May 1, 1962 H. L. KIRBY 3,031,693

MARKER BUOY

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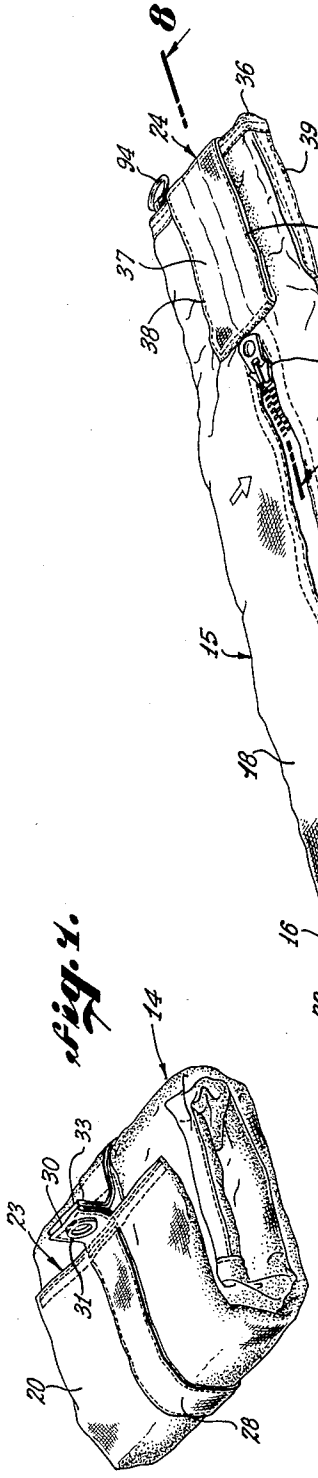


Fig. 1.

Fig. 2.

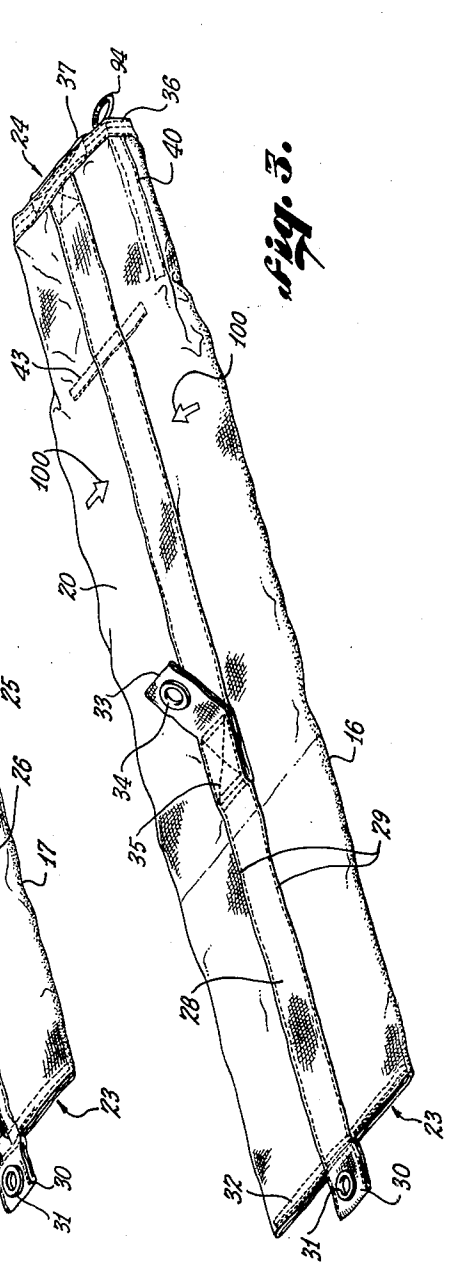


Fig. 3.

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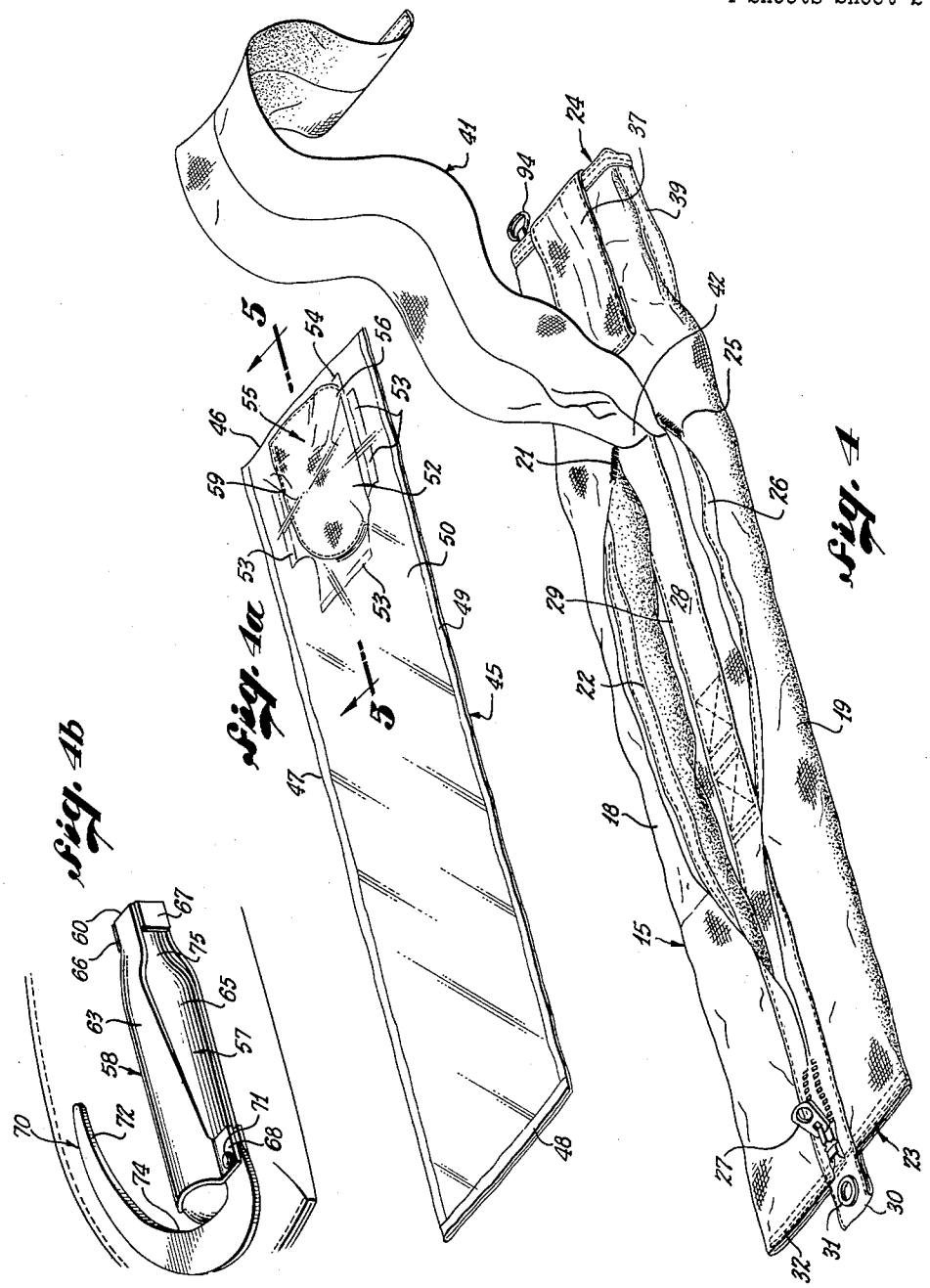
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MARKER BUOY

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MARKER BUOY

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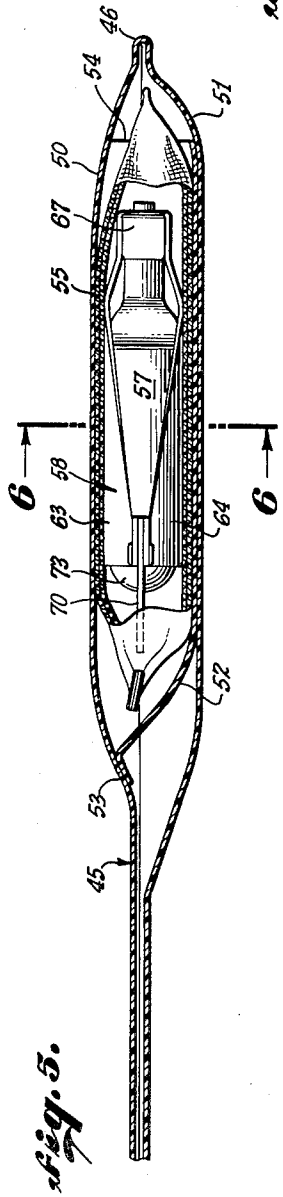


Fig. 5.

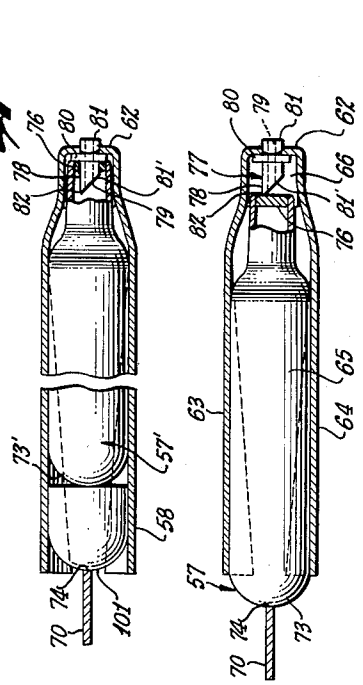


Fig. 13.

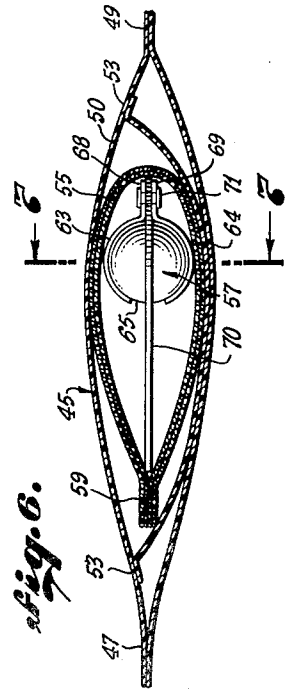


Fig. 6.

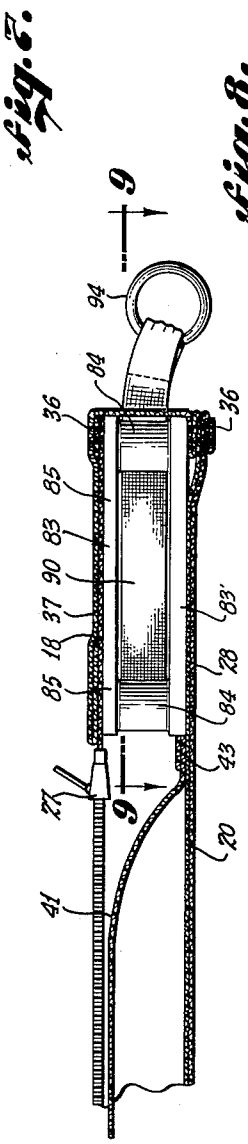


Fig. 7.



Fig. 8.

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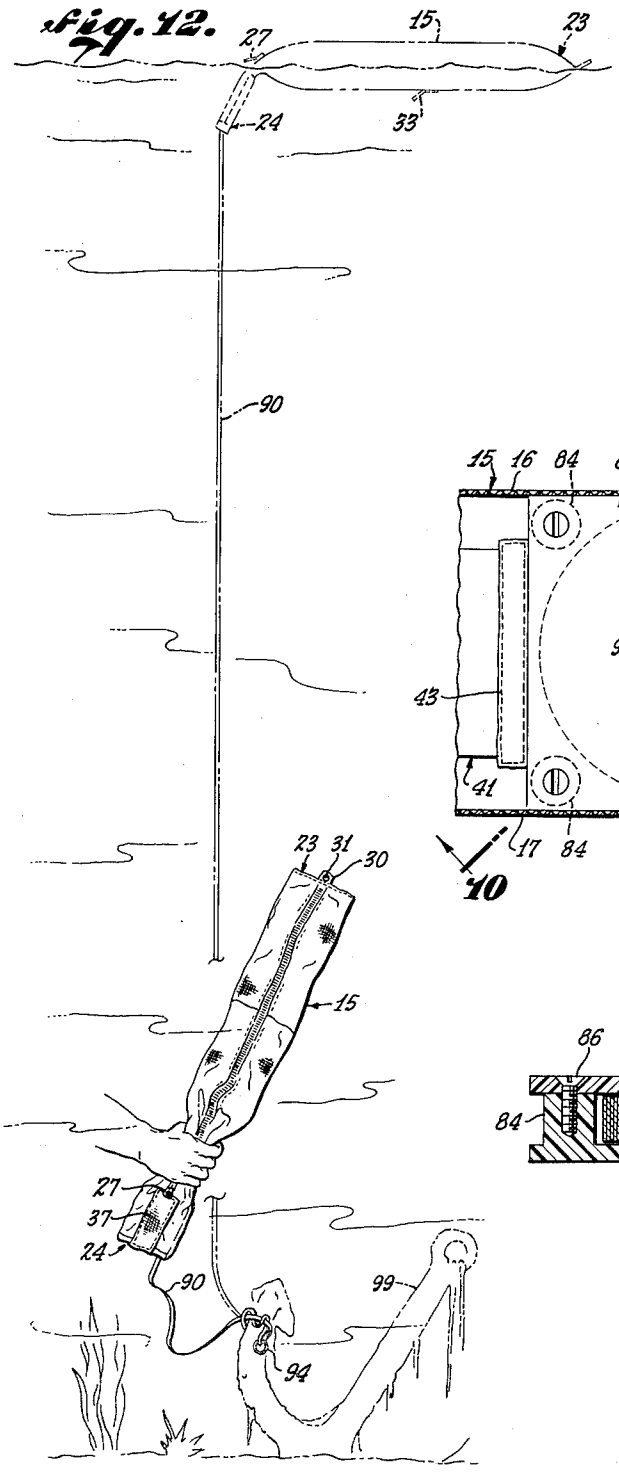
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MARKER BUOY

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fig. 12.



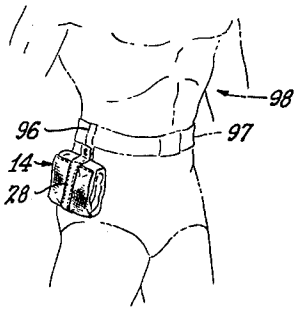


fig. 11.

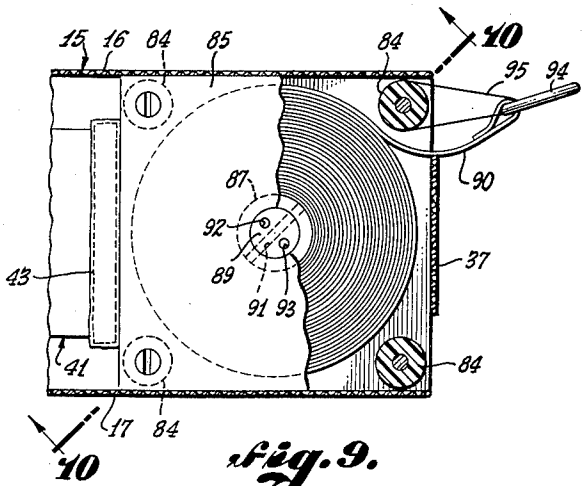


fig. 9.

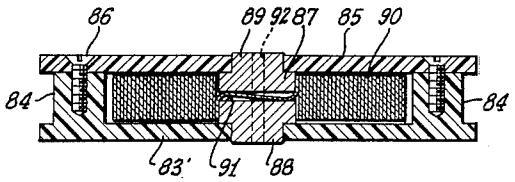


fig. 10.

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3,031,693

MARKER BUOY

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Filed Aug. 29, 1955, Ser. No. 531,169
9 Claims. (Cl. 9—9)

This invention relates to marker buoys and more particular to buoys for marking the location of underwater objects, such as mines and other lost or dangerous objects.

The marking of such objects is presently accomplished by buoys constructed of some light material, such as balsa wood or styrofoam, which are carried underwater by a diver and released so that the buoy will rise to the surface at a point above the underwater object. The present types of marker buoys have the disadvantage that the buoyance of these light materials must be overcome by the diver while underwater. By the present invention, a marker buoy is provided which has no buoyant effect while being carried underwater by the diver and therefore, does not impede the diver's operation. Once the diver has located the underwater object to be marked, the marker buoy of the present invention can be secured to the object and inflated under water so that it will rise quickly to the surface of the water.

The marker buoy consists of an outer casing which carries a reel at one end and contains an inner float cell which is inflated by piercing a high pressure gas cartridge located within the inner float cell. The piercing mechanism for this cartridge is also located within the cell and can be actuated underwater by the diver by simply gripping the outside of the casing and squeezing the piercing mechanism in order to force the cartridge against a piercing point. Thus, the marker buoy need not be inflated until after the ribbon carried by the reel has been tied to the underwater object which is to be marked. Prior to being inflated, the marker buoy can be rolled up into a compact package and carried on the belt of the diver and this package can be quickly unrolled by the diver once the underwater object is located. The outer casing has an opening with closure means so that an inflated cell can be replaced with an uninflated cell and thus, after the casing has been utilized to mark an underwater object, it can quickly be placed in condition for use again. Since the inner float cells are constructed of low cost material, the marker buoy is inexpensive to operate.

It is therefore an object of the present invention to provide a marker buoy which can be carried by the diver in an uninflated condition and which can be quickly attached to an underwater object and inflated so that the buoy will rise to the surface of the water.

Another object of the invention is to provide a marker buoy having a separate inner float cell containing a gas cartridge which can be easily pierced by the diver at such time as an underwater object is located.

A further object of the present invention is to provide a novel piercing mechanism for piercing a gas cartridge, which mechanism has a handle which can be squeezed to force the cartridge against a piercing point.

A still further object of the present invention is to provide a piercing mechanism for a gas cartridge, having a hollow, circular piercing member tapered at one end to form a piercing point which functions as a wedge to open a passage in the cartridge.

Another further object of the invention is to provide a marking buoy for marking underwater objects which consists of a casing carrying a reel at one end and having a space for an inner float cell so that the casing can be wound around the reel while the inner float cell is not inflated to form a convenient, portable package and the cells can be easily replaced.

These and other objects of the invention not specifically set forth above will become readily apparent to those skilled in the arts in the accompanying description and drawings in which:

FIGURE 1 is a perspective view of the marker buoy of this invention ready for attachment to the diver's clothing.

FIGURE 2 is a perspective view of the marker buoy of FIGURE 1 which is unrolled and ready to be inflated.

FIGURE 3 is a perspective view of the back of the marker buoy of FIGURE 1 showing the fastening loops provided in the reinforcing strap.

FIGURES 4, 4*a* and 4*b* comprise an expanded perspective view of the elements of the marker buoy, showing the casing and the inflation mechanism contained in the inner float cell.

FIGURE 5 is a vertical section along line 5—5 of FIGURE 4 showing the manner in which the inflation mechanism is secured within the float cell by an inner liner.

FIGURE 6 is a transverse vertical section along line 6—6 of FIGURE 5 showing the bag containing the inflation mechanism.

FIGURE 7 is a vertical section along line 7—7 of FIGURE 6 showing the inflation cartridge and piercing mechanism prior to discharge of the cartridge.

FIGURE 8 is a vertical section along line 8—8 of FIGURE 2 illustrating the manner in which the reel for the ribbon is contained within one end of the marker buoy.

FIGURE 9 is a horizontal section along line 9—9 of FIGURE 8 showing the ribbon contained within the reel.

FIGURE 10 is a sectional view along line 10—10 of FIGURE 9 showing the construction of the reel.

FIGURE 11 is an elevational view of the folded marker buoy attached to the belt of the diver.

FIGURE 12 illustrates the manner in which the marker buoy is tied to an underwater object and inflated by squeezing the piercing mechanism after the marker buoy has been unrolled.

FIGURE 13 is a vertical section similar to FIGURE 7 of a modification of the piercing mechanism and showing the cartridge after operation of the piercing mechnism.

The embodiment of the invention chosen for illustration purposes is illustrated in FIGURE 1 wherein a marker buoy 14 is in folded condition for storage or for attachment to the body of a diver. The buoy 14 is comprised of an outer casing 15 fabricated from a single piece of heavy nylon cloth and folded along edges 16 and 17 to form front panels 18 and 19 and a back panel 20. One element 21 of a zipper closure is stitched to front panel 18 along seam 22 and extends from one end 23 of the casing to a point spaced from the other end 24 of the casing. In a similar manner, another element 25 of the zipper closure is secured to the front panel 19 along seam 26 and extend the same distance as the element 21. The zipper elements are opened and closed by an operator 27. A reinforcing strap 28 is seamed along the center line of back panel 20 by seam 29 and forms a loop 30 at end 23 of the casing, which loop contains a ring 31. The end of strap 28 is inserted between the back panel 20 and the front panels 18 and 19 and a seam 32 across the end 23 fastens the loop, the end of the zipper element and the casing together and closes the end of the casing.

At the center of the back panel 20, the strap 28 is doubled to form a loop 33, which contains a ring 34 and is stitched to the back panel 20 by seam 35. The casing 15 at end 24 is folded over the end of strap 28 and stitched thereto by seam 36 which passes completely around the open edge of the casing. The seam 36 also secures a folded end of end strap 37 to back panel

20. The strap 37 passes around the open end 24 of the casing and is stitched to front panels 18 and 19 by seam 38 so as to close the space between the front panels extending from the end of the zipper elements to the end 24. Since the strap 37 is of less width than the casing, an end opening remains on each side of the strap. The end 24 of the casing 15 is folded over double upon itself at each side and stitched in this position along seams 39 and 40 at opposite side. The width of each fold is sufficent to form a rectangular container portion at the end 24 for a purpose later to be described.

Referring to FIGURE 4, the casing 15 is shown in a position similar to FIGURE 2 and the zipper operator 27 has been moved to end 23 in order to provide an opening between front panels 18 and 19. A flexible nylon tongue 41 has an end 42 which is stitched to back panel 20 along seam 43 and the tongue is of such width and length that it can be inserted flat within the casing 15. The space within casing 15 between the seam 43 and and end 23 of the casing is designed to receive an inner float cell 45 which can be constructed from a single piece of vinyl plastic material. This single sheet is folded along edge 46 and is then heat sealed along the three edges 47, 48 and 49 to form an air-tight cell defined by vinyl plastic surfaces 50 and 51. Prior to the folding and heat sealing of the cell 45, an inner liner 52 of vinyl plastic is sealed to the inside of surface 50 of the cell at spaced points 53 along three edges of the liner 52. The remaining edge 54 adjacent folded edge 46, is not sealed to surface 50 and remains open to receive a muslin bag 55 containing an inflation unit. After the inner float cell 45 is sealed along its edges, the bag 55 will be held within the liner 52 by the folded edge 46 and the sealed points 53. The spaced points 53 and open edge 54 provide openings between the liner 52 and the surface 50 so that gas can escape from the interior of the bag into the main portion of the inner float cell. The bag 55 is formed of a double layer of muslin cloth which is folded at edge 56 around an inflation cartridge 57 contained in a piercing mechanism 58 and the bag is then closed by stitching 59.

The piercing mechanism 58 is constructed of a single piece of metal, such as aluminum, which is bent at edges 60 and 61 to form an end 62 and two flared sides 63 and 64 are bent to receive the circular body 65 of the cartridge 57. The end 62 carries two pieces 66 and 67 which are bent towards the sides 63 and 64 to form a square container portion at the end of the mechanism. Also, the sides 63 and 64 carry flanges 68 and 69, respectively, which are adjacent to each other after the mechanism is formed. Between the flanges 68 and 69 is positioned one end of an operating handle 70, which end is pivotally secured to the flanges by a pin 71. The handle 70 has a curved end 72 which extends in a direction substantially parallel with the body of the cartridge 57. A dome end 73 of cartridge 57 projects beyond the sides 63 and 64 and engages a cam surface 74 formed in the handle 70. The opposite end 75 of cartridge 57 is in the form of a reduced cylinder which is closed by a soft metal plug 76. The end 62 has a circular opening for receiving a circular piercing member 77 which is comprised of a cylindrical body 78 having a central opening 79 and a collar 80. An end 81 of member 77 is inserted in an opening in end 62 with a press fit to hold the collar 80 against end 62. The other end of the piercing member has a slanted surface 81' which terminates in a point 82 located adjacent to the soft metal plug 76. Thus, it is apparent that if the piercing mechanism is gripped in the hand and the handle end 72 pivoted downwardly by finger pressure, the handle portion 74 will engage the dome end 73 and will serve as a cam to force the soft metal plug 76 against the pointed end 82 of the piercing member 77. Because of its slanted shape, the pointed end 82 will serve as a wedge to force the soft metal away from the

piercing member as the piercing member is forced into the soft metal plug to connect opening 79 with the interior of the cartridge. Because of the ease with which the piercing member penetrates, the handle 70 will quickly move the end 75 of the cartridge into engagement with collar 80. It is understood that any suitably shaped cam surface can be used for the edge 74 of the handle as long as it transmits the downward motion of the handle 70 into an end thrust on the end of the cartridge 57. Since the gas in the cartridge is at high pressure, the gas will be throttled through opening 79 and pass into bag 55. As illustrated in FIGURE 4, the bag 55 will be positioned in liner 52 so that handle 70 is positioned toward end 23 of the casing 15.

As previously mentioned, the end 24 of the casing 15 is fabricated in the form of a rectangular compartment which is just large enough to receive a reel 83. This reel is preferably constructed of a rigid, plastic material and has a one side 83' which carries a projection 84 at each corner thereof and opposite side 85 is secured to these projections by screws 86. A hub 87, also constructed of a rigid, plastic material, has reduced ends 88 and 89 which project into openings in the sides 83' and 85, respectively, which serve as bearing upon which the hub 87 will rotate. Of course, the hub is positioned between the sides 83 and 85 prior to securing of the side 85 to the projections 84. A nylon ribbon 90 is wound upon hub 87 and the end of the ribbon is tied to the hub through a transverse opening 91. Also, the hub contains openings 92 and 93 which are parallel to the hub axis and are for the purpose of receiving a key or other device in order to rotate the hub and wind the ribbon 90 upon the hub. The end of ribbon 90 extends through the opening between end strap 37 and edge 16 of the casing and is secured to a ring 94 which is for the purpose of securing the ribbon to an underwater object. Prior to the use of the marker buoy, this end of the ribbon is kept from being extended by a breakaway thread 95 which is tied between the ring 94 and one of the spacers 84. The end strap 37 serves to retain the reel within the casing as the ribbon is unwound.

The assembly of the marker buoy will now be described in view of the prior description of the individual components and in view of the illustration in FIGURE 4. The reel mechanism 83 is first inserted in the rectangular section at the end 24 of the casing 15 and the end of the ribbon tied by thread 95. Thereafter, the tongue 41 is raised into the position illustrated in FIGURE 4 and the inner float cell 45, containing the cartridge 57 and piercing mechanism 58 within the bag 55, is inserted into the casing with the seam 48 of the inner cell adjacent end 23 of the casing and the seam 46 of the inner cell adjacent the seam 43 for the tongue. The tongue 41 is then placed within the casing 15 to prevent the inner float cell from being damaged by the zipper closure or by the reel. The operator is moved toward end 24 of the casing to close the casing and the marker buoy then has the appearance illustrated in FIGURES 2 and 3. In order to fold the marker buoy for storage or attachment to the diver, the reel end 24 of the casing 15 is folded towards the end 23 and the outer casing is wrapped about the reel mechanism to form a compact unit, as illustrated in FIGURE 1. In the folded condition, the rings 31 and 34 come together to receive a hook or other supporting member for the marker buoy and the strap 37 is wrapped around the folded unit to serve as a reinforcing strap. Also, the end strap 37 is sufficiently strong to retain the reel mechanism within the casing during the time the ribbon 90 is being unwound. In use, the marker buoy can be secured to a hook 96 carried by belt 97 worn by diver 98, and since the marker buoy is not inflated, it will not interfere with the underwater operations of the diver. Once the diver has located an underwater object, such as an anchor 99 or a mine, he will remove the marker buoy from the hook 96

and unfold the buoy into the position illustrated in FIGURE 12. The end of ribbon **90** will hen be freed by breaking the thread **95** so that the ribbon can be tied to the underwater object. After the ribbon is secured, the diver will grip the casing **15** at the point indicated by arrows **100** (see FIGURE 3) and because of the flexibility of the casing and the inner float cell, the diver is able to squeeze the handle **70** in order to pierce the cartridge **57** with the piercing mechanism **58**.

Cartridge **57** can contain carbon dioxide or other suitable gas under pressure and a weight and pressure of the gas will be selected which is sufficient to inflate the inner float cell to the proper pressure. It is understood that the size of cartridge will vary with the size of the inner float cell so that the cell will not be ruptured by too high a gas pressure. The carbon dioxide gas, expanding from the cartridge, will be very cold and therefore the cartridge and piercing mechanism are enclosed in the double-layer muslin bag **55** to disburse the cold gas and protect the vinyl plastic material of the inner cell **45** and layer **52** from direct contact with the expanding gas so that the material will maintain its flexibility. The gas leaving bag **55** will enter the main body of the cell through the openings between sealed points **53** and through the opening at edge **54** of layer **52**. FIGURE 13 illustrates a modification in which the piercing mechanism **58** receives a smaller cartridge **57'** of the same diameter as cartridge **57**. A dowel **101**, having the same diameter as the cartridge **57'**, is inserted between the edge **74** of handle **70** and the dome **73'** of the cartridge **57'** so that the dowel will transmit the force exerted by the handle to the cartridge. Thus, the same piercing mechanism can be used for various sizes of cartridges of the same diameter, depending upon the size of the inner float cell which is to be inflated. In FIGURE 13, the cartridge and piercing mechanism are in the position assumed after the cartridge has been pierced by the diver.

After the inner float cell has been inflated by the diver, the marker buoy can be released and will have sufficient buoyancy to unreel the ribbon **90** and rise to the surface of the water. The marker buoy will give a permanent indication of the underwater object since it can carry suitable colored marking to be visible from aircraft and surface vessels. The marker buoy is particularly suitable for use in landing operations which require that the coast and landing beach be previously survyed by divers to locate underwater mines which would be dangerous to the landing operations and, of course, all of the elements of the marker buoy can be made of non-magnetic material, so that it can safely be used to mark magnetic mines.

By the present invention, there is provided a novel marker buoy having an inner float cell which is easily actuated under water and which does not impede the diver's operations until such time as the diver desires to mark an underwater object. The marker buoy is very inexpensive to use since the inner float cell can be replaced and the casing and reel can be used indefinitely. A novel, low cost piercing mechanism is provided for piercing the cartridge in which the cartridge is slidably supported and forced against the piercing pin by the camming action of the handle. Also, because of the wedging action of the cylindrical piercing point, the soft material at the end of the cartridge can be moved away quickly by the force applied to the handle to provide a positive, quick operation of the inflation process. Said piercing member **77** is held by a press fit in end **62**, the piercing member is easily replaceable and the end **62** is of a proper thickness to hold the pin rigidly in position during piercing of the cartridge. Also, the piercing members can be economically manufactured from non-magnetic material, such as copper and aluminum alloys, and can be replaced after a single use if so desired. Of course, more than one of the marker buoys can be worn by a single diver in order to mark a number of underwater objects. Because of the construction of the reel, it will not foul and the ribbon will only unwind from the reel as it is needed and only as the buoy is rising. While the use of ribbon serves to prevent fouling, it is understood that non-fouling reels can be provided which utilize various other types of cord or line. The casing, flap and other straps are preferably constructed of nylon which will not be damaged by heavy seas and will be resistant to salt water. Also, the zipper elements can be suitably finished to be resistant to salt water. It is further understood that the edge **74** of the handle, which applies the pressure to the cartridge, can be varied in shape depending on the shape of the end of the cartridge so that the desired camming action will result. The materials of which the components are constructed can be varied depending upon the size and uses of the invention and any suitable piercing mechanism can be utilized so long as it can be operated exteriorly of the casing. Various other modifications are contemplated by those skilled in the art without departing from the spirit and scope of the invention, as hereinafter defined by the appended claims.

What is claimed is:

1. A marker buoy for marking underwater objects comprising a pliant casing, a reel contained in one end of said casing and having a line wound thereon extendable through said casing, an inflatable, pliant float cell trapped within said casing in both deflated and inflated conditions, and an inflation unit completely contained within said float cell, said inflation unit having means operable exteriorly of said casing for inflating said cell and initiating movement of said casing and cell after said line has been attached to the underwater object and said casing being of such size as to permit said float cell to expand sufficiently to cause said casing to rise to the water surface.

2. A flexible marker buoy for marking underwater objects comprising a casing, an inflatible inner cell contained within said casing in both uninflated and inflated conditions, an inflation unit trapped within said cell and operable exteriorly of said casing, and reel means contained within said casing and having a line extending through said casing for attachment to the underwater object, said inflation unit being operable to inflate said inner cell and said casing being of such size as to permit said inner cell to expand sufficiently to cause said casing to rise to the surface to indicate the position of the underwater object.

3. A marker buoy for marking the location of underwater objects comprising a pliant casing, a pliant, inflatable float unit enclosed within said casing in both uninflated and inflated conditions, an inflation unit entirely contained within said float unit for inflating said float unit said casing permitting said float unit to expand sufficiently to cause said casing to rise to the water surface, said inflation unit being operable from the exterior of said casing, and means carried by said casing and extendable from said casing in order to tie said casing to said underwater object.

4. A marker buoy as defined in claim 3 wherein said float unit comprises a sealed cell and said inflation unit comprises a high pressure gas cartridge and piercing mechanism for piercing said cartridge, said piercing mechanism having actuating means responsive to a force applied exteriorly of said casing causing deformation of said casing and float unit.

5. A marker buoy as defined in claim 4 having a container for said cartridge and piercing mechanism constructed of gas disbursing material, said container protecting said cell from direct contact with cold gas expanding from the cartridge after being pierced by the piercing mechanism.

6. A marker buoy as defined in claim 5 wherein said extendable means passes through an opening in the end of said casing, said extendable means comprising a reel

contained within said casing and having a ribbon extending through said opening.

7. A marker buoy for marking underwater objects, comprising a pliant casing having an opening therein, closure means for opening and closing said opening, means contained in one end of said casing and extendable through the one end of said casing, a pliant float cell insertable into said casing through said opening and trapped therein upon said opening being closed by said closure means, and inflation means contained within said float cell and operable underwater from exteriorly of said casing for inflating said float cell said casing permitting said float cell to expand sufficiently to cause said casing to rise.

8. A marker buoy as defined in claim 7 wherein said extendable means comprises a rigid flat reel located at said one end of said casing so that the casing and float cell can be wrapped around said reel and formed into a compact package, said casing carrying two mounting rings positioned to hold said casing in package form and provide an attachment for said package.

9. A marker buoy comprising a double cell tubular member having an inner cell and an outer liner, the inner cell being air-tight and said member being substantially flat when said inner cell is in uninflated condition, the outer liner having formed on one end thereof a box-like structure, a substantially flat reel carried in said box-like structure and having an extendable line, said structure having an opening through which said line extends, and an inflation unit carried in said inner cell and actuatable by a squeezing action whereby said unit can be actuated externally by squeezing said outer liner, said outer liner permitting said inner cell to inflate sufficiently to cause said member to rise to the surface after said line is tied to an underwater object.

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