Aug. 20, 1957 F. E. BUTLER 2,803,807

AUDIBLE UNDERWATER SIGNAL

Filed June 30, 1955

FIG.1.

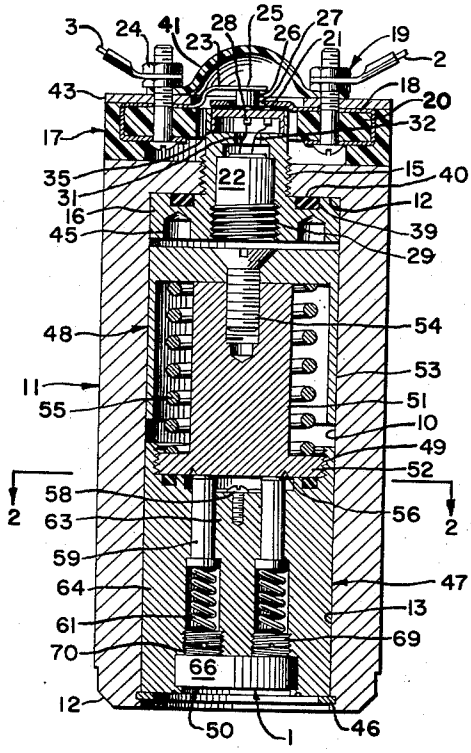


FIG.3.

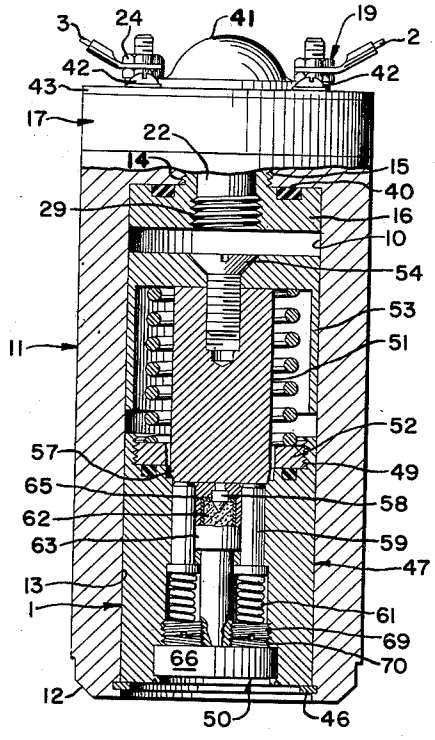


FIG.2.

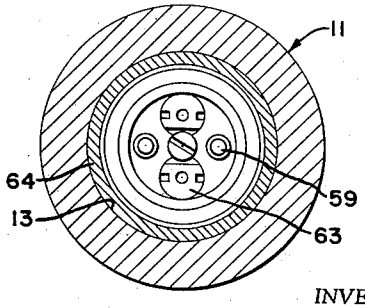
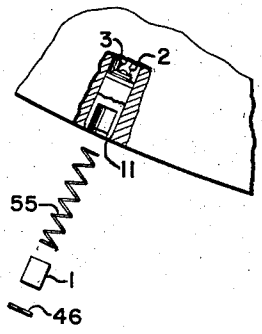


FIG.4.



INVENTOR
F. E. BUTLER

BY

ATTORNEYS

United States Patent Office 2,803,807
Patented Aug. 20, 1957

2,803,807

AUDIBLE UNDERWATER SIGNAL

Francis E. Butler, Washington, D. C., assignor to the United States of America as represented by the Secretary of the Navy

Application June 30, 1955, Serial No. 519,292

9 Claims. (Cl. 340—8)

(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.

This invention relates to a signalling device and more particularly to an underwater signalling device and a gun mechanism for firing thereof and for providing an audible signal indicative of a proper functioning of a torpedo exploder mechanism as a torpedo moving through water strikes a target vessel. It provides an audible signal which may be heard from a target vessel even when the depth is as great as 500 ft. below the surface of the water.

In accordance with the instant invention the underwater signalling device is constructed to be ejected from the torpedo when the torpedo exploder has been fired. The torpedo exploder mechanism closes an electrical circuit after completion of the arming cycle thereof and functions upon impact of the torpedo with a target vessel to provide initiation of the torpedo exploder.

It is therefore a feature of this invention to provide an audible underwater noise signalling mechanism for indicating an actuation of the torpedo exploder in an exercise head under simulated firing and hit conditions of the torpedo wherein a noise is produced a predetermined delay time after target impact under conditions wherein the torpedo and its exploder mechanism follows a prescribed sequence of operations.

One object of the invention is to provide an underwater audible signal of sufficient loudness to be heard above all sea noises as well as the noises produced by the operating target submarine and which is recognizable by operating personnel aboard the target submarine without the use of other audio aids or amplification devices therewith.

In correlation with the foregoing object, it is a further object to provide an audible signalling device of a character providing satisfactory operation in water depths down to 500 ft.

Another object of the invention is to provide an audible signalling device of a character using an explosive charge therein and which device is harmless to the exercise head of the torpedo under the most adverse conditions to which the same may be subjected.

A further object of the invention lies in the provision in an underwater audible signal device for providing an aural indication of a torpedo exploder actuation of means providing a delay in the initiation of the audible signal after torpedo impact which permits the signal to be distinguished from the noise of target impact.

Still another object of the invention resides in providing an underwater audible signalling device with features for readily inserting the same in a gun or discharge mechanism therefor whereby repetitive use of the exercise head may be facilitated by the mere reloading of additional explosives charge components in the gun assembly therefor carried by the torpedo.

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 a longitudinal sectional view in elevation of the audible signalling device and the gun assembly therefor in the assembled relationship thereof prior to firing;

Fig. 2 is a transverse sectional view taken along the lines 2—2 of Fig. 1;

Fig. 3 is a fragmentary view in elevation with the parts thereof in section or broken away to show the relation of the elements thereof immediatley after energization of the detonating charge therefor; and

Fig. 4 is a diagrammatic view showing the signal being discharged from the gun assembly carried by the torpedo.

Referring now to the drawings and more particularly to Fig. 1 thereof, there is shown an underwater signalling device 1 of the instant invention comprising a gun assembly 11 adapted for permanent or semipermanent mounting in the side of the exercise head of a torpedo as for example by riveting or mushrooming over a portion of the skin of the torpedo at the chamfered portion 12 thereof or by a suitably flanged threaded retaining ring or the like.

The gun assembly is provided with an axial bore 13 terminating in a threaded stepped bore to provide a shoulder portion 14 for reception and seating of a detonating charge assembly 16 which is disposed therein. The housing or gun assembly 11 is provided with the threaded bore 15 for mating reception of the explosive fitting 16, the details of which will become apparent as the description proceeds.

The gun assembly is provided with a terminal plate and closure assembly 17 which includes a terminal mounting plate 20 of electrical insulating material for the electrical circuit components for actuation of a charge at 22 contained in the explosive fitting 16.

This terminal plate 20 carries a terminal strip 18, to which is connected as by the screw and nut arrangement indicated generally at 19 the lead 2. Lead 2 is connected to the circuit of the torpedo exploder not shown.

The contact portion is generally of annular configuration and adapted to make contact with the contact 21 of the detonator 22 in fitting 16 irrespective of the rotational position thereof when the fitting 16 is screwed into the gun 11.

The mounting plate 20 additionally carries a second contact element 23 which is connected by the screw, nut and terminal assembly 24 to the second lead wire 3 of the torpedo exploder circuit.

The contact terminal 23 terminates in a strip portion 25 having a cylindrical contact portion 26 disposed thereon and adapted to move axially within the hole or annular aperture portion 27 of the annular contact portion of terminal 18. This cylindrical contact 26 is adapted to engage the terminal 28 of the detonator charge 22. This charge 22 is adapted to be screwed into the explosive fitting 16 at the threaded portion of the bore at 29.

The explosive squib leads 31 and 32 are potted during assembly after attachment to the contacts 21 and 28 carried by the closure cap 35 of the explosive fitting 16.

The explosive fitting is provided with an annular groove 39 for reception of an O ring 40 which is adapted to seal with the shoulder portion at 14 of the gun housing 11.

The contact structure in the closure assembly 17 is closed by a dome-shaped transparent plastic cover 41 to provide a means for observing that the terminals are engaging the contacts of the explosive fitting after the explosive fitting has been assembled in the gun housing 11.

The closure assembly 17 is attached to the gun in any

suitable manner as for example by screws **42**, Fig. 2 which extend through an annular end plate **43** which is disposed under the cover **41**. The cover **41** may be removed by removing the nuts of the terminal assemblies **19** and **24** without disturbing the mounting of the rest of the terminal plate assembly **17**.

The audible signal is discharged from the gun when the detonator at **22** carried by the explosive fitting **16** is energized by the torpedo exploder circuit of the torpedo after target impact. The assembly **16** is generally stored separately from the torpedo and is inserted by a suitable spanner keyed wrench, as a unitary assembly. It is provided with holes **45** whereby it may be screwed into the gun immediately prior to torpedo launching.

Audible signal assembly **47** is retained in the gun barrel bore **10** until explosively discharged therefrom or in lieu of firing by removal of the frangible arcuate retaining washer **46**.

The ejector and signal assembly **47** generally comprises two subassemblies hereinafter designated as the plug or ejector assembly **48** and the detonator assembly **50** which are attached prior to detonation by means of threaded connection therebetween at **49**. The plug assembly comprises a phenolic plug portion **51** having a frangible flange portion **52** which threadedly engages a mating threaded bore of the signal assembly. It is fixedly connected to an aluminum cup member **53**, as by the flat head retaining screw **54**. Disposed between the inner portion of the cup **53** and the inside of the flange portion **52** of plug assembly is a spring **55**. The lower side of the flanged portion of the phenolic plug is provided with an annular groove **56** to provide a shear plane for rupture of the flange as shown in Fig. 3 when the gun is fired. This permits the central portion **57** of the plug to move to compress spring **55** as well as to depress plungers **59** against the loading of the springs **61** and thereby engage the firing pin **58** of the detonator assembly.

The signal and detonator assembly comprises a plurality of safety plungers **59** which are suitably loaded by springs **61** to prevent accidental discharge by the firing pins **58**.

The ejection of the plug assembly and signal unit occurs prior to the detonation of the sound producing charge. This is accomplished by utilizing a delay composition at **62** in the delay elements **63**.

The body of the signal assembly **50** comprises an aluminum body **64** for retaining the two delayed elements **63** which initiate firing of a lead azide sound charge. The delay elements **63** comprise a housing **65** having a charge **62** disposed therein and adapted to be initiated by the firing pin **58** as the central portion **57** of the plug **51** moves thereagainst with detonation of the charge in the explosive fitting **22**.

This construction of the detonator assembly additionally includes the aforementioned pair of safety plunger elements **59** disposed in the stepped bores **70** of the body **64** of the assembly **50**. They are backed by the springs **61** which are deformed by plug portion **57** as it engages the firing pins **58** to fire the delay elements **63**. A spring adjusting and retaining screw **69** is threaded into the threaded portion of the pair of bores **70** in the detonator assembly body to provide adjustment of the tensioning thereon.

In operation the device of the instant invention, the gun assembly **11** is mounted into the torpedo and the terminals **2** and **3** connected in the electrical circuit of the torpedo exploder.

An explosive fitting **16** is inserted by any tool suitable for the purpose which may have provided thereon, for example, a plug having pins for matingly engaging the pair of holes **45** in the explosive fitting to facilitate tightening thereof. The explosive fitting is inserted into the gun, and tightened to insure electrical contact between the contacts **21** and **28** carried thereby and the pair of contacts **18** and **26**.

The plug assembly which has previously been assembled in a manner to compress the spring between the flange of the plug and the inside of the cup **53** is screwed into the detonator assembly. The plug and signal assembly **47** is inserted into the gun and retained by the releasable retaining ring **46**.

When the torpedo strikes the target a proper actuation of the torpedo exploder functions to energize the circuit through the gun terminals **2** and **3** and detonates the initiator **22** in explosive fitting **16** which is connected in series therewith. This circuit is in lieu of the detonator circuit used in a live torpedo for target destruction.

Referring to Fig. 2, it will be apparent that explosive gases which are expelled between fitting **16** and the cup **53** of plug assembly provide a pressure for shearing flange **49** at **56** and driving the plug portion **57** against the load of the safety plungers **59** to engage the firing pins of the delay elements. Actuation of the firing pins occurs only after the shearing of the central portion of the plug from the flange portion thereof.

Thereafter the spring which has previously been depressed during this movement reacts in conjunction with the explosive pressure on the gun to eject the detonator assembly from the gun by shearing or otherwise deforming the retaining washer **46**. The delay element in the explosive train at **62** continues to burn after the detonator signal assembly is ejected into the water and a predetermined time thereafter functions to discharge the sound charge disposed in container **66**. The explosion of this charge in the water provides an audible explosion which may be heard within the submarine.

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

1. In combination, a time delayed audible underwater signal generating device for indicating an actuation of a torpedo exploder electrical circuit in a torpedo with a target hit, and an electrically initiated gun assembly having an explosive charge therein for discharge of said device, said device comprising an audible underwater noise generating means adapted to be ejected from said gun assembly, and ejection means responsive to gun assembly firing for initiating the actuation of the noise generating means, said generating means comprising a primer, an exposive delay mix, a noise generating explosive therein, firing pin means responsive to actuation by said ejection means for initiating actuation thereof for firing of said explosive delay mix subsequent to gun assembly firing and prior to ejection propulsion of said noise generating means from said gun assembly, and means for normally retaining the signal generating means in the gun assembly prior to propulsion therefrom, said ejection means including a normally compressed spring for facilitating the ejection of said noise generating means from the gun, said ejection means being further provided with a member for normally retaining said spring in a preloaded position and shearable with gun assembly firing for providing actuation of the firing pin means for said explosive delay mix.

2. A time delayed audible underwater signal generating device for indicating an actuation of a torpedo exploder electrical circuit in a torpedo with a target hit comprising an electrically initiated gun assembly, and an audible noise generating means adapted to be ejected therefrom on actuation of the electrical firing circuit from said torpedo exploder, said generating means comprising a primer, an explosive delay mix, and a noise generating explosive therein, means for initiating firing of said explosive delay mix subsequent to gun firing and prior to ejection propulsion from said gun assembly, means normally retaining the signal generating means in the gun assembly prior to gun firing, means for facilitating ejec-

tion of said audible noise generating means from said gun, said ejection means being provided with frangible means for providing actuation of the firing initiating means for said explosive delay mix.

3. The structure of claim 2 further including a spring loaded plunger for normally preventing the movement of said firing pin means to a firing position with respect to said primer prior to firing of said noise generating means from the gun.

4. A time-delayed audible underwater signal generating device for indicating an actuation of a torpedo exploder electrical circuit in a torpedo with a target hit comprising, in combination, an electrically initiated gun assembly, an audible noise generating means adapted to be ejected from said gun assembly on actuation of the electrical firing circuit of said torpedo exploder, said generating means comprising a primer, an explosive delay mix, and a noise generating explosive therein, firing pin means for initiating firing of said explosive delay mix subsequent to gun assembly firing and prior to ejection propulsion from said gun assembly, frangible means for normally retaining the signal generating means in the gun assembly prior to propulsion therefrom, means including a normally compressed spring for facilitating ejection of said audible noise generating means from said gun assembly, said last named means being provided with a shearable member for normally retaining said spring in a preloaded position and shearable with gun firing for providing actuation of the firing pin means for said explosive delay mix, and a spring loaded plunger means for normally preventing the movement of said firing pin means to a firing position with respect to said primer prior to firing of said noise generating means from said gun.

5. A time-delay audible underwater signal generating device for indicating an actuation of the torpedo exploder electrical circuit in a torpedo with a target hit comprising, in combination, an electrically initiated gun assembly having an explosive charge therein for discharge of said device, signal generating means comprising a primer, an explosive delay mix, a noise generating explosive, firing pin means for initiating firing of said explosive delay mix subsequent to gun assembly firing and prior to ejection propulsion from said gun assembly, frangible means for normally retaining the signal generating means in the gun assembly prior to propulsion therefrom, means including a normally compressed spring for facilitating ejection of said signal generating means from said gun and being provided with a member for normally retaining said spring in a preloaded condition and shearable with gun assembly firing for providing actuation of the firing pin means for said explosive delay mix, and a spring loaded plunger means for normally preventing movement of said firing pin means to a firing position with respect to said primer prior to firing of said signal generating means from the gun assembly.

6. In combination, a time-delayed audible underwater signal generating device for indicating an actuation of a torpedo exploder electrical circuit with a target hit and an electrically initiated gun assembly having an explosive

charge therein for discharge of said signal generating device, said signal generating device comprising an audible noise generating means and an ejecting booster means therefor whereby the device is adapted to be forcibly ejected from said gun assembly and actuated thereby during ejection, said generating means comprising an explosive delay mix, percussion firing means for said delay mix, and an explosive mix, and means in said ejecting booster means responsive to gun firing for initiating percussion actuation of said explosive delay mix prior to ejection of said device from said gun assembly.

7. The combination with a torpedo exploder mechanism of a character capable of energizing an external electrical circuit, of a time-delayed audible underwater signal generating device, said device comprising a gun assembly disposed in the skin of said torpedo for discharging a signal generating means therefrom, said gun assembly being adapted for firing actuation by closure of the electrical circuit thereto with torpedo exploder actuation upon impact of the said torpedo with a target, and signal generating means comprising a primer, firing pin means for actuating said primer, an explosive delay mix, and a signal generating explosive charge therein, means for preventing premature actuation of said firing pin means, means for rendering said firing pin means operable for actuation only after discharge action of said gun assembly as initiated with torpedo exploder circuit energization, said delay mix being capable of firing said signal generating charge subsequent to ejection of the signal generating means from the gun assembly, a frangible washer normally retaining the signal generating means in the gun assembly prior to propulsion therefrom, an ejecting spring disposed in said signal generating means in a manner to aid in the ejection of said signal generating means from the gun assembly after initiation by said primer of said delay mix and operable after release of said frangible washer for ejecting the signal from the gun.

8. The structure of claim 7 further characterized by the inclusion of a propellant charge, means removably disposed in the gun assembly for carrying the propellant charge, said means functioning to permit the sequential loading and firing of additional audible signal generating means from the same gun assembly.

9. In combination, a gun adapted to be carried by a torpedo having an electrical torpedo exploder mechanism disposed therein and an explosive time-delayed audible underwater signal generating assembly of a character adapted for discharge after propulsion of said signal generating assembly from the torpedo, said gun being adapted for firing actuation by an electrical circuit closure, with torpedo exploder actuation, said signal generating assembly comprising a primer, an explosive delay mix, a noise generating explosive, firing pin means for initiating the firing of said explosive delay mix subsequent to gun firing and prior to propulsion from said gun, and a shearable washer for normally retaining the signal generating assembly disposed in the gun prior to propulsion therefrom.

No references cited.