19 and 52 are then screwed into positions to complete the assembly. Certain of the latch parts including springs 45 and members 27 are inserted into position after the cylindrical casing 28 is applied. To permit assembly of these parts a comparatively large opening 53 (see Figure 4) is supplied through which these latch parts may be inserted. Once the latch parts are slipped into position so that the parts 16 project through the openings in the housing 28, the springs 45 retain the parts in proper relative position. To mount the buoy unit in the cradle 13 the cylindrical latch projecting parts 16 are depressed manually and the unit placed in proper relative position when the latch terminal 16 will snap into holes 17 in cradle 13 to retain the buoy in the cradle. The end of the attachment line 12, which projects through a suitable hole in casing 28, is attached to the cradle in the fashion shown in Figures 2 and 3 just before the buoy is latched to the cradle.

Operation of the buoy is automatic. Upon submergence of the craft even to a few feet in depth, the hydraulic pressure developed is considerably above the atmospheric pressure of the gas enclosed in the buoyancy chamber and the piston chamber. Water may enter the buoy through the large opening 53 and finds its way to the piston chamber and dye chamber through the supporting bulkheads which are not watertight. The hydrostatic pressure therefore causes motion of the piston toward the bottom 36 of the cylinder. This motion is transmitted by the piston rod 38 to the fork 33 and thereby causes tilting of the toggle members 27 and in rolling on their arcuate surfaces a withdrawing motion is transmitted to the latch projections 16. When the toggle members 31 have reached a position such as indicated in dotted outline in Figure 4 the latch 16 will be withdrawn from the hole 17 in cradle 13 thus freeing the marker buoy from the craft and permitting it to rise to the surface.

The line 12 anchors the buoy to the sunken craft and the buoy is thus prevented from drifting away. As soon as released the buoy assumes an upright position and the circuit is completed through the medium of the special mercury switch 21 thus causing illumination of the light 20. At the same time the action of the water upon the dye causes a coloring of the water in the region of the buoy, thus making the location of the buoy visible from a great distance.

It should be noted that connection of the cylinder chamber under the piston 37 by means of tube 44 to the buoyancy chamber provides a large volume of air at sea level pressure. Upon increase of pressure to a point above this normal sea level pressure the piston moves downwardly in the cylinder. No appreciable resisting pressure is built up in the cylinder chamber due to compression of the air under the piston since this is connected with the volume of air in the buoyancy chamber. Thus the operation of the latch can be accurately controlled to operate in response to a desired pressure on the piston. This is generally arranged for actuation under a hydrostatic pressure of 3 or 4 feet of water. It will be further noted that release of the latches 16 to disconnect the buoy from the craft is controlled positively rather than by means of springs. Thus in case increased friction or the like causes greater resistance to the release of the latch then contemplated, the latches will be released at a slightly greater depth by the increased pressure on the piston which will overcome any discrepancy in the latch mechanism.

An important aspect of the construction of the present mechanism is its particular method of control of the latch release. In some previous types of mechanism where leakage could occur into the piston chamber under the cylinder 37 a reduced pressure would occur in the cylinder chamber when an aircraft was flown at high altitudes for considerable periods. With the present arrangement in which there are positive seals protecting the operating cylinder chamber, such a cylindrical seal 43 around the piston rod exit, and diaphragm seal 42 on the pressure side of the piston, reduced air pressure at altitude cannot affect the pressure in the cylinder chamber. The air in the operating cylinder remains at the normal seal level pressure. Therefore a sudden descent of the aircraft such as in a dive cannot build up a higher pressure on the outer side of the piston than on the inner side. It will be evident that inadequate sealing of the operating cylinder could cause inadvertent operation of the latch mechanism and undesired release of the buoy.

The light operating switch shown in Figure 6 is made in a special shape having a cylindrical depression 55 in the bottom of which the contacts for completion of the electric circuit are located. The axis of the switch is located parallel to the longitudinal axis of the buoy mechanism. An enlarged circular or globular part of the switch is illustrated at 56. With the buoy in horizontal position as illustrated in Figure 3 the mercury 57 in the switch will lie at the lowest point of the circumference of the enlarged portion 56. A slight hump 58 is provided around the entrance to the cylindrical section 55 to prevent normal movements of the buoy or craft from causing the mercury 57 to enter the cylindrical central section 55. Upon movement of the buoy to upright position the mercury 57 will enter the space 55 and complete the circuit to light the bulb 20.

The dome shaped lower end 52 of the buoy unit prevents standing the buoy on end during storage or normal handling. This is a protective measure to prevent storing in a position which would cause illumination of the light and depletion of the battery. At the same time the domed shape of the lower end of the buoy has advantages in reduced aerodynamic drag as compared to a flat ended shape.

From the foregoing description it will be evident that I have provided a marker buoy con-

struction having improvements which provide for increased efficiency and greater reliability. The method of assembly of the various components on an exposed framework or chassis not only reduces cost and simplifies the operation of placing the parts in the enclosing casing but allow effective inspection to determine that all parts are properly assembled and sealed to assure reliable operation. The use of my special switch construction for the purpose of lighting the light in a positive fashion provides for further reliability of the operation of the signaling apparatus associated with the marker buoy. The location and shape of the marker dye unit obviously results in increased compactness. The improved latch mechanism assures positive disengagement of the buoy from the craft under conditions of increased pressure above normal atmospheric, and its operation may be accurately predetermined. This latch mechanism further includes features which prevent inadvertent operation, particularly with respect to sudden changes of atmospheric pressure such as occur in an aircraft during a dive.

I claim:

1. For a marker buoy, an elongated unit enclosing the various components including an automatically operated light, a buoyancy chamber, and an automatic release latch, means for operating said latch including a piston, a piston rod attached to said piston, a chamber at one side of said piston through which said piston rod passes, a sleeve seal between said piston rod and said chamber, and a positive seal around said piston.

2. A buoy for marking the location of sunken craft having a releasable unit and a crade for supporting said releasable unit, said cradle being arranged for attachment to the craft, a latch for connecting said buoy to said cradle, automatic releasing means for said latch including a device having a piston and cylinder, a piston rod extending through one end of said cylinder, a sleeve-type seal at the point where said piston rod emerges from said cylinder, and positive pressure seal between opposite sides of said piston.

3. A marker buoy having pressure actuated means for automatically releasing the buoy from a sunken craft, said means including latch parts, a cylindrical piston chamber having a wall at one end, a piston in said chamber, a piston rod attached to said piston, an opening in said wall through which said rod projects, a cylindrical nipple on the exterior of said wall, a latch actuating element attached to the end of said rod, said element having a cylindrical external portion the diameter of which is the same as the diameter of the cylindrical nipple, a tightly fitting flexible sleeve engaging said nipple and the cylindrical portion of said element to provide a positive seal at the outlet of the piston rod from the chamber.

4. A marker buoy having pressure actuated means for automatically releasing the buoy from a sunken craft, said means including latch parts, a cylindrical piston chamber having a wall at one end, a piston in said chamber, a piston rod attached to said piston, an opening in said wall through which said rod projects, a cylindrical nipple on the exterior of said wall, a latch actuating element attached to the end of said rod, said element having a cylindrical external portion the diameter of which is the same as the diameter of the cylindrical nipple, a tightly fitting flexible sleeve engaging said nipple and the cylindrical portion of said element to provide a pressure seal at the outlet of the piston rod from the chamber, a positive seal between the pressure side of said piston and said chamber including a flexible diaphragm covering said piston, the edges of said diaphragm being sealed.

5. For a buoy adapted to mark the location of sunken craft, a buoyancy chamber, a pressure actuated latch mechanism for releasing said buoy from the craft, said latch mechanism including a cylinder, a piston in said cylinder, a piston rod projecting from said cylinder, means for providing a pressure seal between said piston rod and said cylinder, means for providing a positive diaphragm seal between opposite sides of said piston, and a sealed interconnecting passage between said cylinder and said buoyancy chamber.

6. A buoy for marking the location of sunken craft including a releasable latch mechanism for automatically disengaging said buoy from a craft upon submergence, said mechanism including an arc-shaped member having a latch projection thereon, a movable piston, means interconnecting said piston and said latch including a rod element telescopically attached to said arc-shaped member.

7. A marker buoy having a pressure actuated device for automatically releasing the buoy from a sunken craft, said device including latch parts, a cylindrical piston chamber, a piston in said chamber, interconnecting mechanism between said piston and said latch parts, a seal between said piston and said chamber, said seal being in the form of a cylindrical pocket of flexible material, the closed end of said cylindrical pocket being arranged to contact the surface of said piston, the other end of said seal being attached at one end of said cylindrical chamber, thereby providing a positive seal between said piston and said cylindrical chamber while permitting extended motion of the piston therein.

8. A buoy for marking the location of a sunken craft having a pressure actuated release mechanism for disconnecting said buoy from the craft, said release mechanism incorporating a cam-shaped latch member having a curved surface, a buoy part which the curved surface of said member contacts, a piston device, interconnections between said piston device and said cam-shaped member which produce rolling movement of said cam-member on said buoy part upon movement of said piston to cause release of said buoy when said piston device is moved.

9. A marker buoy having a releasable connection for fastening to a craft, a release device actuable by hydrostatic pressure, said release device having a piston member, a piston rod, a pair of toggle links connected to said piston rod by a common pivot, a latch member at the end of each toggle member incorporating a curved portion having a projection thereon, a reaction part in contact with said curved portion, movement of said piston member thus causing said curved portion to roll upon said reaction part to cause release of said latch members.

10. A buoy for marking the location of sunken craft having a pressure actuated release mechanism for disconnecting said buoy from the craft, said release mechanism including a part connected to the craft and having a pair of apertures therein, a pair of toggle members, a pair of latch members attached thereto, each latch member including a portion having an arcuate shape,

a rigid part against which the arcuate portion reacts, a cylinder having a piston supported therein for longitudinal movement, said piston being connected to said toggle members to provide for rotation of said arcuate portion to a position which positively withdraws said latch members from the apertures.

11. A buoy device for marking the location of sunken craft adapted to be releasably fastened to a craft, latch mechanism for disconnecting the buoy device from the craft including an anchor plate having an aperture therein, an arc-shaped member having a projection for engaging in said aperture, a rigid part against which said arc-shaped member reacts, a cylinder with a piston movable therein, said piston having interconnections with said arc-shaped member to cause it to move when said piston moves, movement of said arc-shaped member on said rigid part causing withdrawal of said projection from the aperture.

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