Jan. 12, 1971 D. E. McDOUGAL 3,553,795

HYDRAULIC LATCH

Filed May 5, 1969 2 Sheets-Sheet 1

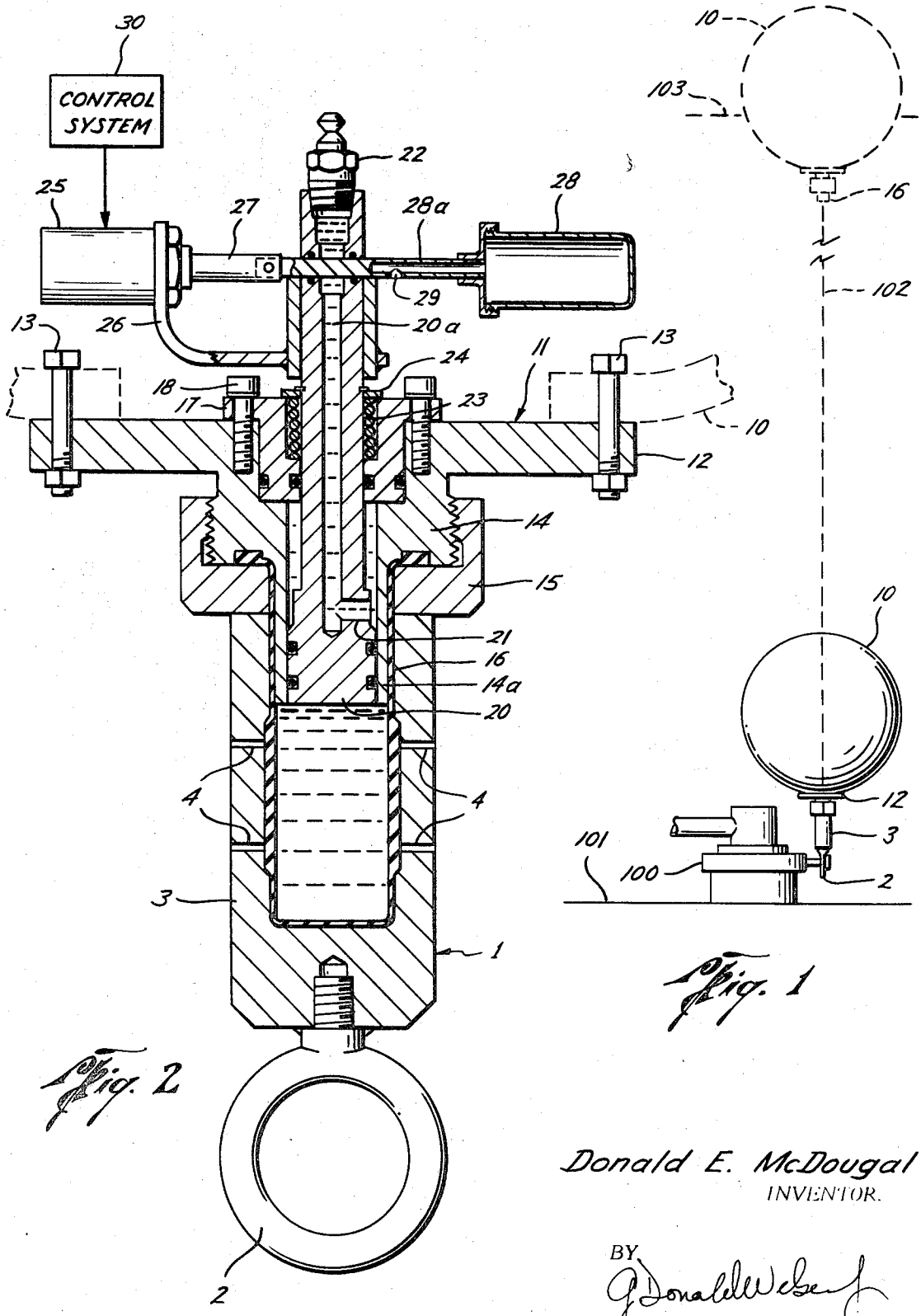


Fig. 2

Fig. 1

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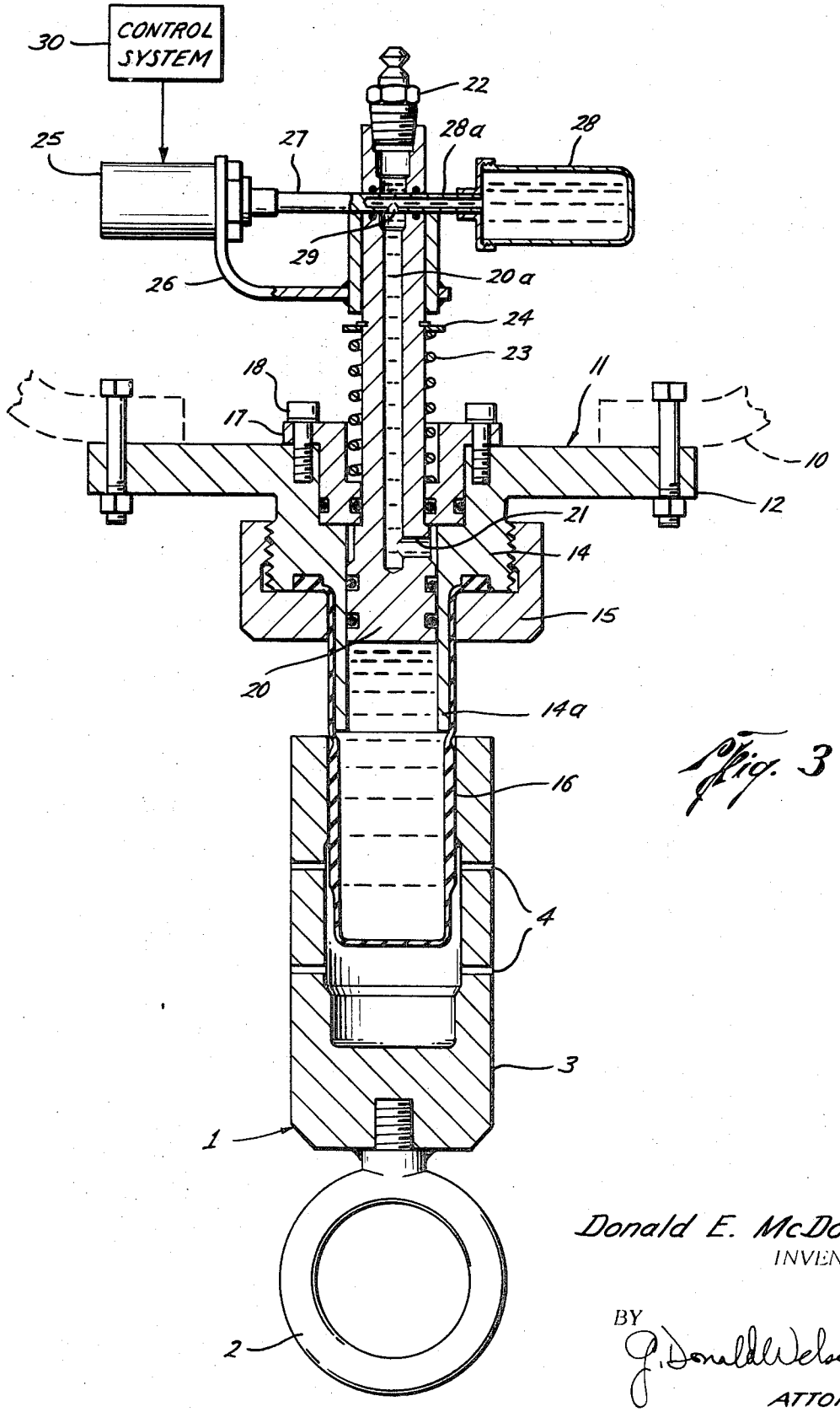


Fig. 3

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HYDRAULIC LATCH

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ABSTRACT OF THE DISCLOSURE

There is provided a latch which is hydraulically operated. The latch comprises a sleeve member adapted to be separable connected to an assembly having a bladder member that is expandable or contractable inside the sleeve member. A spring-biased piston is mounted adjacent the sleeve that is actuated by an electronic control means. By controlling the volume displacement of a hydraulic substance, the latch is selectively secured or released.

BACKGROUND

While this invention is not limited thereto, a typical use is in marine marker devices. May marine markers are known in the art. Typically, a buoy or flotation unit is releasably attached to a suitable anchor unit and located at a predetermined underwater site. A buoy line is connected between the buoy and the anchor. Thus, when the buoy is released from the anchor, the underwater site can be located by tracing the buoy line from the bouy, which has surfaced, to the anchor. The method or means for releasing the buoy varies in accordance with the technology utilized. Typical marine marker systems are described in U.S. Pats. 2,594,702; 2,739,296; 3,066,325 and 3,199,070. In each of these systems, releasable latch means are required to retain the buoy at the anchor site until the latch is selectively released.

The releasable latches which are described in the cited art and which are known in the art have many shortcomings. For example, the so-called "explosive" latches require substantial refurbishing after each use. In addition, each use is expensive inasmuch as the explosive charge is expended and must be replaced. Other known latches exhibit varying degrees of mechanical complexity and, consequently, expense. Moreover, these mechanical latches are generally subject to fouling due to marine growth (unless located in an expensive watertight compartment) and, therefore, are not reliable.

SUMMARY OF THE INVENTION

This invention relates to a hydraulically controlled releasable latch. In particular, such a latch is especially adaptable to underwater markers. The latch includes a flexible bladder which is inserted into an anchor fitting. The bladder is expanded by means of a suitable fluid which is pressurized by a controllable piston. While expanded, the bladder effects a connection between the fitting and a buoyant member. When the piston is moved to the proper position, the fluid is depressurized and the bladder is returned to the non-expanded configuration. When the bladder assumes the latter configuration, the buoyant member is free to move away from the anchor fitting.

Consequently, one object of this invention is to provide a releasable latch.

Another object of this invention is to provide a reuseable latch.

Another object of this invention is to provide a latch which is both releasable and reuseable while being relatively simple and uncomplicated.

Another object of this invention is to provide a releasable, reuseable latch which is relatively inexpensive to produce and exhibits a high degree of reliability.

These and other objects and advantages of the instant invention will become more readily apparent when the following description is read in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

In the drawings,

FIG. 1 is a schematic representation of a typical underwater marker unit;

FIG. 2 is a side view, partially in section, of the latch shown in the locked configuration; and

FIG. 3 is a side view, partially in section, of the latch shown in the released configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a schematic representation of a typical underwater marker unit. This marker includes a bouyant member **10** of any desirable shape and configuration. The buoyant member includes a suitable flotation material so that member **10** will tend to rise to the surface of the water—as suggested by the dashed outline.

A wellhead unit **100** or similar device is located adjacent to the bottom **101** of the body of water. Through a suitable coupling, an anchor fitting **3** is attached to the wellhead **100**. Buoy **10** is retained at or near the bottom of the body of water by means of a connection therewith to anchor fitting **3**. A suitable connecting element may be fastened to buoy **10** by flange **12**.

When the latch is released, as described hereinafter, buoy **10** floats to the surface carrying one end of line **102** which is affixed, at the other end, to wellhead **100**. By tracing line **102**, the wellhead or other subsurface unit can be easily located.

Referring now to FIGS. 2 and 3 concurrently, there is shown an anchor fitting **1**. Anchor fitting **1** includes a ring **2** or similar device suitably connected to the closed end of an elongated cup-shaped member **3**. Ring **2** is used to attach the latch to a subsurface element such as a wellhead or other anchoring device. In some applications, ring **2** may be omitted and the cup-shaped member or sleeve **3** can be affixed to or form a part of the anchoring device. For example, sleeve **3** may be affixed to a wellhead or the like in offshore drilling equipment.

A plurality of holes or vents **4** are included in sleeve **3**. These vents permit pressure equilibrium across the wall of sleeve **3**. In addition, vents **4** allow sea pressure to assist in releasing the latch by deforming the bladder as described hereinafter.

Buoy **10** (shown dashed) may be spherical in configuration, if desired, or any other suitable configuration. In addition, buoy **10** may be substantially hollow or contain some buoyant material. A suitable opening **11** is providede in at least one location on the perimeter of the buoy. Mounting flange **12** is attached to buoy **10** by means of bolts **13** or the like. Flange **12** covers opening **11**. A suitable gasket (not shown) may be included between buoy **10** and flange **12** to preserve a watertight junction. Opening **11** and flange **12** may have any desirable shape such as circular, rectangular or the like.

Regardless of the configuration thereof, flange **12** is, generally, planar. A raised hub-like section **14** is located at the center of flange **12**. A central, axial, opening passes through flange **12** and hub **14**. The outer surface of hub **14** is threaded to receive cap **15**. In addition, hub **14** includes an elongated portion **14A** which has a smaller diameter than hub **14** and extends beyond hub **14**.

Bladder **16** which is fabricated of rubber, vinyl or similar flexible material has the neck thereof fitted over por-

tion 14A of hub 14. The mouth of bladder 16 may be molded to fit a suitable receptical (such as an annular groove) in the surface of hub 14. The body of bladder 16 extends beyond elongated portion 14A and into the central opening of sleeve 3. Cap 15 has a central opening therein. The body of bladder 16 extends through the opening in cap 15. When cap 15 is screwed down on hub 14 (using the mating threads), bladder 16 is firmly and securely attached to flange 12. Moreover, because of the formed mouth of bladder 16 and the mating groove in hub 14, a fluid-tight seal is effected.

Also connected to flange 12, on the side of opposite the hub, is gland 17. Gland 17 is affixed to flange 12 by means of suitable bolts 18. In addition, gland 17 is substantially "force-fit" into a recessed portion at the center of flange 12. The recessed portion is of smaller diameter than hub 14 and extends thereto. A central aperture passes axially through gland 17 and cooperates with the axial opening in hub 14. The aperture has a smaller internal diameter at the end adjacent hub 14 and a larger diameter adjacent buoy 10. Thus, an internal shoulder is provided at the aperture. Annular grooves are disposed around the outer surface of gland 17 and the inner surface of the central aperture therethrough, at the smaller diameter location. Typical O-rings are inserted into the annular grooves to provide seals.

The control portion of the latch includes a piston 20 which has one end thereof disposed within the opening in elongated portion 14A. This end of piston 20 includes a portion thereof which is enlarged to substantially fill the aforesaid opening at the extreme end of the piston. The remainder of piston 20 has an outside diameter substantially equal to the smaller diameter opening of gland 17. Thus, the inner O-ring seal of gland 17 acts in conjunction with piston 20. Moreover, a void or space exists between piston 20 and the inner surface of elongated portion 14A.

Piston 20 has an axial opening 20A therein. At one end the opening 20A joins another opening 21 which opens to the void or space noted previously. The other end of opening 20A is joined to a typical grease or hydraulic fitting 22.

Coil spring 23 is provided around piston 20. Spring 23 engages a suitable abutment 24 which is affixed to piston 20 at one end. The other end of spring 23 abuts against the shoulder formed between the different diameter apertures within gland 17. Spring 23 is compressed when piston 20 is in the locked position.

Solenoid 25 is mounted on a suitable bracket 26 which is affixed to piston 20. Plunger arm 27 of solenoid 25 is connected to a closed cup or receptacle 28. The connecting link 28A between plunger arm 27 and receptacle 28 has a hollow portion which opens into receptacle 28. A radial opening 29 passes through connecting link 28A and opens into the hollow portion thereof. When plunger arm 27 is retracted, link 28A is moved thereby and opening 29 cooperates with opening 20A in piston 20. Control system 30 is connected to solenoid 25 to control the operation thereof.

In operation, after assembly of the several parts, bladder 16 is inserted into sleeve 3. A suitable fluid, such as oil or the like, is included in bladder 16. Piston 20 is then forced into bladder 16 by forcing grease in the void between piston 20 and the internal surface of elongated portion 14A. The grease is inserted via fitting 22, and openings 20A and 21. Insertion of piston 20 into bladder 16 causes bladder 16 to expand and conform to the internal contour of sleeve 3 which includes a small recessed portion. Piston 20 causes bladder 16 to assume a substantially rigid condition whereby sleeve 3 is retained by bladder 16.

Ring 2 and flange 12 are attached to the respective members and the latch is in the latched position. In this condition, the buoy will remain at the anchor site.

When it is desired to release the buoy, a suitable control signal is produced at or near the surface of the water. For example, a seismic-type explosion may be produced or a sonic type signal may be generated. The signal is detected by control system 30 which produces an output signal. The output signal causes solenoid 25 to operate and retract plunger arm 27. Plunger arm 27 pulls receptacle 28 and connecting link 28A. When opening 29 in link 28A cooperates with opening 20A, the pressurized grease therein flows into receptacle 28. When the grease is removed, piston 20 is urged, by spring 20, out of bladder 16. As piston 20 is withdrawn from bladder 16, the fluid in bladder 16 is depressurized and bladder 16 tends to contract. Sea pressure, via vents 4, assists in the collapsing of bladder 16. When bladder 16 is collapsed, the frictional force and contour retention of sleeve 3 is eliminated and the latch is in the released condition whereby buoy 10 is free to surface.

Thus after buoy 10 has been retrieved, the latch can be reused by merely recharging the grease fittings after an anchor fitting has been supplied. Consequently, the only expendable part is sleeve 3, which can be inexpensive, and a small amount of grease.

It is understood, of course, that bladder 16 can be fabricated of rubber or any other suitable material. Moreover, bladder 16 may include in the material a suitable reinforcing material. The outer surface of bladder 16 may be treated to give a suitable friction coefficient, if desired. The grease may be of any type which has suitable characteristics to withstand the pressure applied thereto for extended time periods.

It is seen that the disadvantages of known latches, especially underwater latches, are overcome or avoided by this latch.

Consequently, having described a preferred embodiment of the invention, what is claimed is:

1. A hydraulic latch comprising, sleeve-like means adapted for attachment to anchoring means, expandable bladder means inserted into said sleeve-like means, substantially incompressible fluid means retained within said bladder means, piston means disposed adjacent said bladder means, and means for selectively displacing said piston means within said bladder means such that said bladder means is selectively expanded or contracted as a function of the pressure exerted thereon due to compression of said fluid means by said piston means.

2. The hydraulic latch recited in claim 1 including means for mounting including an aperture therein which cooperates with the mouth of said bladder means, said piston means passing through said aperture to bear upon said fluid means.

3. The hydraulic latch recited in claim 1 including eletronic control means for supplying control signals to said means for selectively displacing said piston means.

4. The hydroulic latch means recited in claim 1 wherein said means for selectively displacing said piston means includes pressurized means for selectively forcing said piston into said bladder means to bear upon said fluid means, and relief means for selectively removing said pressurized means from said piston means such that said piston means does not bear upon said fluid means.

5. The hydraulic latch recited in claim 4 wherein said pressurized means comprises a grease-like substance, fitting means associated with said piston means for receiving said grease-like substance and transmitting same under pressure to said piston means to control said piston means, said relief means including port means selectively movable relative to said piston means, said port means selectively permitting said pressurized grease-like substance to escape from the location of said piston means whereby the position of said piston means is further controlled.

6. The hydraulic latch recited in claim 2 including resilient means disposed between said mounting means and said piston means, said resilient means arranged to force said piston means away from said bladder means.

7. The hydraulic latch recited in claim 1 wherein said piston means is adapted to be attached to buoyant means.

8. The hydraulic latch recited in claim 1 wherein said sleeve-like means has a contoured inner surface and said bladder means has a contoured outer surface which mates with said inner surface of said sleeve-like means when said bladder means is expanded due to pressure exerted by said fluid means.

9. The hydraulic latch recited in claim 5 including solenoid means connected to said port means, said solenoid means adapted to receive electrical signals to control the operation thereof, said solenoid means controlling the positioning of said port means relative to said piston means.

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9—8; 24—211, 230; 294—93; 340—5