July 17, 1956 R. O. WYNN 2,754,760

COMBINATION FUZE FOR A BOMB

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FIG. 1.

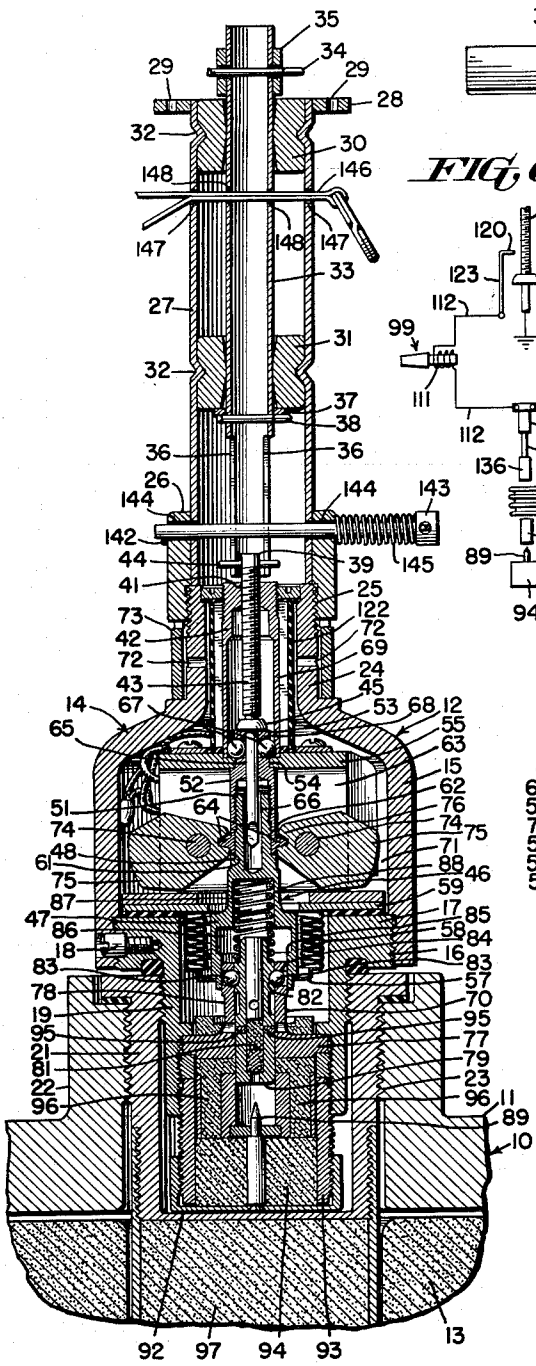


FIG. 6.

FIG. 2.

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FIG. 3.

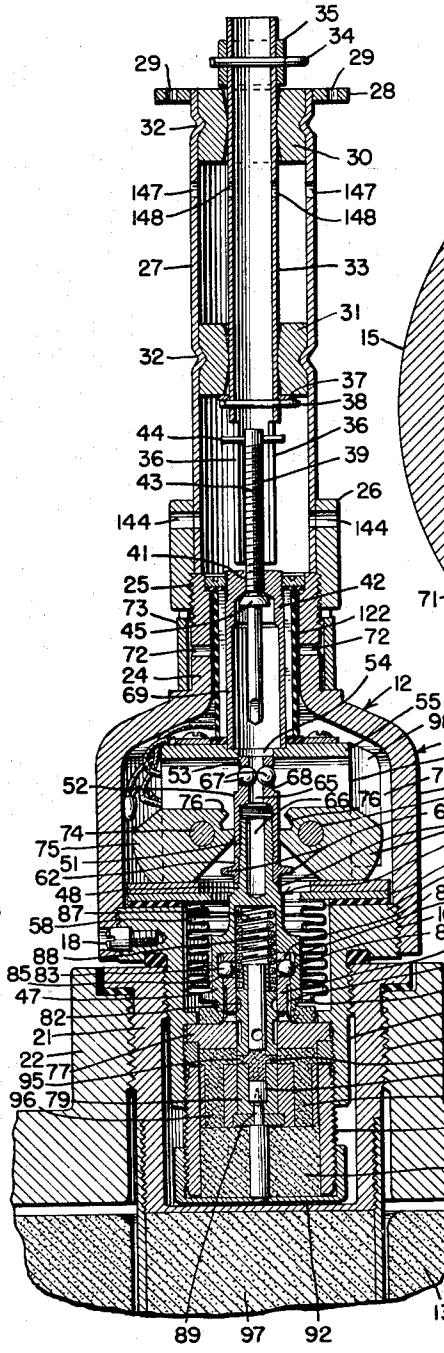


FIG. 4.

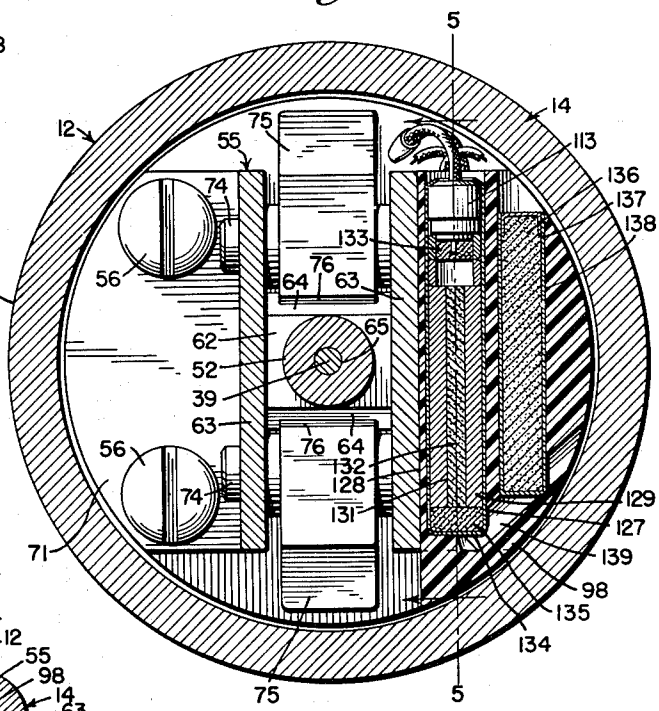
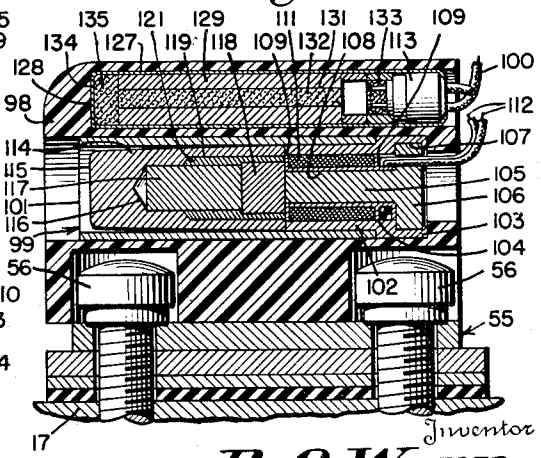


FIG. 5.



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COMBINATION FUZE FOR A BOMB

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Application May 15, 1947, Serial No. 748,328

4 Claims. (Cl. 102—71)

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

This invention relates to a fuze and more particularly to a combination hydrostatic tail fuze for a bomb adapted to be dropped from an aircraft in flight which will explode after striking a target or when the bomb has sunk to a predetermined depth within the water, in the event of a "near-miss."

In bombs of this type heretofore devised, it has been the usual practice to provide the bomb with a nose fuze adapted to fire the bomb in predetermined time relation with respect to the impact of the bomb with the target. Such devices, however, possess the disadvantage that the nose of the bomb is not sufficiently strong to pierce the deck of a modern large naval fighting vessel and, in many cases, it has been found that the bomb explodes on the surface of the deck or after a small degree of penetration of the deck with the result that the damage inflicted by the bomb is greatly lessened.

This difficulty is overcome in the device of the present invention by providing a fuze within the tail of the bomb in which the firing cycle of the bomb is initiated by the sudden displacement of a magnetic keeper from an electromagnetic generator sufficiently to generate a firing impulse and thereby set in operation a time delay mechanism whereby the bomb is not fired until sufficient time has elapsed for the bomb to penetrate the deck of the vessel and pass into the hull sufficiently to utilize to the best advantage, the full destructive force of the bomb. In the event of a near-miss, however, a hydrostatically responsive device within the fuze causes the bomb to be fired at a predetermined depth of submersion adjacent the hull of the vessel and during the time delay interval immediately following the displacement of the aforesaid keeper.

One of the objects of the present invention is to provide a combination tail fuze for a bomb having firing means arranged therein adapted to be controlled by a predetermined increase of either gas or water pressure applied thereto, as the case may be.

Another object is to provide a combination tail fuze for a bomb for igniting an electroresponsive detonator by low electrical energy generated within the fuze as the forward movement of the bomb is suddenly arrested as, for example, when the bomb strikes a target, and in which means adapted to be controlled by either gas or water pressure are employed for firing the main explosive charge arranged within the bomb when a predetermined period of time has elapsed after the impact.

Another object is to provide a combination tail fuze for a bomb having fluid pressure controlled firing means arranged therein for firing the main explosive charge disposed within the bomb in which new and improved means are employed for generating the pressure as the forward movement of the bomb is suddenly arrested.

Another object is to provide a combination hydrostatically and electrically controlled tail fuze for a bomb in which firing of the bomb is delayed until a predetermined period of time has elapsed after the bomb strikes a target, and in which firing thereof will occur in response to a predetermined amount of water pressure applied thereto in the event that the bomb has reached a predetermined depth within a body of water.

Still another object is to provide a combination fluid and electrically controlled tail fuze for a bomb having an electroresponsive detonator arranged therein adapted to be ignited by an inertia voltage generator as the rate of forward movement of the bomb is suddenly decreased, and in which time delay means are employed for firing the main charge arranged within the bomb when a predetermined period of time has elapsed after the detonator has been ignited.

A still further object of the invention is to provide a combination tail fuze for a bomb having pressure controlled firing means therefor in which means are employed for applying a predetermined pressure to the pressure firing means when the bomb has struck either a body of water or a target, as the case may be.

A still further object is to provide a combination fuze for an armor piercing bomb adapted to be dropped from an aircraft in flight upon a vessel target having means for exploding the bomb within the hull of the vessel in which new and improved means are employed for exploding the bomb within the water in the event of a "near-miss" sufficiently near the vessel to inflict severe damage thereto.

Still other objects, advantages and improvements will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

Fig. 1 is a central longitudinal sectional view of the combination tail fuze of the present invention in an unarmed condition showing the manner in which the fuze is secured to a bomb;

Fig. 2 is a view partly in elevation and partly in section of the fuze of the present invention;

Fig. 3 is a view similar to Fig. 1 but showing the fuze in a firing position;

Fig. 4 is a sectional view taken substantially on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken substantially on the line 5—5 of Fig. 4; and

Fig. 6 is a diagrammatic view of the firing mechanism and the pressure generating means, the time delay control means, and the firing circuit therefor.

Referring now to the drawings for a more complete understanding of the invention and more particularly to Fig. 1 thereof, there is shown thereon a fragmentary portion of a bomb indicated generally by the numeral **10** and comprising a casing **11** to which the combination tail fuze **12** of the present invention is secured, the casing having arranged therein the usual explosive charge **13**, as is well known to those skilled in the art to which the invention pertains.

The fuze **12** comprises a casing **14** having an enlarged body portion **15** internally threaded as at **16** and having threaded engagement with an annular disc **17** locked thereto by a set screw **18**. The annular disc having integrally formed thereon a tubular nipple **19** which has threaded engagement with an adapter **21**, the nipple extending a predetermined distance into the adapter, Figs. 1 and 3. The adapter is threaded into a boss **22** integrally formed on the bomb casing **11** as at **23** and thus the fuze is secured to and supported by the bomb in operative relation with respect thereto.

The casing **14** is provided with a reduced tubular portion **24** integrally formed therewith and extending outwardly therefrom, the portion **24** being threaded as at **25** for threaded engagement with a collar **26**. Secured within the collar **26** in any suitable manner is one end of an elongated tube **27**, a flange **28** being secured to the other end of the tube and having a plurality of openings **29**

extending therethrough, the purpose of which will be hereinafter more fully described.

A pair of bearings **30** and **31** are secured within the tube **27** in any suitable manner but preferably as indicated by the reference character **32**, Figs. 1 and 2. Rotatably supported within the bearings **30** and **31** is a vane or propeller shaft **33**, one end thereof extending a predetermined distance beyond the flange **28** and having secured thereto, as by a cotter pin **34** or the like, a vane or propeller **35**, the other end thereof extending into the tube **27** a predetermined distance and having a pair of diametrically disposed slots **36** arranged therein. Endwise movement of the propeller shaft **33** is prevented by a washer **37** having abutting engagement with one face of the bearing **30** and maintained in abutting engagement therewith by a cotter pin **38**.

An arming stem **39** is rotatably and slidably supported within a threaded axial bore **41** arranged in a tubular guide **42** and comprising a portion **43** having threaded engagement with the bore **41** such that during rotation of the arming stem, outward movement is also imparted thereto. Secured transversely to one end of the arming stem **39** in any suitable manner and extending into the slots **36** formed in the vane shaft **33** is a driving pin **44** thereby to provide a driving connection between the stem **39** and the vane shaft **33**. It will be understood, however, that rotative movement is imparted to the shaft **33** by the propeller in response to the pressure of air directed thereagainst during the free flight of the bomb toward the target. A flange or shoulder **45** is formed on the arming stem **39** intermediate the ends thereof, the flange being of greater diameter than the arming stem, the purpose of which will more clearly appear as the description proceeds.

A piston generally indicated by the numeral **46** is slidably arranged within the casing **14**, comprising a cup-shaped head **47** arranged within the nipple **19**, having formed thereon a stem **48** disposed within the enlarged portion **15** of the casing **14**. The stem is threaded as at **51** for threaded engagement with a stem nut **52**, the nut having a reduced extension **53** formed thereon adapted to have sliding movement within a centrally disposed opening **54** arranged in a U-shaped bracket **55** secured to the disc **17** by screws **56**, Figs. 2, 4 and 5. Secured to the head **47** of the piston in any suitable manner is a flange **57** to which one end of a bellows or diaphragm **58** is attached, the other end of the bellows being attached to an annular plate **59** as by solder or the like. The plate **59** is secured to the disc **17** by the aforesaid screws **56**.

Clamped between a shoulder **61** formed on the stem **48** and one end of the stem nut **52** is a rack member **62**, the rack member extending between and in abutting engagement with a pair of spaced legs **63** formed on the U-shaped bracket **55**, thus maintaining the rack member in fixed position on the stem **48** and also preventing rotative movement of the rack and piston but permitting sliding movement thereof. The rack member is provided with a pair of rack teeth **64** respectively arranged on opposite sides thereof, the purpose of which will be apparent as the description proceeds.

As shown on Fig. 1 the fuze is in an unarmed condition and arming thereof will not occur until the bomb has been released from an aircraft in flight and the propeller has made a predetermined number of revolutions during the free flight of the bomb toward the target. In the unarmed condition the arming stem **39** passes through a bore **65** arranged in the stem nut **52** and extends a predetermined distance into a complementary bore **66** disposed within the piston stem **48**. Sliding movement of the piston **46** including the stem nut **52** is prevented by a pair of locking balls **67** disposed with diametrically arranged apertures **68** formed in the extension **53** on the stem nut which is slidably arranged in the aforesaid aperture **54**, the balls being adapted to lock the stem nut, piston and component parts thereof from sliding movement until released. The balls **67** are maintained in locking engagement with the stem nut **52** by the arming stem **39** and a tubular sleeve **69** formed on the guide member **42**. It will be understood, however, that when the arming stem **39** has been rotated in the aforesaid manner a predetermined amount, the axial movement thereof will be sufficient to withdraw the arming stem from engagement with the locking balls **67** thus releasing the balls from locking engagement with the stem nut and permitting sliding movement thereof together with the piston **46** when a predetermined amount of gas or water pressure, as the case may be, has been applied to the disc **57** secured to the piston head and supporting the bellows **58**.

A chamber **71** is provided within the casing **14** and water is adapted to enter therein when the bomb enters a body of water and sinks therein, the water being adapted to enter the chamber **71** through a plurality of ports or vents **72** formed in the extension **24** of the casing **14**. A shield or baffle ring **73** encircles the extension **24** in such a manner as to prevent foreign matter from clogging or entering the ports **72** as the bomb sinks within a body of water thus assuring free flow of water therethrough and into the chamber **71** and also preventing foreign matter from entering the chamber **71**.

Pivoted between the legs **63** of the bracket **55** as by pins **74** are a pair of counterweights **75**, the weights being disposed on opposite sides of the piston stem **48**, each weight having arranged thereon a pair of teeth **76** which mesh with each of the teeth **64** respectively provided on each side of the rack **62**. The weights **75** are arranged on their pivot pins **74** in such a manner such that during the free flight of the bomb toward the target the center of gravity thereof is displaced about 45 degrees from the vertical on each side of the rack **62**. However, the weights are free for pivotal movement outwardly about the pins **74** in order to allow the rack **62**, piston **46** and component parts thereof to move inwardly therebetween as the bomb sinks within a body of water. It will be understood, however, that while the centers of gravity of the weights are free to move in a direction opposite to direction of movement of the rack **62** and the component parts thereof, the weights **75** are not free to move if the same force tending to move the rack **62**, piston **46** and component parts thereof in an inwardly direction also tends to move the counterweights **75** in the same direction. Thus when the bomb strikes the surface of water or target the sudden shock would tend to move the rack **62**, piston **46** and component parts thereof in an inwardly direction and simultaneously therewith it would tend to move the counterweights **75** in the same direction. The tendency of the counterweights **75** to move thus counterbalances the tendency of the rack **62**, piston **46** and component parts thereof to move, and therefore the rack **62**, piston **64** and aforesaid parts thereof do not move under the sudden shock of the bomb striking the surface of the body of water or target, as the case may be.

A plunger housing **70** is secured within the nipple **19** in any suitable manner but preferably as shown on Figs. 1 and 2, and comprising an annular plate **77** having formed thereon and extending therefrom a cylindrical sleeve **78** over which is slideably arranged the piston head **47**. Releasably locked to the sleeve **78** and slideable therein when released is a plunger **79** having a percussion cap **81** arranged therein. The locking means for the plunger includes a circumferential groove **82** formed therein having two locking balls **83** in engagement therewith, Fig. 1, the balls **83** being arranged in diametrically disposed apertures **84** formed in the sleeve **78** and maintained in locking engagement with the aforesaid groove by the piston head **47**. As the piston head moves inwardly by either water or gas pressure exerted on the disc **57**, a shoulder **85** on the piston head **47** passes beyond the locking balls **83**, thus bringing an enlarged chamber **86** formed in the piston

head in registration with the balls and thereby permitting the balls 83 to move outwardly within the respective apertures 84 in the sleeve 78 and releasing the balls from locking engagement with the plunger 79.

As the piston 46 moves inwardly by either hydrostatic or gas pressure, a firing spring 87 arranged in a well 88 formed in the piston 46 is compressed, the firing spring having one end thereof in engagement with the bottom wall of the well 88 and the other end in engagement with the plunger 79. When the piston 46 moves a predetermined amount the locking balls 83 release the plunger 79 for sliding movement, the plunger is driven inwardly by the now contracted firing spring 87 and the percussion cap 81 arranged therein strikes the firing pin 89 with sufficient force to initiate firing thereof. The firing pin 89 is secured to an end cap 92, threaded on one end of a container 93, the container having arranged therein the usual booster charge 94.

As shown on Fig. 3 the fuze is in a firing position, the cap 81 being in firing engagement with the firing pin 89, the lead-in charges 95—95 arranged in the plunger 79 align with the lead-in charges 96—96 disposed within the container 93 thereby to provide a continuous explosive train from the cap 81 to the booster charge 94. It will be understood, however, that the cap 81 is fired upon violent impact with the firing pin 89 thus initiating firing of each pair of lead-in charges 95 and 96, booster charge 94 which fractures the end cap 92 and explodes the auxiliary booster 97 thereby to explode the main charge 13 disposed within the bomb 10.

Arranged within the enlarged portion 15 of the casing 14 is a plastic block 98 having disposed therein a magnetic inertia voltage generator indicated by the reference character 99. The inertia generator may be of any type suitable for the purpose such, for example, as the generator disclosed and claimed in the copending application of H. J. Plumley for Improved Magnetic Inertia Controlled Fuze, Serial No. 718,098 filed December 23, 1946. Briefly stated, the inertia generator comprises a housing 101 composed of nonmagnetic material having arranged in one end thereof an adapter 102, the adapter being composed of magnetic material and having formed thereon an enlarged flange 103 adapted to seat against one end of the housing 101. The adapter has formed therein a centrally disposed bore 104 having arranged therein a core 105 of magnetic material. The core 105 is provided with an enlarged head 106 adapted to seat in a recess 107 formed in the adapter 102, the end of the core being in alignment with one end of the adapter, Fig. 5.

Disposed around the core 105 is a coil support or spool 108 having flanges 109 extending therefrom defining a coil compartment within which a coil 111 is arranged. A pair of lead wires 112 are connected to the coil 111 and adapted to complete a firing connection to an electroresponsive detonator 113 arranged in the plastic block 98 when the fuze is in an armed position. Arranged within the housing 101 and in abutting engagement with respect to one end of the adapter 102 is a tapered inertia sleeve 114 composed of magnetic material and having a closed end 115. A well 116 is formed in the sleeve 114 and disposed therein is a permanent magnet 117 which has abutting engagement with an element 118 of somewhat larger diameter than the magnet 117 and composed of magnetic material. The well 116 is enlarged as at 119 and disposed therein is a bushing 121 of nonmagnetic material suitable for purpose such, for example, as lead or the like.

It will be understood, however, that when the bomb strikes a target or the surface of a body of water, the inertial force received thereby will dislodge the inertia assembly comprising the tapered sleeve 114, magnet 117, and element 118 from its normal position whereupon the lines of force cutting the coil 111 suddenly collapse, and a voltage is generated therein.

Supported by a sleeve 122 composed of any suitable insulating material is a pair of contacts 123 and 124, the sleeve 122 being disposed about the sleeve 69 of the guide member 42. As shown on Fig. 2 the contacts 123 and 124 are completely insulated from each other and from the fuze casing by the insulating sleeve 122. A pair of diametrically disposed apertures 125 are provided in the sleeve 69 through which lugs 126 extend, the lugs being formed on the sleeve 122. The end portions of the contacts 123 and 124 are bent at a right angle with respect to the body portions thereof as at 120 and extend through openings arranged in the lugs 126 and into the sleeve 69, the portions 120 of the contacts being adapted to engage the shoulder or flange 45 on the arming stem 39 when the fuze is in an armed position thereby providing a firing circuit from the coil 111 to the electroresponsive detonator 113, by way of lead wires, one wire 112 connecting the coil with one side of the detonator 113, the other 112 wire connecting the coil with contact 123, and the other side of the detonator 113 being connected to the contact 124 by a conductor 100.

Therefore it will be understood, that when the fuze is in an armed position with the shoulder 45 bridging the contacts 123 and 124, a complete firing circuit is established from the coil 111 to the detonator 113 and ignition thereof will occur upon impact of bomb with a target or the surface of a body of water as the case may be. Such impact force is sufficient to dislodge the inertia assembly comprising the inertia sleeve 114, magnet 117, and element 118, from its normal position, whereupon the magnetic field about the coil 111 collapses, inducing a voltage in the coil, the voltage is applied to the electroresponsive detonator 113 by way of the aforesaid firing circuit thereby to fire said detonator 113 and explode the bomb in predetermined time delayed relation with respect to impact thereof with a target, as will more clearly appear as the description proceeds.

As shown on Figs. 4 and 5 the detonator 113 has secured thereto a casing 127 which is arranged in a well or bore 128 provided in the block 98. A relatively thick tube 129 having a centrally disposed bore 131 extending therethrough is arranged within the casing 127 and arranged within the bore 131 is a time delay fuze 132 adapted to burn for a predetermined period of time when ignited such, for example as 4 seconds. Ignition of the time delay fuze is initiated by a quick-match pellet 133 arranged adjacent one end of the electroresponsive detonator 113 and fired thereby in response to an electrical energy impulse received by the detonator from the magnetic inertia generator upon impact of the bomb with a target or with the surface of a body of water.

The casing 127 is closed at one end at 134, and arranged in abutting relation therewith and with the tube 129 is a flash charge 135 adapted to be fired by the delay fuze 132 when a predetermined period of time has elapsed. The flash from the flash charge 135 ignites a quantity of smokeless powder 136 arranged in a container 137 disposed in a bore 138 formed in the plastic 98, the block being provided with a flash chamber 139 which communicates with the bores 128 and 138 such that the flash from the flash charge 135 is directed against one end of the container 137 thereby to ignite the powder 136 contained therein. When this occurs, a gas pressure is gradually built up in the chamber 71 by the slow burning powder 136, such pressure being adapted to expand the bellows 58 and function the firing mechanism of the fuze in the same manner as by the aforesaid water pressure.

It will be understood, however, that the magnetic inertia generator will function in response to the impact of the bomb against a ship or the surface of a body of water. However, when the bomb strikes the surface of a body of water and has sunk therein to a predetermined depth, such as 25 feet approximately one second later, the fuze will function hydrostatically and the bomb will explode at this depth, inasmuch as the time delay fuze 132 would not ignite the slow burning powder 136 to set up the gas pressure within the chamber 71 until 4

seconds has elapsed after impact of the bomb with a target or the surface of a body of water.

It will be further understood that when the bomb strikes the deck of a ship, the momentum of the bomb is sufficient to cause the bomb to pierce the deck thereof and to continue downwardly into the hold of the ship. As the bomb strikes the deck of the ship, the magnetic flux within the coil 111 is changed sufficiently to fire the electroresponsive detonator 113. The detonator 113, it will be recalled, has arranged therein a delay fuze 132 adapted to ignite the slow burning powder 136 approximately 4 seconds after impact of the bomb with a target. When this occurs sufficient gas pressure is created from the burning powder to operate the firing mechanism of the fuze in the same manner as by water pressure. By reason of the delay, however, the bomb is exploded below the deck of the ship where the full explosive force of the bomb is made effective.

As shown on Fig. 2 an arming wire 141 is preferably employed to prevent rotative movement of the propeller 35 until the bomb is released from an aircraft in flight. The arming wire 141 is normally arranged in one of the openings 29 in flange 28 and in complementary loops formed on the free ends of a wire band 142 arranged about the collar 26 and passing through an aperture provided in the enlarged head formed on a pin 143, the pin extending through a pair of complementary apertures 144 in the collar 26 and tube 27, Fig. 1, and disposed in the slots 36 formed in the propeller shaft 33. Thus the propeller 35 is prevented from rotative movement until the arming wire is withdrawn from the aforesaid loops and opening. When this occurs the pin 143 is ejected from the apertures 144 by a spring 145 and carries therewith the wire band 142, the spring being arranged about the pin 143 and having one end thereof in engagement with the collar 26, and the other end in engagement with the enlarged head formed on the pin.

The fuze is maintained in a safe position during handling and transportation by a cotter pin 146, Fig. 1, arranged in a pair of complementary openings 147 in tube 27 and a pair of complementary openings 148 in the propeller shaft 33. It will be understood, however, that the safety pin 146 is removed when the bomb is detachably secured to the aircraft at which time the arming wire 141 is detachably secured to the fuze in the aforesaid manner.

The operation of the fuze will now be described. Let it be assumed by way of example, that the bomb is released from an aircraft in flight. As the bomb falls away from the aircraft during the flight toward the target vessel the arming wire 141 is withdrawn from the aforesaid loops and opening thereby releasing the propeller 35 for rotation. As the propeller 35 rotates during the free flight of the bomb through the air, the propeller shaft 33 is rotated thereby and when the propeller shaft has made a predetermined number of revolutions the arming stem 39 is rotated and moved outwardly to an armed position by the propeller shaft 33. When this occurs the arming switch contacts 120 are closed thereby completing a firing circuit between the coil 111 and the electroresponsive detonator 113. When the arming stem 39 has been moved to the armed position the balls 67 are released from locking engagement with the stem nut 52 thus permitting sliding movement of the piston 46 and components parts thereof as heretofore described.

Upon impact of the bomb with a target or a body of water momentum thereof tends to move the piston and component parts thereof in an inward direction, this movement being prevented as heretofore described by the aforesaid counterweights and rack arrangement. Concurrently with the aforesaid impact the inertia sleeve 114, magnet 117, and element 118 are dislodged from their normal position and the electroresponsive detonator 113 is fired, it being understood, however, that the firing mechanism for exploding the bomb will not function by gas pressure until a predetermined period of time such, for example, as 4 seconds has elapsed. Therefore, should the bomb just miss the target and strike the surface of a body of water and sink therein approximately 25 feet, the bomb is fired by water pressure entering apertures 72 rather than by gas pressure, as the smokeless powder 136 is not ignited by the delay fuze for approximately 4 seconds after impact of the bomb with a target while the bomb will sink to a depth of 25 feet in approximately 1 second. Thus the ratio of time between the ignition of the smokeless powder 136 by the delay fuze and the time it takes the bomb to sink to a depth of 25 feet is sufficient to permit the fuze to be fired hydrostatically at a depth of 25 feet thereby effecting severe damage to the target vessel.

Let it be assumed further that the bomb strikes the deck of the vessel in which case the momentum of the bomb is sufficient to cause the bomb to pierce the deck and to continue the downward movement thereof into the hold of the ship. As the bomb strikes the deck of the ship, the magnetic flux within the coil 111 is altered sufficiently to fire the electroresponsive detonator 113, initiating firing the quick-match fires the time delay fuze 132 and when a predetermined period of time has elapsed such, for example, as 4 seconds, the delay fuze ignites the flash charge 139 and the flash charge ignites the smokeless powder 136 thereby creating a sufficient amount of gas pressure within chamber 71 to function the firing mechanism of the fuze. By reason of the delay, the bomb is exploded below the deck of the ship, the final firing operation thereof being initiated by the percussion cap 81 and firing pin 89 when the locking balls 83 release the firing plunger 79 for sliding movement, whereupon the firing spring 87 drives the plunger 79 inwardly and the cap 81 supported thereby strikes the firing pin 89 with sufficient force to initiate firing thereof and explode the bomb.

Briefly stated in summary, the present invention contemplates the provision of a new and improved fuze for a bomb in which means are provided for functioning the fuze by either hydrostatic or gas pressure thereby to explode the bomb, and in which a magnetic inertia generator is employed for functioning the fuze in response to a sudden impact received thereby such, for example, as when the bomb strikes the deck of a ship, and in which additional means are employed for functioning the fuze hydrostatically when the bomb sinks within a body of water to a predetermined depth. Furthermore, the present invention provides means for firing an explosive charge in predetermined time delayed relation with respect to the operation of a magnetic inertia generator arranged therein.

While the invention has been described with reference to a preferred example thereof which gives satisfactory results, it will be understood by those skilled in the art to which the invention pertains, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, in the appended claims to cover all such changes and modifications.

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 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. In a fuze for an aircraft bomb, a casing, a container secured to said casing, a detonator charge arranged within said container, a normally locked pressure responsive device arranged within said casing and adapted when released to be moved a predetermined amount in response to an increase in pressure within said casing, means including a member carried by said pressure responsive device for locking said pressure responsive device, means including a propeller rotatably supported on said casing

for releasing said locking means when said propeller has made a predetermined number of revolutions during the free flight of the bomb toward a target, gas pressure generating means in communication with the casing and adapted to effect said increase in pressure, means including a magnetic inertia generator responsive to impact of the bomb with a target surface, a time delay element operable by said inertia generator for igniting said pressure generating means in predetermined time delayed relation with respect to said impact, means including a percussion cap releasably locked to said member and actuated to a release position when the pressure responsive device has been moved said predetermined amount in response to said increase in pressure for firing said detonator charge, firing means for said percussion cap, and means including a pair of weighted members pivotally mounted on said casing and operatively connected to said member for preventing said movement of the device as the bomb strikes said target surface.

2. In a fuze for an aircraft bomb, a casing, a container secured to said casing, a detonator charge arranged within said container, a normally locked pressure responsive device arranged within said casing and adapted when released to be moved a predetermined amount in response to an increase in pressure within said casing, means including a member carried by said pressure responsive device for locking said pressure responsive device within said casing, means including a propeller rotatably supported on said casing for releasing said locking means when said propeller has made a predetermined number of revolutions during the free flight of the bomb toward a target, a combustible gas pressure generating device in communication with the casing and adapted to effect said increase in pressure when ignited, means including a magnetic inertia generator responsive to impact of the bomb with a target surface, a time delay element operable by said inertia generator for igniting said pressure generating device in predeterimned time delayed relation with respect to said impact, a plunger releasably locked to said member and having a percussion cap supported thereby, means including a plurality of detents for locking said plunger to the member, said last named means being adapted to release the plunger for sliding movement when the pressure responsive device has been moved said predetermined amount, a firing pin supported by said container for firing said percussion cap as said plunger is released, means for urging the percussion cap into firing engagement with said firing pin when the plunger has been released thereby to fire said detonator charge, a rack element carried by said member, and a pair of weights pivotally mounted on said casing in engagement with said rack for preventing said movement of the pressure responsive device as the bomb strikes said target surface.

3. In a fuze for an aircraft bomb, a casing, a container secured to said casing, a detonator charge arranged within said container, a pressure responsive device arranged within said casing and adapted to be moved a predetermined amount in response to an increase in pressure within the casing, a magnetic inertia generator adapted to generate an electrical firing impulse as the bomb strikes a target surface, a normally open firing circuit connected to said generator, an electroresponsive detonator included within said firing circuit and adapted to be fired in response to said impulse, a propeller on the tail of said bomb, means including a switch controlled by said propeller for closing the firing circuit during the free flight of the bomb toward a target, combustible gas pressure generating means in communication with the casing and adapted to effect said increase in pressure, means controlled by said detonator for igniting said pressure generating means in predetermined time delayed relation with respect to said impact, and means controlled by said pressure responsive device for firing said detonator charge when the pressure responsive device has been moved said predetermined amount, a rack member operatively connected to said pressure responsive device, and a pair of weights pivotally secured to the casing in engagement with said rack member for preventing said movement of the pressure responsive device as the bomb strikes said target surface.

4. A combination fuze for an aircraft dropped bomb for attack on a surface vessel comprising a casing having a plurality of vents therein for the admission of water thereto, a container secured to said casing, a detonator charge arranged within said container, means including a pressure responsive device in communication with the surrounding water through said vents for firing said charge in response to an increase in hydrostatic pressure within the casing when the bomb misses said vessel and sinks to a predetermined depth within a body of water, gas pressure generating means adapted to actuate said pressure responsive device sufficiently to fire the charge when the gas pressure has increased to a value corresponding to said predetermined depth of submersion, means including a magnetic inertia generator responsive to impact of the bomb with a target surface, a time delay element operable by said inertia generator for initiating operation of said pressure generating device in predetermined time delayed relation with respect to said impact, and means including a pair of weighted members pivotally secured to said casing and operatively connected to said pressure responsive device for maintaining the pressure responsive device inactive upon said impact and movable by the pressure responsive device when said gas pressure has increased to said value corresponding to said predetermined depth of submersion.

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