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BUOY AND METHOD FOR PREPARING THE SAME

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FIG. 1

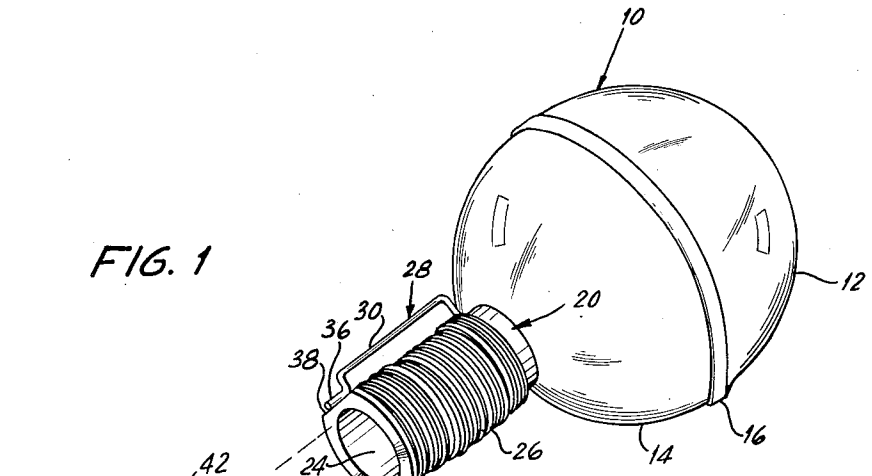


FIG. 2

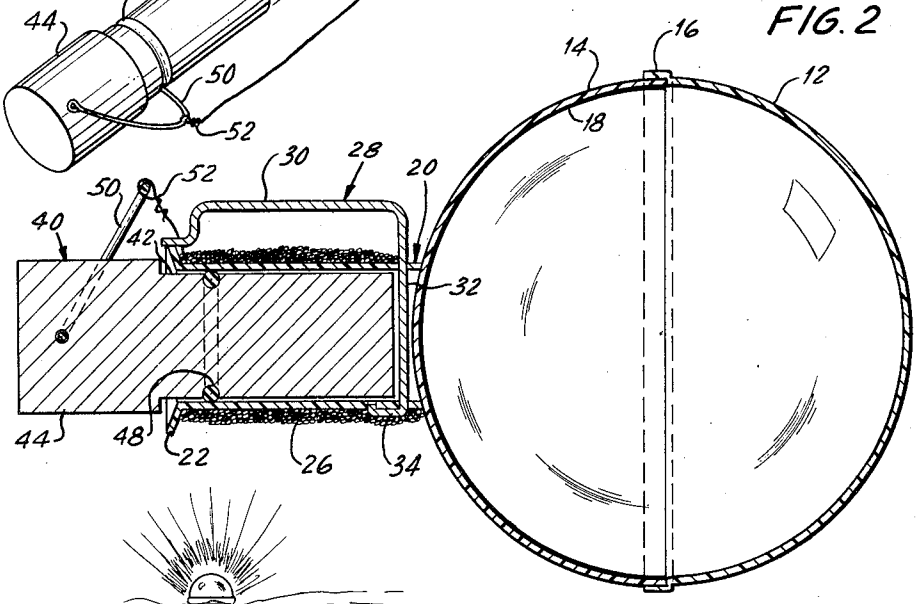
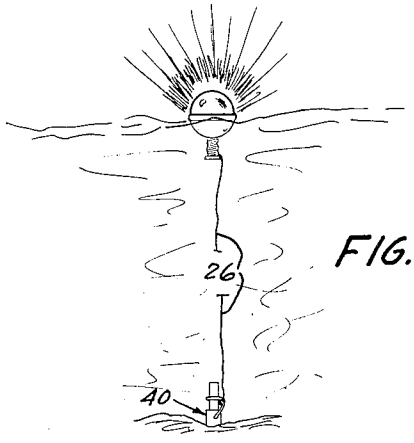


FIG. 3



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BUOY AND METHOD FOR PREPARING THE SAME

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This invention relates to marine devices and more particularly to buoys. The invention also relates to methods for manufacturing marine devices such as, specifically, floatable bodies operatively associated with anchoring devices.

In its preferred form, the invention is specifically concerned with buoy structures especially suitable for use in connection with "skin diving." The invention is, however, not limited to such use and provides, for example, buoy structures adapted for being dropped into the water from airplanes and the like.

It is one of the objects of the invention to provide buoy structures which can be seen from a great distance, and methods for preparing the same. The invention thus obviates the difficulties inherent in conventional marine station-marking devices which are difficult to see under various circumstances.

It is another object of the invention to provide an improved buoy which accurately marks the under-water zone whose position is to be indicated.

Another object of the invention relates to the provision of an improved buoy structure which is capable of withstanding extreme impact forces such that it is capable of being dropped from great heights into the water without undergoing structural damage.

Briefly, in accordance with one embodiment of the invention there is contemplated the provision of a floatable body consisting of connected sections, one of which is light permeable and the other of which is provided with a mirrored surface. The mirrored surface is operatively associated with an anchoring device or weighted body such that the section bearing the mirrored surface is maintained in lowermost position. Thus, when the buoy structure is in the water, the mirrored surface floats in a position whereat it is superposed by the light permeable section and light, such as sunlight, enters into the hollow body and is reflected by the mirrored surface in such a manner that the buoy structure can be readily located.

As a feature of the invention, the mirrored surface can be provided completely within the hollow body such that it is shielded from the corrosive action of the water as well as other ambient conditions which prevail.

Preferably, the hollow body is provided in the form of sphere, the light permeable and mirrored sections noted above being hemispheres. This shape is especially selected for purposes of enabling a buoy to resist large forces such as may be exerted when the buoy is under water or when it is dropped from extreme heights.

The floatable body of the invention is operatively associated with an anchoring device by a line or cable. In accordance with a feature of the invention, however, it is most desirable that the floatable body be substantially directly above the anchoring device and not moved to one side by wind or current. Accordingly, the invention provides means permitting the playing out of only enough line that the floatable body is maintained directly above the associated anchoring device.

In further accordance with the invention, the floatable body noted above is provided with means which provides accommodation for the associated anchoring device. In accordance with a preferred embodiment of the invention, the means is in the form of a hollow cylinder which centrally accommodates the anchoring device so that the entire structure is provided in the form of a single unit which is readily manipulated.

A further feature of the invention is that means are provided whereby the anchoring device is frictionally retained in such a manner as to be separable only by shock or deliberate withdrawal. Preferably, the weight of the anchoring device is neutralized by that of the floatable body so that, if the buoy is accidentally dropped into the water, it can be readily recovered.

With regard to the method of the invention, there is featured a sequence of manufacturing steps which render the provision of the afore-noted structure very simple and economical.

Other objects, features and advantages of the invention will be found in the following detailed description of a preferred embodiment thereof as illustrated in the accompanying drawing in which:

FIG. 1 is a perspective view of a buoy provided in accordance with the invention with the anchoring device separated from the floatable body;

FIG. 2 is a longitudinal sectional view of the buoy shown in FIG. 1 with the anchoring device and floatable body engaged; and

FIG. 3 illustrates the buoy with the anchoring device and floatable body in operative positions in a body of water, the connecting line or cable being broken away to illustrate that varying depths of the body of water can be accommodated.

The buoy illustrated in the drawing comprises a floatable body **10** consisting of two generally hemispherical sections **12** and **14**, the section **12** being provided with an annular flange **16** by means of which the sections can be connected to form a hollow spherical body.

The sections **12** and **14** are preferably made of a plastic material such as acetate and at least the section **12** is transparent or translucent. The section **12** is, in accordance with the invention, preferably always light permeable although it is contemplated that this section be tinted in various colors such as yellow, red and so forth.

When acetate is employed as the material from which sections **12** and **14** are made, the walls of these sections may be for example, of .025 inch thickness. This thickness is exemplary only since it is obvious that many other thicknesses may be employed, depending upon intended use.

The section **14** may also be made of a plastic such as acetate or alternatively this section may be made of a metal or other light impervious material, it being unessential to the invention that section **14** be light permeable. The reason that the section **14** need not be light permeable, is that the inner surface **18** thereof is mirrored. This mirroring can be effected with any conventional technique, but in accordance with the invention it is preferred that aluminum be vacuum deposited on the surface **18** to a thickness of approximately .0001 of an inch.

If both the sections **12** and **14** are made of acetate they may be readily joined in accordance with the invention, and after the surface **18** has been appropriately mirrored, by the application of acetone to the inner surface of flange **16** or by the application of acetone with acetate dissolved therein. Alternatively, the two sections may be joined by high frequency welding or by the use of conventional bonding agents and techniques. It is important, however, that the seal along flange **16** intermediate sections **12** and **14** be absolutely water-tight and capable of resisting impact shock. Accordingly, the above described technique involving the simple application of acetone or acetone in which acetate has been dissolved is preferred.

The use of a spherical form for the floatable body **10** is preferred inasmuch as a spherical form most effectively resists the forces to which the floatable body **10** is subjected while submerged. This is especially im-

portant at extreme depths. Moreover, this shape provides for a symmetrical concave surface 18 which is best adapted for reflecting light despite the direction from which the light is received.

Centrally connected to the body of the section 14 is a spool 20 which is connected at one end to the hollow body 10 and which at its opposite end is provided with a peripheral annular flange 22. Spool 20 is preferably in the form of a right circular cylinder defining an inner axial bore 24.

The spool 20 may be either of metal, whereupon it constitutes a weighted body, or of a plastic such as acetate. Conventional high frequency welding techniques can be used to connect the spool 20 to the section 14 and conventional bonding agents and bonding techniques can also be employed. Where the spool 20 is of acetate, it is preferable that the same be connected to the section 14 in the same manner as has been indicated above for purposes of connecting sections 12 and 14. Spool 20 may also be integral with section 14.

Stored or wound on the spool 20 is a cable or line 26. Line 26 may consist of a monofilament nylon cord or a stranded nylon cord, or may be a stranded line of linen or other conventional material which is preferably waxed or otherwise rendered water proof. Typically the line may be such as to withstand a twenty-five pound breaking test. However, this may vary widely in accordance with the conditions under which the buoy is to be employed.

A resilient device 28 is operatively associated with the floatable body 10 and with the line 26 and is preferably mounted on the spool 20. The resilient device 28 may take the form of a cantilever spring which, as illustrated, is formed of two angularly disposed sections 30 and 32. Section 32 which is illustrated as a linear section is diametrically accommodated in the spool 20 by means of holes provided for this purpose. Section 32 can be provided with a hook section 34 after its insertion through the spool 20 so as to prevent the withdrawal of the resilient device 28.

Section 30 extends generally axially along the spool 20 in parallel to the axis defined by the cylinder. The free end 36 of section 30 is accommodated on a flat surface 38 provided in flange 22.

Device 28 is made of a resilient material. For example, a phosphor bronze or chrome nickel wire having a diameter of .060 inch may be employed. The criteria for operation of resilient device 28 will be set forth in greater detail hereinafter.

Slidably and frictionally accommodated within the bore 24 of spool 20 is an anchoring device 40. Anchoring device 40 is of a metal such as lead, or the like, which is easily cast. The anchoring device consists of a section 42 having a diameter slightly less than the diameter of bore 24 and a section 44 having a diameter substantially exceeding that of bore 24 so that only section 42 can penetrate into the bore.

The section 42 of anchoring device 40 is provided with an annular groove 46, the purpose of which is to accommodate a friction ring or washer 48 which is preferably of rubber or the like. The outer diameter of the friction ring 48 when positioned in groove 46 slightly exceeds the diameter of bore 24 so as to provide a sliding frictional fit between the anchoring device 40 and the spool 20.

On the section 44 of the anchoring device 40 is pivotably mounted a yoke or bail 50 to which an end 52 of line 26 is connected. The other end of line 26 can be simply tied to spool 20 or otherwise fastened thereto in conventional manner. The provision of yoke 50 generally avoids entangling of the anchoring device 40 and the line 26.

Upon detachment of anchoring device 40 from spool 20, line 26 will be pulled off spool 20 in axial direction relative to the same and will tend to ride around flange 22. Line 26 will therefore pass between end 36 and surface 38 when sufficient force is applied to the line. If a lesser force is applied to the line, no line will be pulled from the spool. The line cannot become entangled with resilient device 28 because the line moves axially relative to the spool.

The buoy described above is susceptible of use and has preferably certain features which determine the operative association of the various parts noted above.

For example, if the buoy is accidentally dropped into the water, it is preferred that the buoy float for purposes of facilitating recovery and that the anchoring device 40 not become detached from the spool 20 so that it is not necessary to recover the line which would be discharged from the spool 20. To this end, the buoyancy of hollow body 10 is such as to neutralize the combined weights of spool 20, line 26 and anchoring device 40 and, in fact, the hollow body has a slight excess of buoyancy so as to remain floating while supporting the weight of the afore-noted complementary structure. Furthermore, so that the anchoring device does not accidentally become detached from the spool 20, the diameter of friction ring 48 is made sufficiently large so as to resist detachment of anchoring device 40 other than by a force deliberately exerted on the anchoring device 40 or by an impact force.

By way of example, to achieve the above-noted effects, with the weight of the line, spool and anchoring device being in the magnitude of approximately one pound, this weight can be supported by a hollow body of approximately 4 inch diameter. By way of further non-limiting example, a rubber ring whose outer diameter exceeds the diameter of bore 24 by .050 of an inch, prevents the anchoring device from becoming accidentally detached from the spool 20.

It is to be noted that this structure also provides for avoiding the accidental detachment and floatation of hollow body 10 when the buoy is carried under water by an under-water swimmer. Thus, in order to release the hollow body for floatation when the buoy is under water, a purposeful detachment of the anchoring device 40 from the spool 20 is necessary. The taking of the buoy under water by an underwater swimmer is facilitated since the buoyancy of hollow body 10 is effectively neutralized by anchoring device 40.

Mention has been made above of the fact that the hollow body 10 is preferably retained in position directly over the anchoring device 40. This is accomplished by permitting a discharge of line 26 from the spool 20 only in such amounts as will permit the hollow body to reach the surface.

The invention contemplates, for example, that a sphere having the diameter of 4 inches as indicated above, will exert a 19 ounce pulling force on a line connected thereto when the hollow body is released beneath the surface of a body of water. The invention also considers that wind and current will exert, for example, a force of no more than approximately one ounce on a spheroidal body of this size when the spheroidal body is on the surface. The invention therefore contemplates that resilient device 28 provide a locking force on the line 26 so that the line is discharged in response to the buoyancy of hollow body 10 while being retained against forces exerted on the hollow body 10 by wind and current. Preferably the resilient device 28 exerts a locking force of about 4 or 5 ounces so as to account for variations in the above-noted figures. Consequently, line 26 will be discharged from the spool 20 or played out therefrom only in response to the buoyancy effect of hollow body 10, whereas no line whatsoever will be played out due to the effects of wind and current. Accordingly, the result is that there is never an excess of line 26 between anchoring device 40 and the hollow body 10 whereby the latter stays directly above the anchoring device 40 and consequently accurately marks the position thereof.

As has been noted above, a primary purpose of the

invention is to provide for ready apprehension of the buoy when it has been employed to mark a position. For this purpose, the upper section **12** of the hollow body is light permeable and the lower section **14** thereof is provided with a mirrored surface. To insure that the mirrored surface is in lowermost position and superposed by light permeable section **12**, the spool **20** and anchoring device **40** are connected to the section **14**. This has the effect of maintaining section **14** in the most favored position when the hollow body **10** is in the water.

Additionally, note has been made of the fact that the buoy provided in accordance with the invention preferably can be dropped from great heights such as from an airplane. To this end, it is to be observed that the weight of anchoring device **40** causes this portion of the structure to strike the water first when the buoy is dropped, the resulting impact force detaching the anchoring device **40** from the spool **20** whereupon line **26** is played out and a buoy marking operation effected.

There will now be obvious to those skilled in the art many modifications and variations of the methods, structures and apparatus set forth above. These modifications and variations will not, however, depart from the spirit of the invention as defined in the following claims.

What is claimed is:

1. A buoy comprising a floatable body including an internal light-reflective surface, a spool connected to said body adjacent said surface, said spool being hollow and being provided with an axial bore, an anchoring member adapted for detachable engagement with said spool in said bore, a line normally housed on said spool and connecting the latter to said anchoring device, resilient means operatively associated with said line to retain the latter on said spool until a predetermined force is applied to said line, and a friction ring between said spool and anchoring device and providing a friction force sufficient to hold the spool and anchoring device together with the buoy submerged.

2. A buoy as claimed in claim 1 wherein said body comprises connected hollow hemispherical sections one of which includes an internal mirror surface constituting said light-reflective surface.

3. A buoy as claimed in claim 2 wherein said body has a buoyancy sufficient to float said anchoring device.

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