United States Patent [19]

Perez

[11] 3,848,226

[45] Nov. 12, 1974

[54] **HIGH CAPACITY UNDERWATER ACOUSTIC RELEASE**

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[73] Assignee: **AMF Incorporated,** White Plains, N.Y.

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[52] **U.S. Cl.** ..... **340/5 R,** 9/8 R, 294/83 AE, 340/16 C

[51] **Int. Cl.** **B66c 1/34**

[58] **Field of Search** ..... 9/8 R; 114/208 R; 294/83 R, 83 AB, 83 AE; 340/4 R, 5 R, 16 C

[56] **References Cited**

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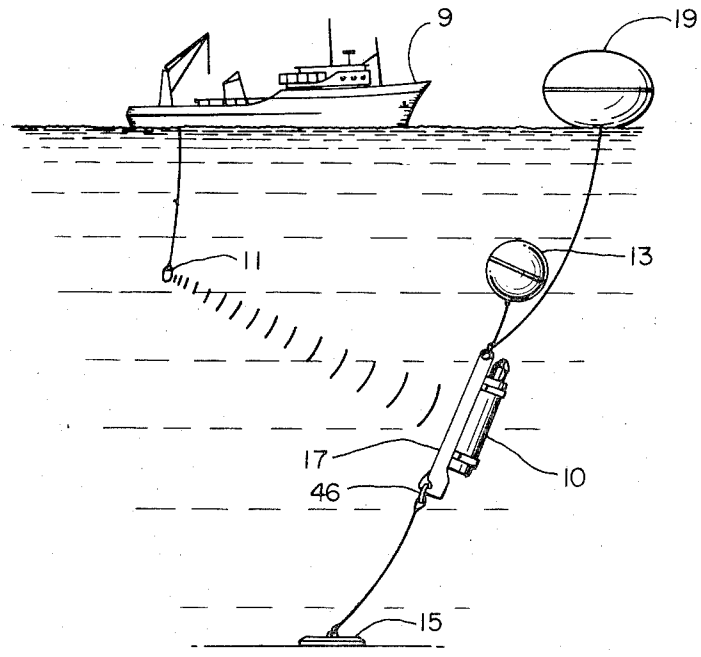
Attorney, Agent, or Firm—George W. Price; John H. Gallagher

[57] **ABSTRACT**

A high capacity underwater acoustic release means is described. A tubular housing is provided for containing an electronic acoustic receiver for detecting a coded acoustic command signal and a detonation means for actuating a release mechanism in response to the detection of said command signal. The release mechanism is coupled to the exterior of said receiver housing and includes a pair of evenly spaced support plates having a release linkage means disposed therebetween. The support plates extend longitudinally of said receiver housing beyond both ends thereof and are provided at one end with a shackle means for attachment to a cable or other suitable means. The release linkage is disposed between said plates at said other end and includes at least one pivotally mounted release arm operatively associated with the detonation means, and a pivotally mounted pelican hook. The load to be released is supported by said pelican hook until said release linkage is actuated by said detonation means.

9 Claims, 9 Drawing Figures



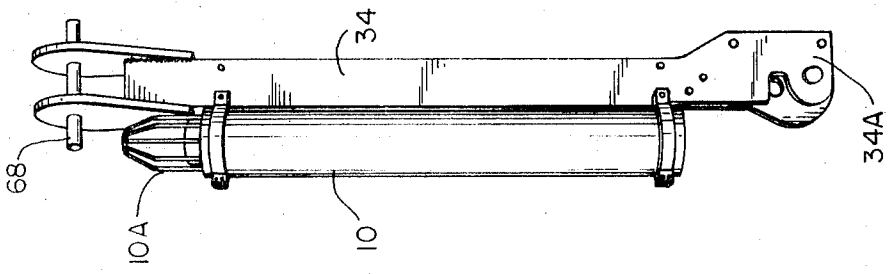


FIG. 6

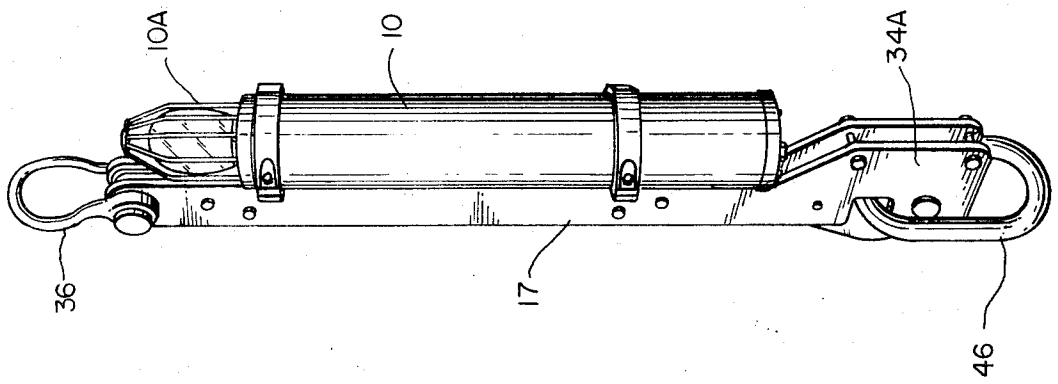


FIG. 2

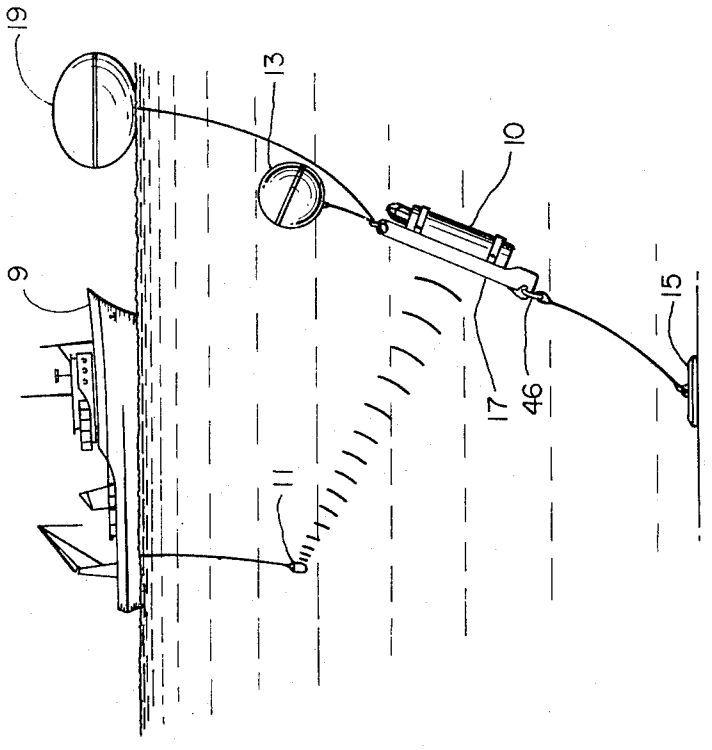
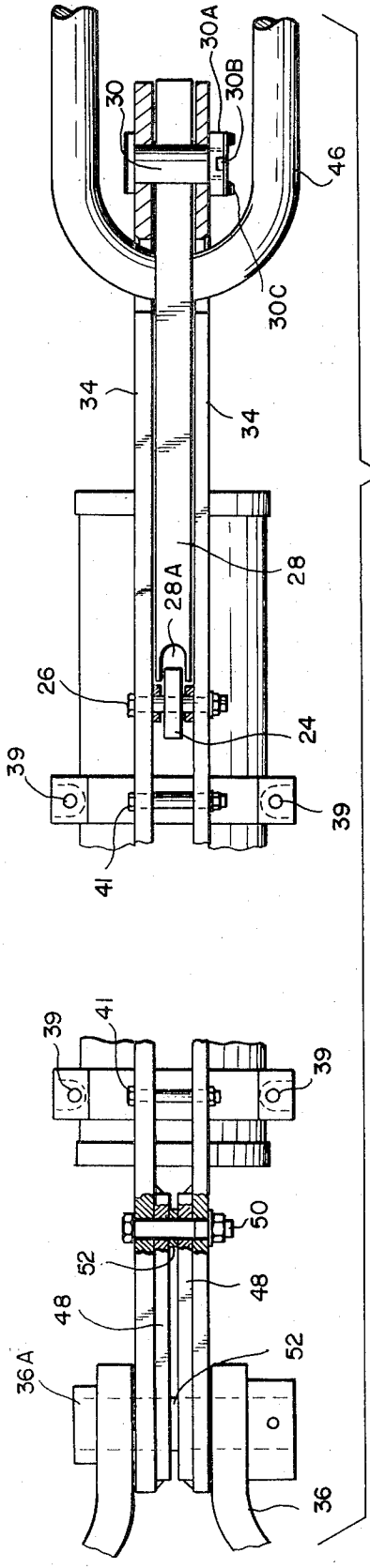


FIG. 1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30B
30
46
30C
34
34
28A
28
26
24
39
39
41
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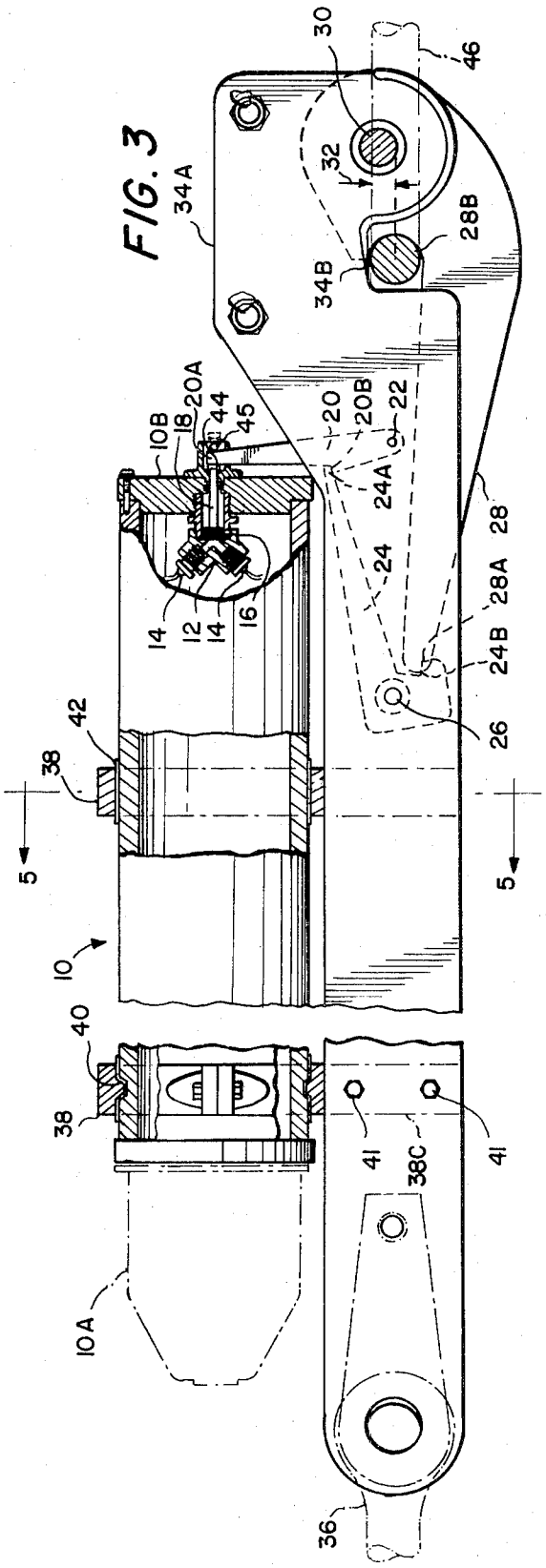
41
39
50
52
48
48
52
36A
36

FIG. 4

FIG. 3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38C
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10A
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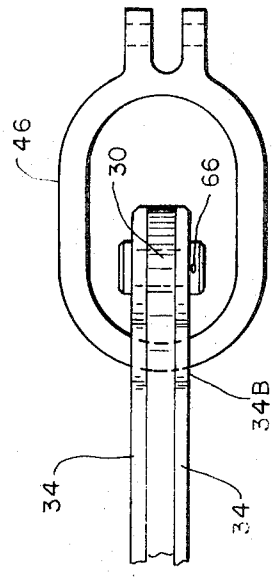


FIG. 9

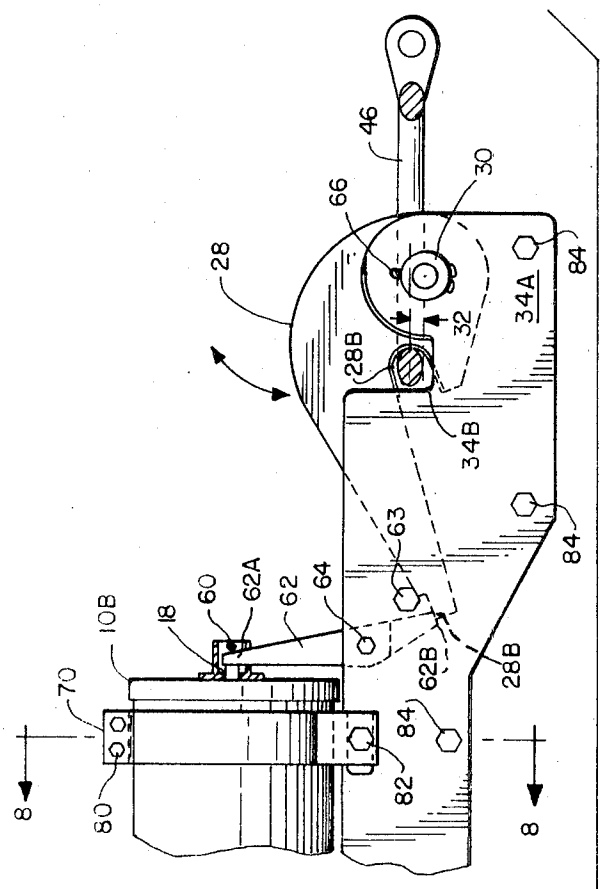


FIG. 8

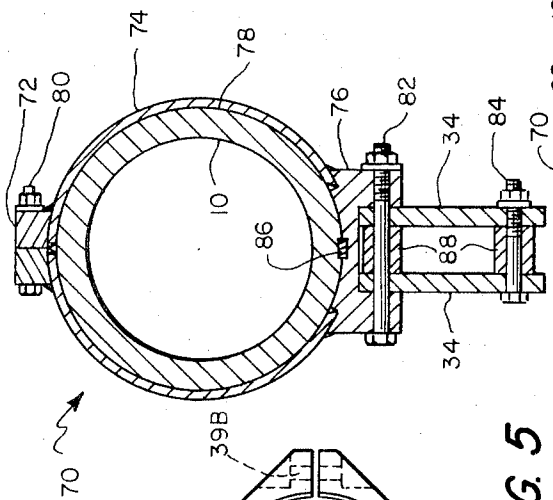


FIG. 5

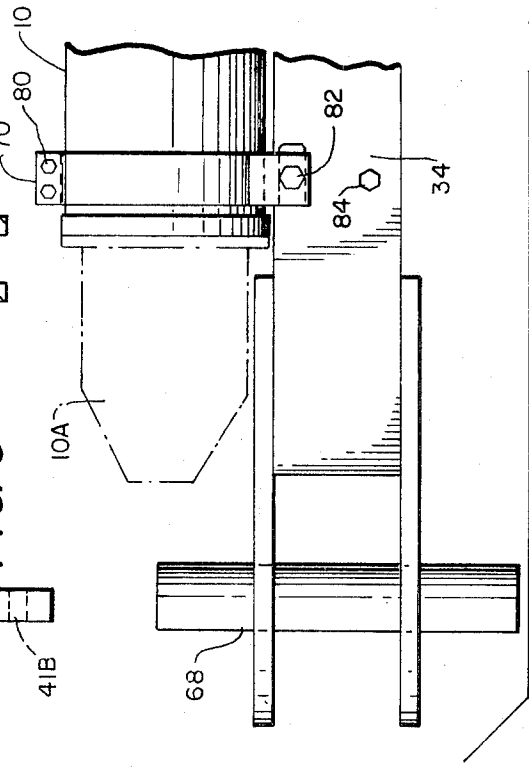
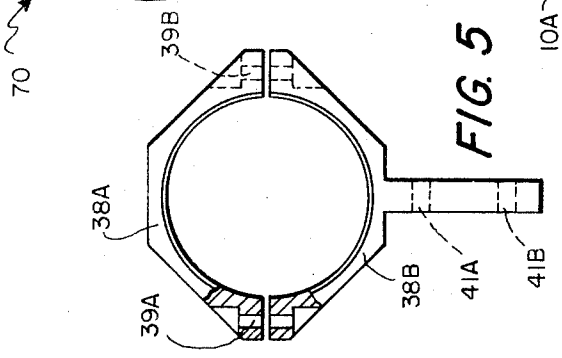


FIG. 7



HIGH CAPACITY UNDERWATER ACOUSTIC RELEASE

This invention relates to a high capacity acoustic underwater release mechanism. More specifically this invention relates to a high capacity underwater release linkage means and a support means therefor.

Heretofore underwater release means have been provided which are capable of supporting and releasing loads of several thousand pounds. However, these prior art release means have not been capable of supporting and releasing loads in the range between 40,000 and 100,000 pounds.

Prior art release mechanisms have further suffered from the disadvantage that the external mechanical release means was not readily removable from the electronic receiver and detonator housing. Moreover, the external mechanical release means known heretofore have been coupled to the electronic receiver housing in such a way that the end caps of the housing have been stressed by the load to be released, thereby causing leaks in the receiver housings.

Accordingly, it is an object of the present invention to provide an acoustical underwater mechanical release structure which is capable of supporting and releasing loads in the range between 40,000 and 100,000 pounds in water depths up to 20,000 feet.

It is another object of the present invention to provide a squib actuated mechanical release means which is highly reliable in its operation.

It is still another object of the present invention to provide a mechanical release means having low power requirements for its actuation.

It is a further object of the present invention to provide a mechanical release structure which may be easily detached from the receiver housing to facilitate the repair or replacement of parts.

It is still a further object of the present invention to provide a mechanical release means wherein the only stress to the end caps of the acoustic receiver housing results from hydrostatic pressure.

The objects of the present invention are fulfilled by providing an underwater mechanical release means including a housing containing an electronic acoustic receiver for receiving a coded command signal and means for actuating an external mechanical release means. The external mechanical release means is removably coupled to the exterior side walls of said housing by clamp means having means thereon for indexing the clamps with respect to a predetermined reference point on said housing. The external mechanical release means includes a pair of evenly spaced support plates which extend longitudinally of said housing and beyond both ends thereof. A release linkage including a pelican hook for releasably supporting the load is mounted for rotation between said side plates at one end thereof. The release linkage is self locking under a load condition until a command signal constrains said actuating means to rotate and unlock said linkage to thereby release said load from said pelican hook. The side support plates provide the structural strength needed to support extremely heavy loads and facilitate a substantially even distribution of load forces along the side walls of the receiver housing.

The objects of the present invention will become more fully apparent with reference to the following description of the drawings wherein like numerals refer to like parts and wherein:

FIG. 1 is a diagrammatic view illustrating the underwater acoustic release system of the present invention;

FIG. 2 is a perspective view of a first embodiment of the release mechanism of the present invention;

FIG. 3 is a side elevational view of the release mechanism of FIG. 2;

FIG. 4 is a bottom plan view of the release mechanism of FIG. 3;

FIG. 5 is a cross sectional view taken along lines 5—5 of FIG. 3;

FIG. 6 is a perspective view of a second embodiment of a release mechanism of the present invention;

FIG. 7 is a side elevational view of the release mechanism of FIG. 6;

FIG. 8 is a cross sectional view taken along lines 8—8 of FIG. 7; and

FIG. 9 is a bottom plan view of a portion of the release mechanism of FIG. 7.

Referring in detail to FIG. 1 there is shown one example of an application of the acoustic release system of the present invention. As shown in FIG. 1 a subsurface buoy 13 is connected to one end of a mechanical release means 17 by a cable or other suitable means. Mechanical release means 17 has a tubular receiver housing 10 secured thereto for containing the electronic components of an acoustic receiver of a type well known in the art and a detonation means for actuating the mechanical release means 17. Buoy 13, mechanical release means 17, and housing 10 are held below the surface of the water by an anchor 15 connected by a cable to a chain link 46 releasably held in one end of mechanical release means 17.

When it is desired to retrieve buoy 13, release mechanism 17, and receiver housing 10, a coded signal is generated by acoustic transmitter 11 carried by ship 9. The coded signal is detected by the electronic receiver in housing 10 which triggers a firing means. The firing means in turn actuates release mechanism 17 to release chain link 46 and anchor 15. Buoy 13, release means 17, and receiver housing 10 are then free to float to the surface for retrieval by ship 9.

The function of buoy 13 in FIG. 1 is to provide a sufficient buoyant force to lift release means 17, receiver housing 10, and any other device which may be attached to the same to the surface of the water. In a preferred embodiment a large weather buoy 19 floating on the surface of the water may be attached to release mechanism 17 by several miles of cable. Since this cable is very expensive, it is desirable to be able to retrieve it. By actuating the release mechanism of FIG. 1 the cable will float to the surface with buoy 13, where it may be retrieved by ship 9.

The system of FIG. 1 is offered only by way of example. It should be understood that the release mechanism of the present invention may be used to release any other type of underwater load without departing from the spirit and scope of this invention.

Referring in detail to FIGS. 2 to 5 there is illustrated a first embodiment of an underwater acoustic release mechanism of the present invention. The release mechanism of FIGS. 2 to 4 is capable of supporting and releasing a load of up to 100,000 pounds.

As shown in FIGS. 2 to 4 there is illustrated a tubular receiver housing 10 having a transducer head 10A at

one end thereof for receiving coded release signals and an actuator cylinder **12** disposed in the opposite end wall **10B** of housing **10.** A suitable electronic receiver means is disposed in the central portion of housing **10** for selectively receiving coded command signals from an acoustic transmitter. The electronic receiver is electrically connected to a pair of squib means **14** disposed in actuator cylinder **12** to facilitate the detonation of either of squibs **14** in response to the receipt of a coded command signal by the transducer head **10A.** Two squibs **14** are provided in a preferred embodiment to provide a fail safe means for actuating piston **16.** In other words, if one of the squibs **14** should fail to fire, the other of said squibs **14** may be fired to actuate piston **16.** A piston means **16** is disposed adjacent squibs **14** and is provided with a piston rod **18,** which extends through end **10B** of housing **10.** Upon firing one of the squibs **14** piston rod **18** is propelled outwardly through end wall **10B** against a first release arm **20** by the force of the gas released by squibs **14** into actuator cylinder **12.**

Squibs **14** may be any suitable type known in the art which explode and release a gas under pressure in response to an electrical impulse. Suitable sealing means are provided around piston rod **18** to prevent sea water from entering actuator cylinder **12** and housing **10.**

A mechanical release mechanism is coupled to the exterior of housing **10.** The release mechanism includes two spaced parallel support plates **34** which extend along and beyond housing **10.** Support plates **34** are coupled to housing **10** by suitable clamp means **38** to be further described hereinafter. A tongue and groove arrangement may be provided in one clamp **38,** as shown at **40,** to facilitate the correct positioning of housing **10** in clamps **38.**

Referring to FIG. **5** clamp **38** is shown having a top section **38A** and a bottom section **38B** having an integral spacer stem **38C** extending from the bottom thereof. Stem **38C** is bolted between side plates **34** by bolts **41** and sections **38A** and **38B** are bolted together around housing **10** by bolts **39.** Bolts **41** are inserted in holes **41A** and **41B** and bolts **39** are inserted in holes **39A** and **39B.**

Clamps **38** perform two functions. First, clamps **38** secure housing **10** to plates **34.** Second, stems **38C** of clamps **38** function as spacers for side support plates **34,** thus maintaining the correct distance between plates **34** to prevent binding of the moving parts of the release linkage to be described hereinafter.

Since clamps **38** and side plates **34** are preferably fabricated from structural or stainless steel and housing **10** is fabricated from an aluminum alloy, neoprene insulators **42** are inserted between the dissimilar metals to prevent galvanic corrosion. For a similar reason a nylon bushing **44** is provided between piston rod **18** and a first release arm **20.**

A shackle **36** is suitably attached to the top end of support plates **34** by a bolt **36A.** As shown in FIG. **1** a buoy may be attached to shackle **36** by a cable. To give plates **34** greater strength in the area of the shackle reinforcing plates **48** may be provided between plates **34.** Plates **48** are welded to plates **34** in addition to being bolted in place by bolts **36A** and **50.** Spacers **52** may be provided between plates **48.**

Chain link **46,** which supports the load to be released, is releasably supported in a U-shaped slot **34B** in a widened section **34A** of plates **34** which extends beyond end **10B** of housing **10.** Chain link **46** is held in slot **34B** by the hook portion **28B** of pelican hook **28.** Pelican hook **28** is pivotally mounted on a shaft **30,** which extends through plates **34.** Shaft **30** is secured in plates **34** by a threaded collar **30A.** A plate **30B** is keyed to shaft **30** and is secured to collar **30A** by bolts **30C.** This arrangement provides the strength necessary to support a heavy load.

The center of shaft **30** is off-set from the center of chain link **46,** as shown at **32** in FIG. **3.** As will become more fully apparent hereinafter, off-set **32** in combination with the weight of the load attached to chain link **46,** ultimately provide the force which causes pelican hook **28** to rotate in a counter clockwise direction to release chain link **46.**

As shown in FIG. **3** pelican hook **28** is locked in the position shown by first and second release arms **20** and **24** which are pivotally mounted about pins **22** and **26,** respectively. Pelican hook **28** in combination with release arms **20** and **24** comprise a substantially self locking linkage as long as a load is applied to chain link **46.** This is so because the load applied to link **46** in conjunction with offset **32** generates a counter clockwise force at U-shaped slot **28A** of pelican hook **28.** This counter clockwise force pushes slot **28A** against shoulder **24B** of release arm **24** and generates a clockwise force at end **24A** thereof. End **24A** pushes against shoulder **20B** of release arm **20** and generates a counter clockwise force at end **20A** thereof which constrains end **20A** against piston rod **18.** Therefore, under a load condition the coacting forces of pelican hook **28** and release arms **20** and **24** substantially lock each other in the positions shown in FIG. **3.**

A shear pin **45** of nylon or any other suitable material is provided to constrain arm **20** against clockwise rotation under a no load condition. However, pin **45** is easily sheared by the force generated by piston **18** at detonation.

Referring to the operation of the acoustic release means of FIGS. **2** to **5** a coded acoustic command signal received by transducer **10A** generates an electrical signal which detonates one of the squibs **14.** The gas pressure released by squibs **14** into cylinder **12** supplies a thrust to piston **16** which forces piston rod **18** against end **20A** of a first release arm **20.** This force will shear pin **45** and constrain arm **20** to rotate in a clockwise direction. When this occurs end **24A** of arm **24** will disengage shoulder **20B** of arm **20** and free arm **24.** Under the force generated by pelican hook **28** arm **24** will rotate in a clockwise direction thereby disengaging shoulder **24B** thereof and slot **28A.** Once disengaged pelican hook **28** will rotate in a counter clockwise direction until chain link **46** falls out of hook portion **28B,** thereby releasing the anchor or other load attached thereto.

Referring to FIGS. **6** to **9** there is illustrated a second embodiment of an acoustic release mechanism of the present invention. The release mechanism of FIGS. **6** to **9** is similar in some respects to the release mechanism of FIGS. **2** to **5.** For example, similar side plates **34** are provided for pivotally supporting a pelican hook **28,** which releasably supports a chain link **46** attached to the load to be released. There is also provided a similar firing mechanism (not shown) in end **10B** of housing **10** which includes cylinder **12,** squibs **14,** and piston **16,** as shown in FIG. **3.**

The side support plates 34 of the release mechanism of FIGS. 6 to 9 are also attached to receiver housing 10 by suitable clamp means. As shown in FIG. 8 clamp means 70 includes top blocks 72 having holes bored therein for receiving tension bolts 80. Blocks 72 are welded to steel straps 74, which extend around the circumference of tubular housing 10, and are welded at the bottom thereof to blocks 76. Blocks 76 have a channel therein for receiving side plates 34 and a spacer means 88. Blocks 76 are bored transversely to said channel to receive a tension bolt 82. A dowel means 86 is also provided between blocks 76 and housing 10 to assure the proper positioning of housing 10 with respect to side support plates 34. An insulator 78, which may be neoprene, is provided between strap 74 and housing 10 to prevent galvanic corrosion between the dissimilar metals. An additional spacer 88 is bolted between the bottom of plates 34 by bolts 84.

As shown in FIGS. 6 and 7 a different type of shackle 68 is provided which may be suitably attached to a buoy such as 13. Of course any type of shackle may be used without departing from the spirit and scope of this invention.

The release mechanism of FIGS. 6 to 9 is designed for supporting and releasing loads of up to 40,000 pounds, as compared to the 100,000 pound capability of the release mechanism of FIGS. 2 to 5. This reduced capacity is due in part to the elimination of one stage of the release linkage. As shown in FIG. 7 only one release arm 62 is provided in this embodiment. Since the release arms function in much the same way as a gear train, the elimination of one of the arms or links reduces the mechanical advantage of the release linkage.

Referring to the release linkage of FIG. 7 release arm 62 is pivotally mounted between plates 34 on a shaft 64. A shear pin 60 is provided to prohibit the rotation of arm 62 under a no load condition. Under a load condition the linkage is substantially self locking, since the pivot point of pelican hook 28 is again offset, as shown at 32, from the center of hook portion 28B. Arm 62 has an end 62B which is held in locking engagement with end 28A of pelican hook 28 until detonation occurs. A safety bolt 63 is provided in plates 34 to prevent hook 28 from pivoting clockwise in the event of an accidental detonation. Bolt 63 can be removed after the load is suspended over the water. Hook 28 is pivotally mounted in plates 34 on a shaft 30. Due to the decreased load requirements a cotter pin 66 is sufficient to hold shaft 30 in place.

In operation upon detonation of squibs 14 piston rod 18 is forced outwardly against end 62A of release arm 62. Arm 62 will pivot in a clockwise direction shearing pin 60 and disengaging end 62B thereof with end 28A of pelican hook 28. Pelican hook 28 will then pivot clockwise under the force created by the load on chain link 46 and offset 32 thus releasing line 46 and the anchor or load attached thereto.

The mechanism and system of the present invention may be modified as would occur to one of ordinary skill in the art without departing from the spirit and scope of this invention.

What is claimed is:

1. An underwater release mechanism for releasing a load in response to an acoustic command signal comprising:

a. an elongated housing containing an acoustic receiver for detecting said command signal;

b. a pair of evenly spaced support plates disposed longitudinally of said housing and at least coextensive therewith, said support plates being removably coupled to the side walls of said housing by clamp means and having a portion extending beyond one end of said housing for releasably supporting the load to be released;

c. a release linkage pivotally mounted between said side plates in said portion extending beyond said one end of said housing, said release linkage including a pelican hook pivotally mounted about an axis passing through said support plates and having a hook portion for releasably supporting said load, said hook portion being offset from the axis of said pelican hook, and release arm means pivotally mounted between said plates between said pelican hook and said one end of said housing for preventing said pelican hook from rotating; and

d. actuating means disposed in said one end of said housing for rotating said release arm means to thereby permit said pelican hook to rotate in response to the detection of a command signal by said acoustic receiver.

2. The release mechanism of claim 1 wherein said clamp means includes means for indexing said clamp means at a predetermined reference point on said housing.

3. The release mechanism of claim 1 wherein said clamp means includes a stem portion which fits between said plates for evenly spacing the same.

4. The release mechanism of claim 1 wherein said actuating means comprises a squib means for constraining a piston means against said release arm means to thereby rotate said release arm means in response to the detonation of said squib means.

5. The release mechanism of claim 4 wherein said release arm means comprises: a first release arm pivotally mounted between said portion of said plates and having a first end in engagement with said piston means, and having a shoulder thereon; and a second release arm pivotally mounted between said plates and having an end for releasably engaging said shoulder of said first release arm, said second release arm further including a hook portion for releasably engaging one end of said pelican hook.

6. The release mechanism of claim 5 including shear pin means for preventing rotation of said first release arm until said squib means is detonated.

7. The release mechanism of claim 4 wherein said release arm means comprises a single release arm pivotally mounted between said plates and having one end in engagement with said piston means and one end releasably engaged with said pelican hook.

8. The release mechanism of claim 7 including shear pin means for preventing rotation of said release arm until said squib means is detonated.

9. The release mechanism of claim 7 including a removable safety bolt means for preventing accidental rotation of said pelican hook.

* * * * *