This invention relates to a demolition firing device and more particularly to a demolition firing device particularly adapted for multiple use in the simultaneous detonation of a plurality of underwater charges.

In many cases, such as in amphibious warfare, it is necessary to remove underwater hazards so as to permit landing parties to go safely ashore. The obvious way of removing such obstacles is by blowing them up. In placing demolition charges around obstacles under water, the most dangerous and consuming task is the connecting together of the detonating means for such charges to secure the simultaneous detonation thereof. This is particularly the case when the placing of such charges and the connecting together of same must be carried out under enemy fire.

In the co-pending application of Frank C. Clay Jr., Serial No. 395,720, now U. S. Patent No. 2,779,276, filed March 13, 1946, for Demolition Firing Device, there is described and illustrated a device for firing underwater demolition charges. This device has been found to be quite effective in operation but it is subject to the drawbacks that it may be self-detonated, after the expiration of the arming period, if planted in water of from twelve (12) to twenty-five (25) feet in depth, and also that it may be rendered a "dud" by pressure waves resulting from countermining prior to the expiration of the arming period.

It is an object of the present invention to provide a device for detonating a demolition charge which will fire the charge in response to a pressure impulse through the water originating from any near-by explosion.

It is another object of the present invention to provide a demolition firing device which is of mechanical nature and is simple in construction.

It is another object of the present invention to provide a demolition firing device which may be used in multiple relationship on a plurality of demolition charges to fire all of the charges simultaneously in response to the same pressure wave in the absence of mechanical or electrical interconnections.

It is further an object of the present invention to provide a demolition firing device which will not be self-detonated due to hydrostatic pressure up to a predetermined depth such, for example, as a depth of twenty-five (25) feet.

It is moreover an object of the present invention to provide a demolition firing device having depth compensating means and time device, when planted at depths up to twenty-five (25) feet, will not be detonated by the hydrostatic pressure.

It is an additional object of the present invention to provide a demolition firing device which will be unaffected by shock waves resulting from countermining until the expiration of the arming period.

Other objects, advantages, and improvements will be apparent from the following description, taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view of the pressure responsive demolition firing device attached to a demolition charge; Fig. 2 is an elevational view of the pressure responsive firing device; Fig. 3 is a view of the device taken at a right angle to Fig. 2 with the cover removed; Fig. 4 is an enlarged longitudinal sectional view on the line 4-4 of Fig. 3; Fig. 5 is a sectional view taken substantially on the line 5-5 of Fig. 4; Fig. 6 is a sectional view similar to Fig. 4 and showing the device in an armed condition; Fig. 7 is a sectional view taken on the line 7-7 of Fig. 5; Fig. 8 is a sectional view taken on the line 8-8 of Fig. 2; Fig. 9 is a view taken substantially on the line 9-9 of Fig. 5; Fig. 10 is a sectional view taken on the line 10-10 of Fig. 5; Figs. 11, 12 and 13 are detail views of the arming disk, Fig. 12 being a view taken along the line 12-12 of Fig. 11; and Fig. 14 is a detail view of the retainer plate.

Referring now to the drawings and to Fig. 1 in particular, this figure shows the pressure responsive demolition firing device having a body 12 which is secured by a wire 11, or other suitable member, to a demolition charge 10. Projecting from the top of the body 12 there is the arming cell 100 and from the bottom there is the booster casing 85. The casing 12 is provided with lower and upper integral bosses 13 and 14 in which the arming cell 100 and an adapter 75 mounting the booster casing 85 are respectively mounted. The casing 12 is provided with axial bores 23 and 24, Figs. 5, 7 and 8, extending from the opposite faces, the bore 23 forming the chamber for a plate type firing piston 38 and the bore 24 forming a depth compensating chamber. The bore 23 is formed with a counterbore 27, which is internally threaded at 29, the juncture of the bore 23 and the counterbore 27 forming a shoulder 25. Similarly, the bore 24 is formed with a counterbore 28, which is threaded at 50, the juncture of the bore 24 and the counterbore 28 forming a shoulder 26. The axial bores 23 and 24 are separated by a web or partition 31, which is integral with the body 12, this web being provided with a central hole 32.

The firing piston 38 comprises a thick plate arranged within the axial bore 23 with close clearance and is adapted for limited reciprocation therein. The firing piston 38 has a firing pin 37 which is adapted to project through the central hole 32 formed in the web 31. Over the outer face of the firing piston 38 there is positioned a diaphragm 40 of rubber, or other suitable material, this diaphragm being secured on its periphery against the shoulder 25 by a retainer ring 39. The diaphragm 40 forms an air tight seal for the piston chamber 23 and protects the firing piston 38 from corrosion incident to the action of the sea water. A grill 42, formed as a reticulated plate, is screw threaded on its periphery and is fitted into the threaded counterbore 27 to complete the assembly. The plate 42 is preferably provided adjacent its periphery with diametrically spaced holes 41-41, extending partially through same, for the reception of a suitable wrench to facilitate insertion and removal of the plate.

The web 31 is provided with a first pair of diametrically spaced holes 43-43 in which are positioned compression springs 44-44. At one end the compression springs 44-44 are each provided with end caps 45-45, which abut the firing piston 38, and at the other ends these springs abut a retainer plate 46. The retainer plate 46 is secured on the opposite face of the web 31 by
screws 52—53 which extend into a second pair of chordally spaced holes 50—59 in the web. Aligned with the spring holes 43—43 through the web 31, there is formed a pair of holes 47—47 which are of lesser diameter than the holes 43—43 through the web, whereby the peripheries of the holes 47—47 form abutments for the compression springs 44—44 but the holes aid in permitting air passage between the piston chamber 23 on one side of the central web 31 and the depth compensation chamber 24 on the opposite side of the web, and also obviate any dash pot action due to air becoming entrained in the holes 43—45 through the spring caps 45—45. The reciprocating passage of air between the piston chamber 23 and the depth compensation chamber 24 is further facilitated by a third pair of chordally spaced holes 51—51 through the web 31, positioned below the spring holes 43—43, and a fourth pair of chordally spaced holes 53—53, through the web 31, positioned above the spring holes 43—43, these pairs of holes continuing through registering holes of the same diameter in the retainer plate 46. Because of space limitation the upper pair of air passage holes 53—53 is necessarily of lesser diameter than the lower pair of air passage holes 51—51.

A compensating diaphragm 55 of rubber, or other suitable material, is trapezoidal in cross-section and has its flange positioned against the shoulder 26 with the crown normally positioned outwardly. A retainer plate 54 encircles the crown of the diaphragm 55 and is secured in place by a cup shaped cover 56 which is externally screw threaded on the periphery of its skirt for engagement in the threaded counterbore 28. The cover 56 has one or more (two being shown) small diameter holes 57—57 therethrough, these providing for slow leakage of the sea water through the cover and against the diaphragm 55. Two (2) diametrically spaced holes 58—58 are also provided, adjacent the periphery of the cover and extending partially therethrough, for the reception of a suitable wrench to facilitate insertion and removal of the cover.

The diaphragms 40 and 55 cooperate to seal the interior of the body 12, comprising the bore 23 forming the chamber for the firing piston 38 and the bore 24 forming the depth compensation chamber, against water leakage and, as will be later pointed out in greater detail, to maintain the internal air pressure equal to that of the sea water.

Formed in the web 31 and on the opposite face thereof with respect to the piston chamber 23 and eccentrically positioned on the bottom of the bore 24, is a disc chamber 33 in which the central hole 32 through the web 31 extends. The body 12 is provided with a radial bore 16 extending through the upper boss 14 from the disc chamber 33, this bore being enlarged by a counterbore 20, the juncture of the bore 16 and the counterbore 20 forming a shoulder 18, and the counterbore 20 being internally threaded at 22. The disc chamber 33 has a centrally positioned pivot pin 34 and a stop pin 36 secured to the web 31, the stop pin being positioned on the periphery of the chamber. A hole 35 is provided in the bottom of the disc chamber 33 for the reception of one end of a torsion spring 61, as will be later described in greater detail.

Rotatably mounted in the disc chamber 33 there is a disc 60 which is of the same thickness as the depth of the disc chamber, this disc having a central hole 59, which freely encompasses the pivot pin 34, and the periphery of the disc fitting with close clearance in the disc chamber 33. In the periphery of the arming disc 60 there is formed an axially extending arcurate groove 62 which provides a seat for a locking ball 65 which is positioned in the radial bore 16 through the body 12. Also on the periphery of the inner face of the rotary disc 60 there is formed a cut-away sector 63 of ninety (90) degrees arcuate length and of width equal to approxi-
mately half of the thickness of the disc. The ends of the cut-away sector 63 are adapted to abut the stop pin 35 to limit movement of the disc 60 about the pivot pin 34 to ninety (90) degrees. The coiled torsion spring 61 is fitted in the central hole 59 through the arming bore 60 and surrounds the pivot pin 34. This spring is fastened to the outer disc 60 and its inner end bent normal to its axis and embedded in a radial slot 64 in the outer face of the rotary disc 60 and its inner end bent parallel to its axis and projecting into the hole 35 formed in the bottom of the disc chamber 33.

On the same diameter with the groove 62, but on the opposite side of the pivot pin 34 there is formed, through the disc 60, a hole 66 which is enlarged by a counterbore 67 extending from the inner face of the disc. Spaced ninety (90) degrees from the hole 66 and the counterbore 67, and on an equal radius therewith, there is a bore 68 extending from the inner face of the rotary disc 69 and partially through the same.

A radial bore 69 extends from the periphery of the disc 60 and intersects the bore 68. The eccentricity of the disc chamber 33 and the radius of the hole 68 and the bore 69 are so chosen that either the hole 66 or the bore 69 may be in registry with the central hole 32 through the web 31 and the firing pin 37, which is adapted to reciprocate in the central hole 32, may therefore enter either the hole 66 or the bore 69. As previously described, the rotary disc 60 is of the same thickness as the depth of the disc chamber 33 and hence the outer face of this disc is flush with the bottom of the bore 20, which forms the depth compensation chamber, and the retainer plate 46 is secured by the screws 52—52 against the web 31 in abutting relationship with the rotary disc 69. A hole 48 is formed in the retainer plate 46 for reception of the pivot pin 34.

Also formed in the retainer plate 46 is an arcuate slot 49, Figs. 10 and 14, having its center coincident with the pivot pin 34 and this slot being of a radius equal to the radius of the hole 66 and the bore 68 in the rotary disc 60. Thus, if the cover 56 and the depth compensating diaphragm 55 are removed, it may be ascertained by inspection whether the demolition firing device is in the “Safe” or the “Armed” condition. Preferably the legend “A” is stamped in the retainer plate 46 adjacent the upper end of the arcuate slot 49 and the legend “S” adjacent the lower end of this slot.

The bore 69 in the rotary disc 69 is adapted for the reception of a priming cap 70. The priming cap 70 may contain any suitable explosive substance adapted to detonate under a sharp blow. An initiating charge of fulminate of mercury and a main charge of the explosive mixture known in the art of pyrotechnics as “Pom Pom Mixture” has been found satisfactory for this purpose.

The casing 12 is also provided with a second radial bore 15 extending through the lower boss 13 from the disc chamber 33, this bore being enlarged by a counterbore 19, the juncture of the bore 15 and the counterbore 19 forming a shoulder 17, and the counterbore 19 being internally threaded at 21. When the demolition firing device is not in use, the bore 15 and the counterbore 19 are preferably closed by a shipping plug (not shown). Upon planting the demolition firing device in the water, the shipping plug is removed and replaced by an adapter. The adapter comprises an arcurate extension 76 of reduced diameter extending from the outer threaded hub 71, and an integral extended extension 76 of reduced diameter, the latter terminating in a shoulder 79. An axial bore 72 is provided through the inner threaded hub 71, the integral central disc hub 75, and partially through the outer threaded hub 76; a continuation bore 78 of reduced diameter extends from the outer threaded hub 76 to the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end threaded hub 76, the elongated extension 77, and the end
shoulder 79. A gasket 73 is positioned around the inner threaded hub 71 and intermediate the central disc hub 75 and the face of the boss 13; similarly, an identical gasket 74, except for larger internal diameter, is positioned around the outer threaded hub 76 and also abuts the central disc hub 75 of the adapter. Mounted on the elongated extension 77 of the adapter is a flame ignited blasting cap 80, this cap having its exposed end crimped over the shoulder 79 on the inner end of the adapter. Around the blasting cap 80 there is positioned a cylindrical booster casing 85. Within the casing 85 is mounted a hollow cylindrical spacer 81 in the bore of which the blasting cap 80 is received. Intermediate the spacer 81 and the outer end of the cylindrical casing 85 there is secured a metal insert 82. The metal insert 82 is held in the cylindrical casing 85 by a rolled-in groove 83 formed in the latter and this insert is provided with internal threads for engagement with the threads on the outer threaded hub 76 of the adapter. The blasting cap 80 and the cylindrical spacer 81 are substantially coextensive in length and at their outer terminus there is provided a shock absorber 84 in the form of a cylindrical pad, preferably of ceramic felt, of the proper diameter to have a snug fit within the cylindrical casing 85. An end cap 86 is secured over the outer end of the cylindrical casing 85, as by a soldered joint. In the space within the cylindrical casing 85 intermediate the end cap 86 and the booster casing 85 and the end cap 86 is arranged the booster charge 87, this charge comprising a suitable quantity of tetryl, or some similar high explosive.

The arming cell 100 is mounted in the upper boss 14 on the major body 12 by an open ended barrel 95, this barrel having external threads 94 at its bottom, for engagement with the threads 22 in the counterbore 20, and internal threads 96 at its top for reception of the arming cell. A diaphragm 88 of rubber, or other suitable material, is positioned on the shoulder 18, intermediate the bore 16 and the counterbore 20, this diaphragm overlying the locking ball 65, and a retaining ring 89 is interposed between the lower end of the barrel 95 and the diaphragm. Within the barrel 95 there is mounted a cylindrical safety block 90 which rests on the diaphragm 88. The safety block 90 is provided with a diametral slot 91 in its top and a twenty pin 92 projects through one pair (two pair being shown) of diametrically aligned holes 97—97 in the barrel and along the diametral slot in the safety block. The safety pin 92 is preferably an ordinary cotter pin with a pull ring 93 in its outer end.

An arming cell suitable for the purpose is shown and described in the foregoing co-pending application of Frank A. Clary, Jr., now U. S. Patent No. 2,779,276. The modification of this arming cell herein described and illustrated differs from the previous arming cell only in regard to minor details.

The arming cell is comprised principally by a base 100 and a can shaped cover 98. The cover has in its top a suitable hygroscopic agent (not shown), this being held in place by a suitable screen member (also not shown).

Silica gel has been found to be a satisfactory hygroscopic agent. The base is comprised by a bottom disc 100 and an integral upwardly extending hollow cylinder 102. Circumferentially spaced holes 103 are provided in the cylinder 102 for the admission of sea water to the underside of the electrolytic elements, as will be later described. The bottom disc 100 has circumferentially spaced recesses 101 formed therein for the reception of corresponding circumferentially spaced tabs 99 on the skirt of the cover 98. A centrally positioned boss 106 is integrally formed for under-face of the bottom disc 100 and is externally threaded for cooperation with the internal threads 96 in the top of the barrel 95. The boss 106 has an inverted frusto-conical axial bore 107 therethrough, this bore being surrounded by a groove 75 formed as a segment of a toroid. An inverted frusto-conical plunger 109 is fitted in close engagement in the axial bore 107 and extends downwardly in close proximity to the safety block 90 within the barrel 95. The plunger 109 has an axial bore 110 extending partially through same from the upper or larger base and this bore is intersected by a transverse bore 111. Two (2) locking balls 112—113 are positioned respectively in the ends of the transverse bore 111 through the plunger 109 and partially in the toroidal groove 108 around the axial bore 107 through the central boss 106. A locking rod 113 has a head 114 which normally rests on the upper base of the plunger 109 with the stem positioned in the axial bore 110 through the plunger and intermediate the locking balls 112—113.

The electrode elements of the electrolytic arming cell comprises two (2) cathode washers 116—117 of silver chloride and an anode disc 120 of magnesium, the two cathode washers being positioned on either side of the anode disc 120. The two cathode washers 116—117 have central apertures in which are positioned bushings 119 of a phenolic condensation product, such as "Bakelite," similarly, the anode disc 120 has a central aperture in which there is secured a grommet 122, preferably of brass and tin plated, this grommet being beaded over at its ends on the faces of the disc. Intermediate the ends of the grommet 122 and the corresponding cathode washer 116 there is positioned an insulating washer 123, the latter preferably being made of "nylon" parachute cloth impregnated with a phenolic resin compound. Dished spring washers 118—119 are positioned on the exposed faces of the cathode washers 116—117. The cathode washers 116—117 and the anode disc 120 are held in assembled relationship by a central tube 117, also preferably of silver, which passes through the dished spring washers 118—119, bushings 119—119, insulating washers 123—123, and the grommet 122, the tube being soldered to the grommet at its midportion and the respective ends of the tube being beaded over against the dished spring washers 118—118.

After the anode disc 120 has been soldered to the central tube 117, the disc is heavily coated. The preferred form of coating is one application of zinc cuprite, a second application of grey enamel, and a third application of white enamel. Around the peripheries of the cathode washers 116—116 the anode disc 120 is provided with a row of accurately spaced holes 121. The area of the disc between the holes 121 in scraped bare of the coating to provide an indication as to whether or not the device has become inadvertently armed, for instance through damage to the
arming cell 100. If such a condition should exist, the arming cell 100 may be replaced with a fresh one, and the rotary arming disc 60 reset.

Let it be assumed for the purpose of description that the arming cell 100 is in proper condition and the device is unarmed, the safety pin 92 has been removed and the demolition charge 10 with the attached demolition firing device are planted in the sea water against whatever obstacle is to be removed. The device is in a safe condition to begin the operation of the arming cell 100.

In this condition the locking ball 65 rests partially in the bore 16 through the upper boss 14 and partially in the arcurate groove in the arming disc 60, thereby locking this disc against rotation. Also, the plunger 109 of the arming cell is locked to the boss 106 by the locking balls 112—112 which are each positioned partially in the transverse bore 111 in the plunger and in the toroidal groove 108 around the boss 107 through the bore. The counterbore 67 and the concentric hole 66 in the rotary disc 60 are in registry with the central hole 32 through the web 31. Should a shock wave now impinge upon the diaphragm 40 and the firing piston 38, the latter would be driven inwardly against the force of the compression springs 44—44 and the firing pin 37 passing harmlessly through the counterbore 67 and into the hole 66 in the rotary disc.

When the demolition charge and the attached demolition firing device are planted in the water, electrolytic action begins in the arming cell 100, the sea water functioning as the electrolyte and the circuit being completed from the cathode washers 116—116 through the sea water, the anode disc 120, grommet 122, and the central tube 117. As the electrolytic action proceeds, the anode disc 120 is corroded away over the bare areas intermediate the arcurately spaced holes 121. When these areas are thus sufficiently weakened by electrolytic action, the anode disc 120 will be fractured and the spring 115 will drive the locking rod 113, the cathode washers 116—116, and the central portion of the anode disc 120 outwardly to the position shown on Fig. 6. The outward movement of the locking rod 113 releases the locking balls 112—112 which move inwardly within the transverse bore 111 in the plunger 109, thereby freeing the plunger, as well as the safety block 90 for upward movement. Delayed arming periods of nine (9) to ninety (90) minutes may be attained by using anode discs 120 of different thicknesses and/or different numbers and diameters of holes 121 therein and correspondingly varying widths of the portions of the disc between the holes.

Upon expiration of the arming period, the torsion spring 61 will rotate the rotary disc 60 through ninety (90) degrees, the camming action of the arcurate groove 62 in the periphery of the disc forcing the locking ball 65 and in turn the safety block 90 upwardly. The rotation of the rotary disc 60 is stopped after ninety (90) degrees by one end of the cut-away sector 63 in the inner face of the disc abutting the stop pin 36. In this position of the rotary disc 60, the bore 67 in the disc with the priming cap 70 therein is now in registry with the central hole 32 in the web 31. Should a shock wave now impinge upon the diaphragm 40 and the firing piston 38, the firing piston will again be driven inwardly against the force of the compression springs 44—44 and the firing pin 37 will strike the priming cap 70 thereby detonating same.

The burning gases from the priming cap 70 will be ejected through the radial bore 69 in the rotary disc 60, the registering boss 72 and 78 in the adapter, and into the open face of the flame ignitable blasting cap 80, thereby firing the latter. The blasting cap 80 acts as a detonator and in turn sets off the booster charge 87 in the cylindrical booster casing 85, and the explosion of the latter subsequently detonates the main demolition charge in the casing 10.

The apparatus and the structure thus far described will work satisfactorily in relatively shallow sea water up to a predetermined depth such, for example, as 12 feet. For greater depths, however, the hydrostatic pressure would alone drive the firing piston 38 inwardly against the force exerted by the compression springs 44—44 and the firing pin 37 would enter the counterbore 67 and the concentric hole 66 in the rotary disc 60. Since there would be no appreciable diminution in the hydrostatic pressure, unless the device be raised to a lesser depth, the firing pin 37 would hold the rotary disc 60 in locked position and the torsion spring 61 would be unable to rotate the latter after expiration of the arming period as determined by the electrolytic cell 100. To obviate this disadvantage the depth compensating diaphragm 55 is provided. When the demolition firing device is immersed in the sea water then water will leak through the two (2) small diameter holes 57—57 in the cup shaped cover 56. The diaphragm 55, being supported only on its periphery, is then driven inwardly thereby compressing the air within the depth compensation chamber 24 and, through the pairs of holes 51—51, and 53—53 in the web 31, also the air in the piston chamber 23, thereby maintaining the internal pressure equal to that of the sea water. There is therefore no tendency of the water pressure to move the firing piston 38 inwardly. A sudden shock wave, however, will be fully effective in driving the firing piston 38 inwardly as there is not sufficient time to force the sea water from the space behind the diaphragm 56 and through the small diameter holes 57—57 in the cover 56, that is, there is no loss motion during the inward travel of the firing piston 38 due to further compression of air in the piston chamber 23 and the depth compensation chamber 24. The depth compensation diaphragm 55 will not reach its full inward flexure until a predetermined depth such, for example, as twenty-five (25) feet has been attained. The depth compensation feature is therefore effective up to this limit.

While there is shown and described herein a certain preferred embodiment of the invention which gives satisfactory results, many other and varied forms and uses will present themselves to those versed in the art without departing from the spirit of the invention, and the invention, therefore, is not limited either in structure or in use except as indicated by the terms and scope of the appended claims.

The invention herein described and claimed 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.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A demolition firing device for underwater use, a body, a bore in said body, a firing piston reciprocably mounted in said bore, a firing pin carried by said piston, means carrying an explosive charge, means for locking said charge carrying means in one position, means in said charge carrying means for freely receiving the firing pin in said locked position, means biasing the charge carrying means against the action of said locking means and effective upon release of the locking means to move the charge carrying means into another position with the charge in the path of travel of the firing pin, a second bore in said body, means forming communication between said bores, a diaphragm secured across said second bore, and a cover secured over said diaphragm and exposed to the surrounding water, said cover having a small hole therein for providing a slow leak of said water against the diaphragm.

2. In a marine demolition firing device, a priming cap, reciprocable means responsive to shock impulses, firing means operated by said reciprocable means, a priming cap, moveable means carrying said cap, an electrolytically responsive cell including a pair of electrically
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interconnected exposed anode and cathode elements, said anode element being initially disposed in locking relation to said carrying means in an initial position with the cap out of the path of travel of the firing means, said electrolytically responsive cell being responsive to submersion in sea water for causing said anode element to corrode away a predetermined period of time after the cell is activated, and means for moving the cap carrying means into another position with the priming cap in the path of travel of the firing means when the anode element has corroded away.

3. In a marine demolition firing device, a priming cap, reciprocable means responsive to shock impulses within the surrounding water, firing means carried by said reciprocable means for firing said cap, movable means carrying the priming cap, means for releasably locking said cap carrying means in a locked position with the priming cap out of the path of travel of the firing means, said locking means comprising an electrolytically responsive anode element including a pair of electrically interconnected exposed anode and cathode elements, said anode element being releasably locking said cap carrying means and adapted to be corroded away by electrolytic action of said anode element in a predetermined period of time after sea water communicates with said anode element, means for admitting water within said anode element when the firing device is submerged therein, said sea water functioning as an electrolyte for enabling said anode element to function to electrolytically decompose said anode element, means in said cap carrying means for freely receiving the firing means in said locked position, means biasing the cap carrying means against said anode element and effective upon corrosion of said anode element to move the cap carrying means into another position with the cap in the path of travel of the firing means.

4. In a marine demolition firing device, an explosive charge, reciprocable means responsive to a pressure wave in the surrounding water, firing means operated by said reciprocable means for firing said charge, means carrying said explosive charge, an electrochemical responsive anode element including a pair of electrically interconnected exposed anode and cathode elements, means releasably locking said charge carrying means in an inoperable position with the explosive charge out of the path of travel of the firing means, means actuating the explosive charge means adapted to be activated for electrochemical action when submerged in sea water for causing the anode element to corrode away a predetermined period of time after the cell is submerged, and means biasing the charge carrying means against said anode element and effective upon corroding away of the anode element for moving the charge carrying means into an operative position with the explosive charge in the path of travel of the firing means.

5. In a demolition firing device, reciprocable means responsive to shock impulses, a firing pin carried by said reciprocable means and operated thereby, movable means carrying a priming cap, electrolytically responsive time delay means for releasably locking said charge carrying means in an initial unarmored position with the cap out of the path of travel of the firing pin, means biasing the cap carrying means against said locking means, said electrolytically responsive means being adapted to be activated when submerged in water and said anode element to be corroded away by electrochemical action a predetermined period of time after activation of said cell has been initiated, said locking means being released upon corroding away of said anode element whereby said biasing means is rendered effective to move the cap carrying means to an armed position with the cap in the path of travel of the firing means.

6. In a demolition firing device, reciprocable means responsive to shock impulses, firing means operated by said reciprocable means, means carrying an explosive charge, electrolytically actuated time delay means disposed to normally lock said carrying means in a position with the explosive charge out of the path of travel of the firing means, said delay means including a plurality of mutually electrochemically reactive elements comprising at least an anode and cathode which are interconnected to provide a short circuit therefore and disposed for exposure to sea water, thereby to be rendered electrolytically active for time delayed release of said explosive charge means after electrochemical erosion of said anode and means for biasing said charge carrying means against the locking action of said delay means and which is effective upon sufficient electrolytic deterioration of the delay means to move the charge carrying means into a position with the explosive charge in the path of travel of the firing means.

7. In a demolition firing device, reciprocable means responsive to shock impulses, firing means operated by said reciprocable means, a movable disc carrying an explosive charge, electrolytically actuated delay means for maintaining said disc normally locked in a position with the explosive charge out of the path of said firing means, said electrolytically actuated delay means including anode and cathode elements which are interconnected to provide a short circuit and disposed to be rendered electrolytically active by immersion thereof in sea water whereby an electrolyte therefore is provided, said disc having a hole for freely receiving the firing means in said locked position, and means for biasing the disc against the locking action of said delay means and effective upon electrolytic decomposition of said anode to effect release of said disc for movement to position the explosive charge in the path of travel of the firing means.

8. In a demolition firing device, reciprocable means responsive to shock impulses, firing means operated by said reciprocable means, a rotatable disc carrying an explosive charge, electrolytically responsive means including cathode elements and a decomposable anode means for releasably maintaining said rotatable disc in a normally locked position with the explosive charge out of the path of said firing means, said disc having a hole for freely receiving the firing means when in said locked position, spring means for biasing said disc against the action of said decomposable anode means and for partially rotating the disc when said last-named means is electrolytically released, and means for stopping said disc in another position with the explosive charge in the path of travel of the firing means.

9. In a demolition firing device, reciprocable means responsive to shock impulses, firing means operated by said reciprocable means, a rotatable disc carrying an explosive charge, electrolytically actuated time delay means for releasably locking said disc in a normally locked position with the explosive charge out of the path of said firing means, said delay means including initially inert electrolytically interconnected anode and cathode elements adapted to be exposed to and rendered active upon immersion in sea water, said disc having a hole for freely receiving the firing means when in said locked position, spring means for biasing said disc against the action of said anode element and for partially rotating the disc when released as the anode element is eroded away, and means for stopping motion of the disc in another position with the explosive charge in the path of travel of the firing means.

10. In a demolition firing device for use under water, a body, a bore in said body, a firing piston reciprocably mounted in said bore, a firing pin carried by said piston, means mounted intermediate said firing piston and a part of said body and responsive to pressure waves in the surrounding water for moving the piston into the firing position, means carrying an explosive charge, electrolytically responsive means including an erodable anode
element for releasably maintaining said charge carrying means in a locked position for a predetermined period of time after the device has been submerged in sea water, said electrolytically responsive means further including a pair of cathode elements disposed for contact with sea water when the device is immersed therein and normally electrically interconnected with said anode to provide a short circuit therefor, means in said charge carrying means for freely receiving the firing pin when in said locked position, and means for moving said charge carrying means to another position with the charge in the line of travel of the firing pin as the charge carrying means is unlocked at the completion of a period of time sufficient to erode away said anode element.

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