Sept. 20, 1960 J. M. WALKER 2,953,092

UNDERWATER EXPLOSIVE DEVICE

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FIG. 1

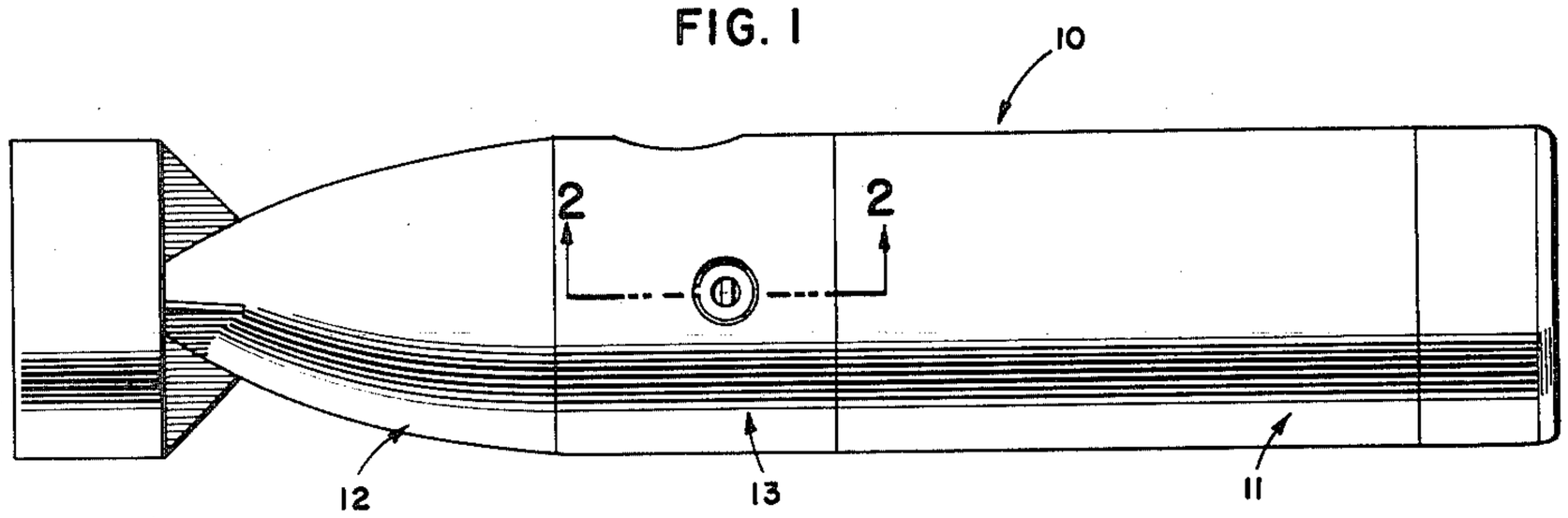

FIG. 2

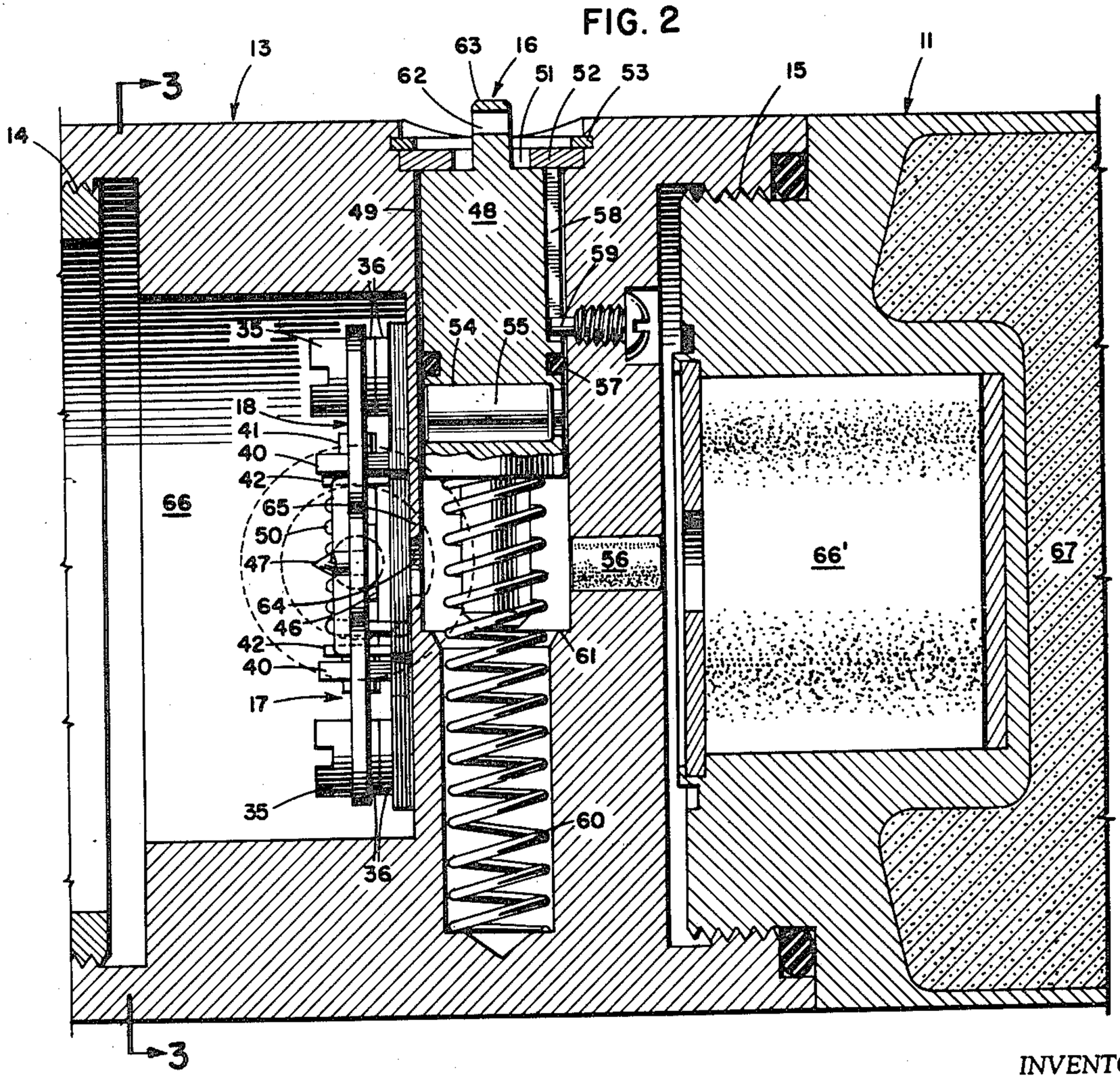

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FIG. 3

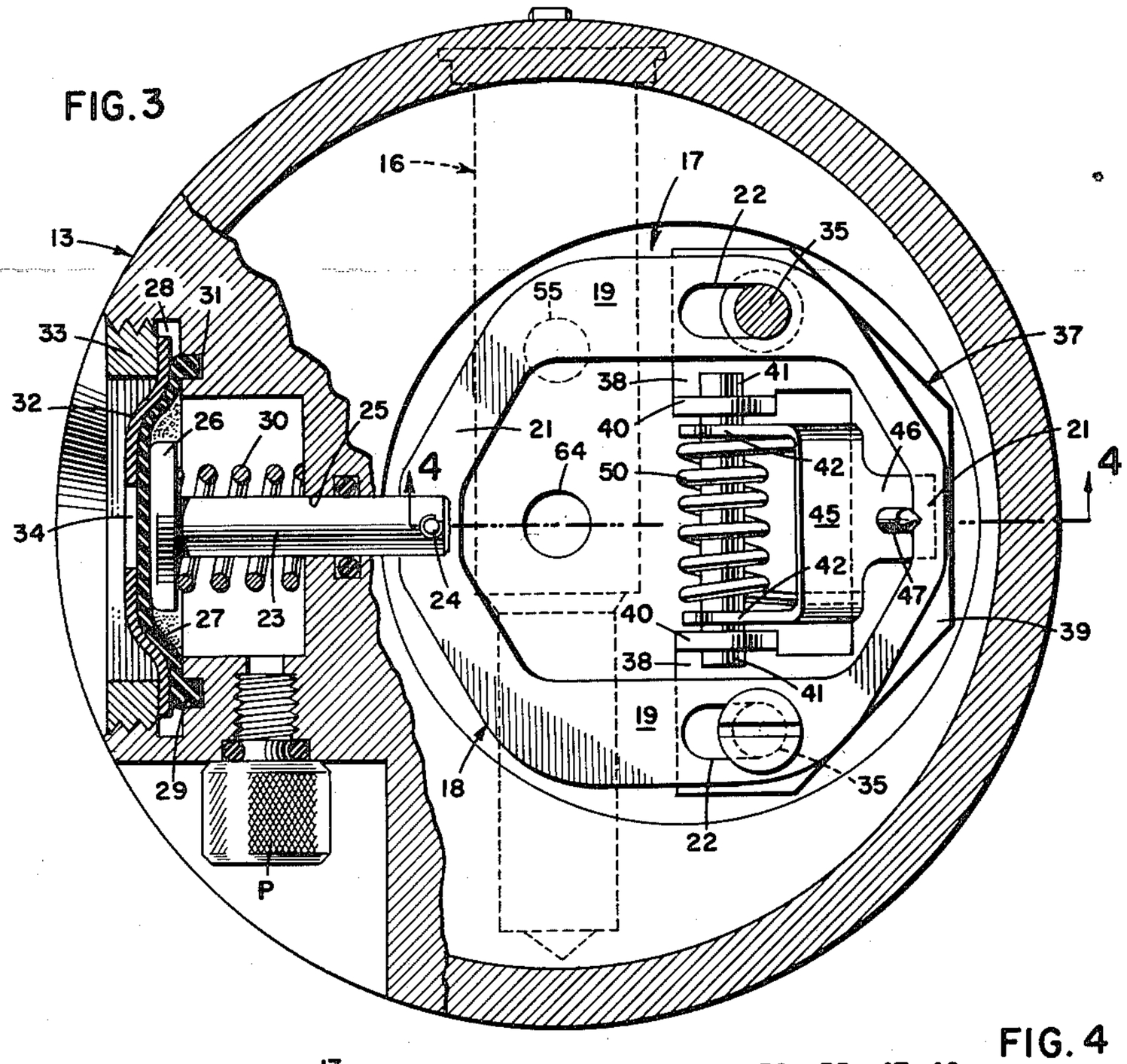


FIG. 4

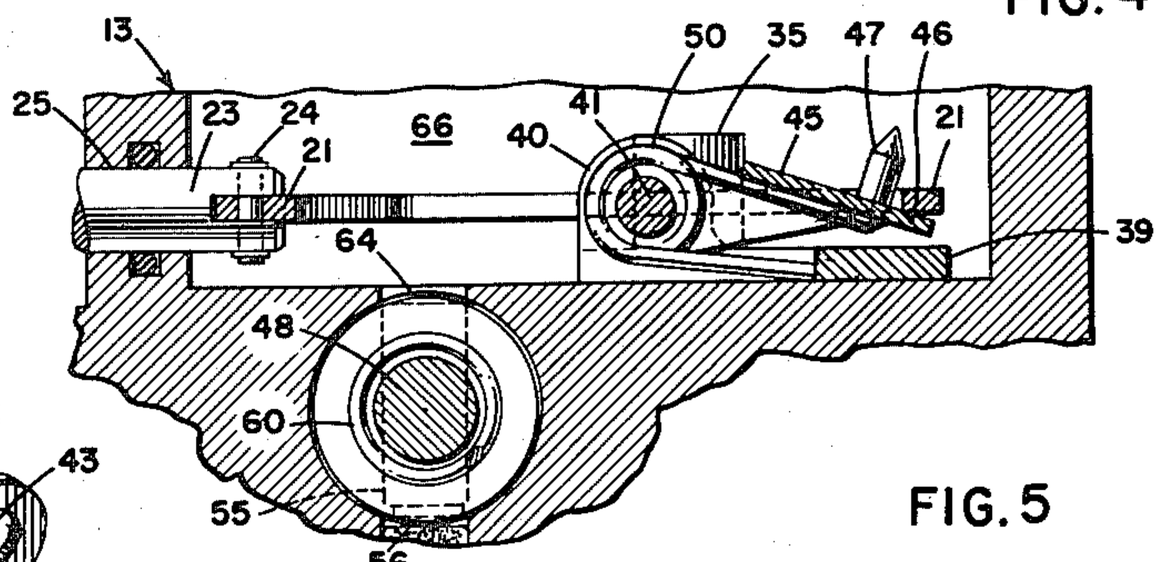


FIG. 6

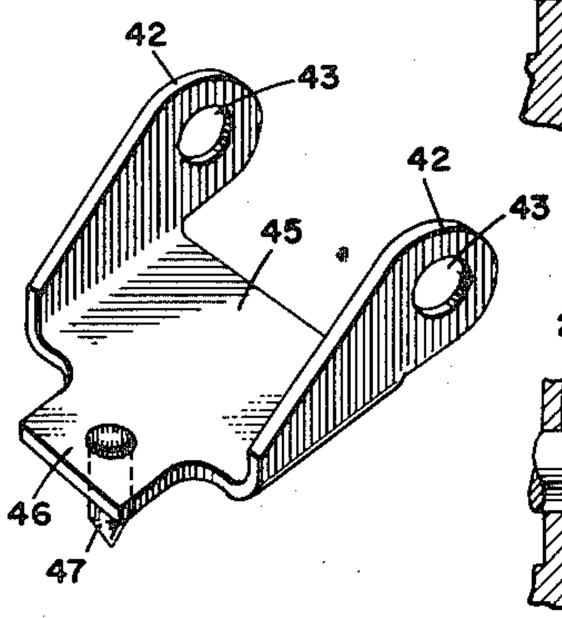
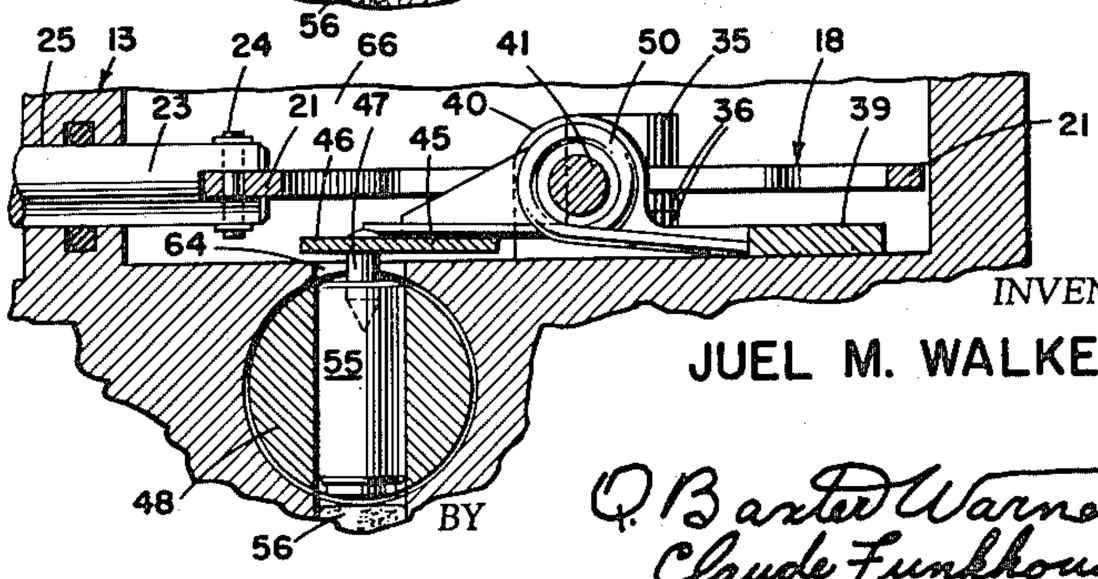


FIG. 5



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UNDERWATER EXPLOSIVE DEVICE

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2 Claims. (Cl. 102—7)

(Granted under Title 35, U.S. Code (1952), sec. 266)

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 invention relates to an explosive device, and more particularly to a new and improved underwater explosive device.

Briefly, the invention provides an underwater explosive signaling device having an arming member for arming the device in response to a predetermined hydrostatic pressure applied thereto and a spring actuated pivotally mounted firing pin, normally locked in an initial safe position and out of alignment with the arming member by a movable yoke actuated to release the firing pin for movement into firing engagement with a detonator carried by the arming member when the yoke is moved an amount sufficiently to release the firing means by a pressure responsive member actuated in response to hydrostatic pressure in excess of the predetermined hydrostatic pressure. Moreover, the invention is particularly suited for use in connection with shore installations, such for example, as signal detecting and receiving stations for detecting signals produced as the device is exploded at a predetermined depth within a body of water thereby to determine the exact point or area at which such an explosion occurred. Thus by this arrangement and in the event of an accident or when any other difficulties are encountered at sea, such for example, as shipwreck or force landing of a plane upon a body of water, the detecting stations may quickly locate the troubled area as the signals from the underwater explosions are received thereby, whereupon assistance and supplies may be dispatched to the trouble area immediately.

An object of the present invention is to provide a new and improved underwater signaling device.

Another object of the invention is to provide a novel underwater explosive device actuated from an initial safe position to a firing position when the device reaches a predetermined depth of submersion within a body of water.

Still another object of the invention is to provide an underwater explosive device in which the arming of the device occurs when the device reaches a predetermined depth of submersion and explosion of the device occurs when the device reaches a depth of submersion in excess of the predetermined depth.

A still further object of the invention is the provision of an underwater explosive device wherein the firing means is normally locked out of alignment with the arming means and maintained out of alignment therewith until the device reaches a predetermined depth of submersion within a body of water.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is an elevational view of an explosive signaling

device constructed in accordance with the present invention;

Fig. 2 is a sectional view taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken at a right angle with respect to Fig. 2 and substantially on line 3—3 thereof;

Fig. 4 is a sectional view taken substantially on line 4—4 of Fig. 3, with the firing mechanism in an initial safe position;

Fig. 5 is a view similar to Fig. 4, with the firing mechanism in a firing position; and

Fig. 6 is a view in perspective of the firing pin and supporting element therefor.

Referring to the drawings and more particularly to Fig. 1 thereof, the numeral 10 generally indicates an underwater explosive device having a nose portion 11, a tall portion 12 and an adapter 13 disposed between the nose and tail portions and secured thereto in any suitable manner, such for example, as by threaded engagement therewith, as at 14 and 15, Fig. 2.

As more clearly shown on Fig. 2 the adapter 13 is provided with a hydrostatically operated arming device or mechanism generally indicated by the reference character 16 and a hydrostatically operated firing device generally indicated by the reference character 17. The firing mechanism comprises a yoke 18, having a pair of mutually spaced side members 19 and a pair of mutually spaced end members 21, the side members 19, each being provided with an elongated slot 22 with a plunger 23 secured to one of the members 21, as at 24. The plunger 23 is slidably disposed within a bore 25 formed in the adapter 13, as best shown on Fig. 3 and provided with a head or flange 26, the purpose of which will be more clearly set forth as the description proceeds.

A flexible diaphragm 27 is disposed within a recess or well 28 formed in the adapter 13, Fig. 3, the diaphragm being provided with an annular sealing flange 29 disposed within an annular groove 31 and maintained in sealing engagement with the walls defining the groove 31 by a gasket 32 and annular nut or retaining element 33. The diaphragm is adapted to be in communication with the surrounding water by reason of recess 28 when the device is launched within a body of water. It will be noted in Fig. 3, that the aforesaid gasket is disposed within well 28 and provided with a centrally disposed opening 34 thereby to allow hydrostatic pressure to be applied to the diaphragm 27 by way of recess 28 and opening 34 when the device is launched within a body of water. The head 26 is maintained in engagement with the diaphragm 27 by a spring 30.

As more clearly shown on Fig. 3, a guide element 35 is arranged within each slot 22, the guide elements being in the form of screw carried by the adapter 13 in any suitable manner, such for example, as by threaded engagement therewith. Each of the guide members 35 carry a pair of spacers 36 disposed between the yoke and a bracket or support generally indicated by the reference character 37. The bracket 37 comprises a pair of mutually spaced legs 38 connected at one end thereof by an end portion 39 and each having a lug or ear 40 carried thereby for supporting a shaft 41, the bracket being maintained in position by the aforesaid guides and spacers. Furthermore, by the aforesaid slot, guide and spacer arrangement, the yoke 18 may be moved slidably in a true plane without any deviation therefrom when the plunger is actuated in response to hydrostatic pressure.

The firing device 17 is provided with a pair of mutually spaced ears 42, each ear having an opening 43 therein for receiving the shaft 41, the firing device being actuated to a firing position by a firing spring 50 disposed about the shaft 41 with one end in engagement with the firing device and the other end thereof in engagement with adapter.

Thus by this arrangement the firing device is rotatably supported on the shaft for movement from a cocked or locked position to a firing position when released. The ears 42 are connected by a bridge portion 45 having formed thereon a tongue or lug 46 extending outwardly therefrom and which carries a firing pin 47.

It will be noted, Fig. 3, that when the firing device 17 is in a cocked or locked position, tongue 46 thereon is disposed beneath the outermost end member 21 of the yoke 18, head 26 of plunger 23 is in engagement with diaphragm 27 and guide members 35 are disposed in the outermost end of slots 22, this position of the aforesaid components being maintained by spring 30 and thus the firing device is maintained in a cocked or locked position until a predetermined pressure is applied to the diaphragm 27.

As more clearly shown on Fig. 2, the arming device 16 comprises a hydrostatically actuated plunger 48 slidably disposed in a bore 49 formed in the adapter 13, the bore 49 being in communication with the surrounding water by way of an opening 51 formed in retaining disc 52 secured within the bore by a split ring or the like 53. The plunger 48 has formed therein a bore 54 in which is disposed a detonator 55, the detonator being adapted to align with a lead-in charge 56 when the plunger is actuated from an initial safe position to an armed position in response to a predetermined pressure applied thereto. The plunger 48 is further provided with a sealing element 57 and an elongated slot 58 cooperating with a pin 59 for preventing rotation of the plunger within the bore 49, the slot and pin arrangement together with a shoulder 61 formed on the adapter and within bore 49 assuring alignment of the detonator with the lead-in charge when the plunger is moved from an initial safe position to an armed position. A spring 60 is disposed within bore 49 having one end in engagement with the plunger and the other end thereof in engagement with the wall defining the bottom of the bore for maintaining the plunger in the initial safe position. It will be understood, however, that the plunger 48 is adapted to be locked in the initial safe position by the conventional safety pin (not shown) during transportation, the pin being adapted to cooperate with the opening 62 formed in a reduced lug 63 carried by the plunger.

As more clearly shown on Fig. 2 an opening 64 is formed in a wall 65 defining the bottom of a recess 66 in which the firing device is arranged, the opening 64 being in communication with bore 49 and aligned with the detonator 55 when the arming plunger is in an armed position and thus by this arrangement the firing pin 47 may be forcibly driven into firing engagement with the detonator when the firing device 17 is released and actuated to a firing position by firing spring.

The nose portion 11 of the missile is provided with a conventional booster charge 66′ and main charge 67, the booster being in communication with the lead-in charge 56. By this arrangement an explosive train is provided from the detonator 55 to the main charge 67 by way of lead-in charge 56 when the arming plunger has been moved to an armed position.

In the aforesaid arrangement the arming plunger 48 is moved to an armed position by hydrostatic pressure when the missile reaches a predetermined depth of submersion within a body of water, such for example, as 30 feet. The firing device, however, remains in a cocked or locked position and out of alignment with the arming mechanism until the missile or depth charge reaches a depth of submersion in excess of the predetermined depth, such for example, as 60 feet. It will be understood, however, that, if desired, the diaphragm 27 may be rendered effective to operate at a depth in excess of 60 feet by removing plug P to allow pressure to be applied to both surfaces of the diaphragm whereupon the diaphragm will not function until the pressure on the outer surface thereof is greater than the pressure on the inner surface thereof. When this occurs the diaphragm 27 is actuated by the pressure thereby moving the yoke an amount sufficiently to cause the aforesaid member 21 to release and move out of the path of travel of lug 46. As lug 46 is released the firing device is rotated about shaft 41 by firing spring 50, forcibly driving the firing pin 47 carried thereby into engagement with the detonator 55 with sufficient force to fire the detonator, the detonator firing the lead-in charge 56. When this occurs the booster charge 66′ is fired which in turn fires the main charge 67 and explodes the signaling device.

From the foregoing, it will be apparent that the present invention provides a new and improved explosive signaling device having a pressure responsive means for arming the device when the device reaches a predetermined depth of submersion within a body of water and in which pressure responsive firing means function to explode the device when the device has reached a depth of submersion in excess of the aforesaid predetermined depth.

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. An underwater explosive signaling device for launching in a body of water and comprising a casing, pressure operated arming means disposed within said casing and movable to an armed position in response to a predetermined hydrostatic pressure, a normally locked member having a body portion rotatably mounted on the casing at one side of the longitudinal axis of the arming means and movable through an arcuate path as the member is released, a locking tongue formed on the body portion and movable with said member, a firing pin carried by said tongue and movable with said member from an initial position to a firing position corresponding to a line along said longitudinal axis of said arming means during movement of the member through said arcuate path, a movable yoke mounted on the casing in locking engagement with said tongue for releasably locking the member to maintain the firing pin in said initial position, a movable plunger mounted on the casing and pivotally connected to said yoke for moving the yoke out of locking engagement with said tongue to release the member for movement through said arcuate path as the plunger is moved a predetermined amount, means in engagement with said member and the casing for quickly and forcibly moving the member through said arcuate path and the firing pin to said firing position as the member is released, pressure responsive means in engagement with said plunger for moving the plunger said predetermined amount when the hydrostatic pressure has reached a value in excess of said predetermined hydrostatic pressure, a spring in engagement with said plunger and the casing for maintaining the yoke in locking engagement with the tongue and the plunger in abutting engagement with the pressure responsive means until said hydrostatic pressure is in excess of said predetermined pressure, a pair of guide pins carried by the casing, a pair of slots in the yoke and cooperating with the guide pins for movably supporting and guiding the yoke during movement of the yoke to a tongue releasing position.

2. An underwater explosive signaling device for launching in a body of water and comprising a casing, pressure operated arming means for arming the device in response to a predetermined hydrostatic pressure, a normally locked member having a body portion rotatably mounted on said casing at one side of the longitudinal axis of the arming means, a pair of mutually spaced ears carried by said body portion and disposed at a right angle with respect thereto and each ear having an opening therein, a shaft carried by the casing and disposed within the opening in each ear for rotatably mounting said member on the casing for movement through an arcuate path, a tongue on said body portion in the same plane as the

body portion and extending outwardly therefrom and movable with said member, a firing pin carried by said tongue and movable therewith from an initial position to a firing position corresponding to a line along said longitudinal axis of the arming means during movement of the member through said arcuate path, a yoke slidably mounted on the casing, an end member carried by said yoke in locking engagement with said tongue for releasably maintaining the member in a locked condition and the firing pin in said initial position, a plunger slidably mounted in the casing and pivotally connected to an additional end member on the yoke for moving the yoke an amount to move said end member out of locking engagement with the tongue to release the member for movement through said arcuate path as the plunger is moved a predetermined amount, means disposed about said shaft in engagement with said member and casing for quickly and forcibly moving the member through said arcuate path and the firing pin to said firing position as

the member is released, pressure responsive means in engagement with the plunger for moving the plunger said predetermined amount when the hydrostatic pressure has reached a value in excess of said predetermined hydrostatic pressure, and a spring in engagement with the plunger and the casing for maintaining the end member on the yoke in engagement with the tongue and the plunger in abutting engagement with the pressure responsive means until said hydrostatic pressure is in excess of said predetermined hydrostatic pressure.

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