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ELECTRICALLY-ACTUATED OCEANOGRAPHIC RELEASE MECHANISM

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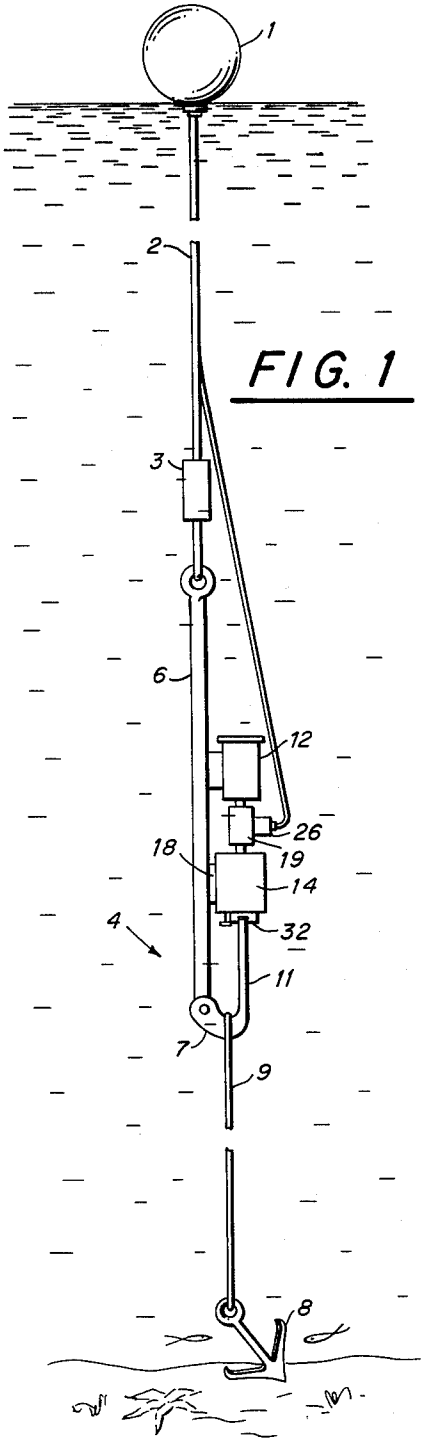


FIG. 1

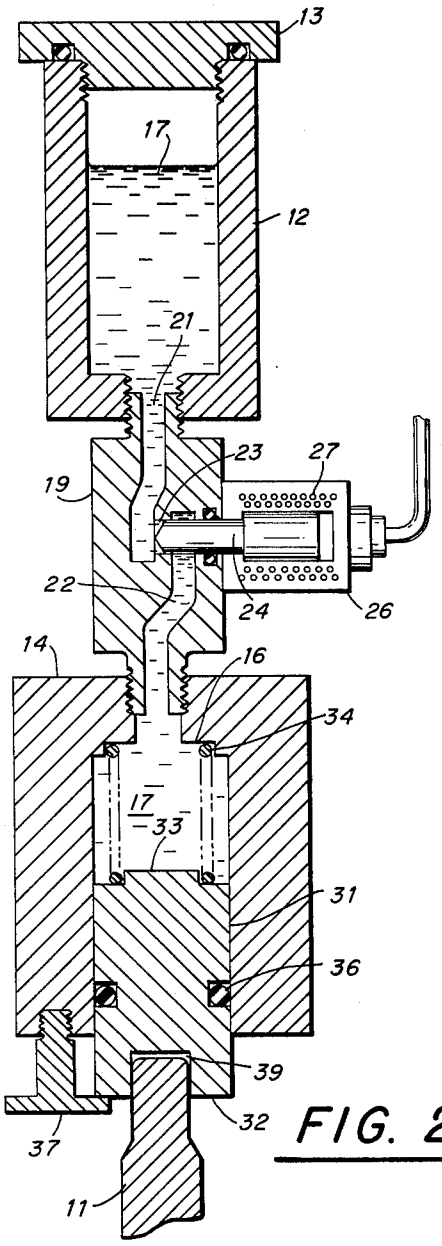


FIG. 2

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ELECTRICALLY-ACTUATED OCEANOGRAPHIC RELEASE MECHANISM

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5 Claims. (Cl. 24—241)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The present invention relates to apparatus for releasing sub-surface instrumentation in the ocean and, in particular, to mechanisms in which the release is accomplished by remote control.

In oceanographic work, it often is desired to suspend sonar equipment close to the bottom of the ocean above a suitable anchor and, after the equipment has served its purpose, to remotely cause the release of the sonar equipment which then may float to the surface with the aid of attached buoys or due to some built-in flotation. Although the present invention is particularly concerned with oceanographic work, there are many other types of gear, such as mines, test instruments, missiles, etc., which are adapted to be suspended in a submerged condition in the ocean and which, after a period of usage, must be recovered in the same manner as the sonar equipment.

To accomplish these and other purposes, a variety of mechanisms have been developed. Generally, however, they fall into one or two categories the first of which employs an explosive bolt or squib that is fired electrically in a pressure-tight sitting to sever a mooring cable. The other category also employs an explosive squib, although, in this instance, the squib is used to drive a piston which then may, for example, cut a wire to release another piston to open a valve and ultimately promote the release of a hook or clamp so as to drop the mooring weight or anchor.

The principal difficulty with the prior developments is the fact they are relatively complex and also that they involve the use of explosives which obviously create personnel hazards, as well as storage inconvenience. In addition the explosives demonstrate poor reliability.

A further dissuasive consideration is that explosively-actuated mechanisms and their counterparts are not readily reusable after recovery. Obviously, the device must be contained in a pressure case and the mechanism, after use, must be removed from the case while replacing the charge and resetting the various components. For example, in the particular situation in which the charge is used to cut a securing wire it obviously would be necessary to replace the wire and perform a variety of other operations before the device could be put back into use.

It is therefore an object of the present invention to provide a relatively simple, readily reusable release mechanism capable of performing its intended function without requiring subsequent replacement of parts.

Another object is to provide such a release mechanism in which resetting can be accomplished quickly and easily without any need for dismantling the apparatus.

Another related object is that of providing a simple, inexpensive device which is entirely self-contained to the extent that it does not employ any extraneous components such as explosive squibs, which must be stored so as to be available for each re-use.

Other objects and their attendant advantages will become more apparent in the subsequent detailed description.

Generally considered the objects of the invention are accomplished by utilizing a pair of fluid-containing reservoirs or cylinders interconnected by a solenoid-actuated valve. A piston is mounted in one of the cylinders and the piston is so arranged as to have one end exposed to sea water pressure. Also, the arrangement is such that, when the valve is closed, the fluid, which may be oil, in the piston-mounting cylinder provides a solid pressure head against the piston to maintain the piston in an extended position against the opposing external pressure of the sea water.

When in an extended position, the piston is adapted to engage a hook which, in turn, suspendably supports a weighted object, such as an anchor and, of course, the hook itself is suspended from the surface of the water by a buoy or other flotation means. Release of the hook may be accomplished by opening the valve to permit a flow of fluid from the piston-mounting cylinder into the other cylinder, the sea water pressure then being sufficient to cause the piston to retract and the hook to be freed. Resetting of the piston in its hook-securing disposition also may be accomplished in a relatively simple manner by operating the valve to permit a return flow of the fluid into the piston-mounting cylinder, the valve then being closed to maintain the pressure head on the piston. As will be apparent, the use of a solenoid actuated valve is but one of a variety of manners in which the valve can be actuated, although, as should be apparent from the foregoing discussion, it is desired to actuate the valves electrically rather than by any explosive means.

A preferred embodiment of the invention is illustrated in the accompanying drawing of which:

FIG. 1 is a schematic illustration of the release mechanism carried by an anchor-supporting hook which, in turn, is suspended from a buoy; and

FIG. 2 is a partially-schematic sectional view of the release mechanism proper.

Referring to the drawings, a buoy **1** is shown supporting a suspension line **2** on which is secured sonar equipment or instrumentation **3** that is to be recovered after it has served its intended purposes. Most suitably, the sonar equipment will incorporate buoys so as to float to the surface when released or it may be provided with a built-in bouyant capacity. Suspension line **2** further supports a hook means generally indicated by numeral **4**, this means including an elongate arm **6** which pivotally mounts a hook arm **7**. Arm **7**, in turn, supports an anchor **8** which has a bail or other appropriate device riding on an arcuate portion of the hook. In particular, it is to be noted that arm **7** has a vertically extending length **11** adapted to engage with and be secured by the release mechanism that is to be described.

Obviously, the hook arrangement can be varied widely to suit whatever purposes may be desired although the arrangement should be such that, when portion **11**, or its equivalent, is released, the weight of the anchor will cause the hook arm to swing downwardly thereby releasing the anchor and permitting the sonar equipment to float upwardly to the surface where it can be recovered.

The principal features of the invention best are shown in FIG. 2 which is a sectional view of the release mechanism that obviously functions to secure hook arm **7** until such a time as it is desired to recover the sonar equipment.

Referring to FIG. 2 it will be seen that the mechanism includes a fluid pressure reservoir **12**, preferably containing oil or another relatively incompressible fluid, this reservoir preferably being constructed with a removable pressure-tight tap **13**. Also, the mechanism includes a cylinder **14** provided with a central bore **16**

forming a chamber which also is adapted to contain a similar fluid **17**.

To support the mechanism, cylinder **14** is secured to a casing **18** which, in turn, is carried by elongate arm **6** of the hook.

Intermediately disposed between reservoir **12** and cylinder **14** is a valve casing **19** provided with three passageways **21**, **22** and **23**. Passageway **21** communicates with the interior of reservoir **12**, while passageway **22** communicates with the upper part of the bore **16** of cylinder **14**. Passageway **23** interconnects the other two passageways and, as clearly shown in FIG. 2, the communication may be selectively blocked by a valve stem **24** carried by valve casing **19** as well as by a solenoid casing **26**. Within casing **26** are mounted conventional solenoid coils **27** having leads which project outwardly of the casing and, preferably, extend upwardly along suspension line **2** to surface of the water. Energization of the solenoid coils causes valve stem **24** to reciprocate from a blocking to an unblocking position or vice versa.

It should be mentioned at this point that the provision of electrical leads for coils **27** is not considered absolutely essential and, instead, some acoustic means operating through electronics contained in casing **18** may be employed to control the action of the valves. However, it is contemplated that any such acoustic means will function to energize coils or their electrical equivalent to promote the desired reciprocation.

A piston **31** is mounted in cylinder **14**, this piston having an exterior end **32** exposed to sea water pressure. Its other interior end **33** is exposed to the oil **17** within the bore of the cylinder. Also, a coil spring **34** is compressed in bore **16** so as to exert its pressure against end **33**. Suitable piston seals **36** may be employed, as well as other seals that may be needed.

Piston **31** obviously reciprocates from a retracted position within bore **16** to the extended position illustrated in FIG. 2. A limit arm **37** is threadably mounted in the cylinder to limit the degree of the extension of the piston.

The function of the piston is to secure hook arm **7** when the piston is in its extended position, and to release arm **7** when retracted. Thus, its lower, sea water-exposed end **32** is provided with a suitable notch **39** adapted to engage the free end of vertical extension **11** of the hook arm.

The operation of the release mechanism should be reasonably apparent. First, it of course, is necessary to load the reservoir and cylinder with oil and this can be accomplished by inverting the release mechanism, removing piston **31** by first unscrewing limit stop **37**, and then pouring oil into the cylinder. With the valve open, the oil flows through its passageways into reservoir **12**. The mechanism then is returned to an upright position and piston **31** replaced in its extended position in which it will be held by spring **34**. Valve **24** then is opened so that the oil can flow into and completely fill bore **16** of the cylinder.

Prior to submerging the equipment ,anchor **8**, of course, is positioned on hook **7** and the hook, in turn, is secured in notch **39** of piston.

In use, the anchor is retained in its secured position even though the pressure of the sea water acting on end **32** of the piston urges the piston toward a retracted position. The piston cannot retract since there is a solid body of oil trapped between its upper end **33** and valve stem **24**. When it is desired to recover the sonar equipment, the valve may be electrically energized to communicate the cylinder with the reservoir. When this is done the sea water pressure acting on piston end **32** is sufficient to retract the piston and free hook arm **7** which, in turn, pivots outwardly and releases the anchor. Although the energization of the solenoid may be accomplished remotely from a surface position, it also would be possible and, in some instances, preferable to utilize a timing device which would energize the solenoid after a predetermined period of time had elapsed. As earlier indicated, the same energization could result from an electronic signal.

After use, the resetting of piston **31** may be accomplished in a very simple manner. As may be noted, the piston will remain in its retracted position as long as valve **24** is in its closed position. Thus, to reset, valve **24** is retracted and the piston moved downwardly in response both to the pressure of spring **34** and the compressed air pressure which will have been developed within reservoir **12**. It is not absolutely essential to employ a spring within cylinder **14** since the reset pressure could be achieved through a spring loaded piston in reservoir **12** or simply through the air pressure in the reservoir. If desired, the reset can be accomplished manually by drilling a hole in bottom end of piston **31** to permit manually pulling it out by means of a suitable screw jig.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A remotely controlled apparatus for releasably supporting weighted objects under water comprising:

articulated hook means for releasably suspending said weighted objects,

suspension for said hook means, and

means carried by said hook means for releasably securing said hook in a closed position,

said hook-securing means including;

a fluid reservoir,

a fluid cylinder,

a valve casing disposed intermediate said reservoir and cylinder and provided with separate fluid passageways communicated one with said reservoir and the other with said cylinder,

said casing further being provided with a third passageway intercommunicating said separate passageways,

a valve stem reciprocably movable in said casing for blocking and unblocking said third passageway,

remotely-controlled means for reciprocably moving said stem, and

a piston reciprocably mounted in said fluid cylinder with one of its end portions exposed to sub-surface ambient pressure and the other end portion exposed to the fluid pressure of said cylinder, said piston being reciprocably movable from a retracted position within said cylinder to an extended position, and

said piston being formed for engaging and securing said articulated hook means when extended and for releasing said articulated hook means when retracted,

whereby said piston can be held in an extended position by filling said fluid cylinder with fluid and blocking said third passageway for maintaining fluid pressure on the piston,

said hook-releasing retraction of said piston being accomplished by unblocking said third passageway to permit fluid flow from the cylinder into said reservoir in ambient sub-surface pressure acting upon the exposed end of the piston.

2. The apparatus of claim **1** further including resilient means normally urging said piston into an extended position.

3. The apparatus of claim **1** further including means for limiting said extended position of the piston.

4. The apparatus of claim **3** wherein said valve stem reciprocating means is in the form of a solenoid-actuated valve.

5. The apparatus of claim **3** wherein said articulated hook means includes an elongate arm having one end carried by said hook suspension means, and

a hook arm pivotably secured to the other end of said elongate arm,

said ambient-pressure-exposed end of the piston being formed with a notch for receiving the free end of said hook arm,

said notch and hook arm being so formed as to permit the hook arm to be engaged in said notch when said piston is in its extended position and to be released from said notch engagement when the piston is in its retracted position.

References Cited by the Examiner

UNITED STATES PATENTS

3,130,703 4/1964 Thompson.

FOREIGN PATENTS

66,243 8/1927 Sweden.

BERNARD A. GELAK, *Primary Examiner.*