

Oct. 12, 1965

D. F. SMITH

3,211,092

ANTIMINE WEAPON

Original Filed Feb. 17, 1959

Fig. 2

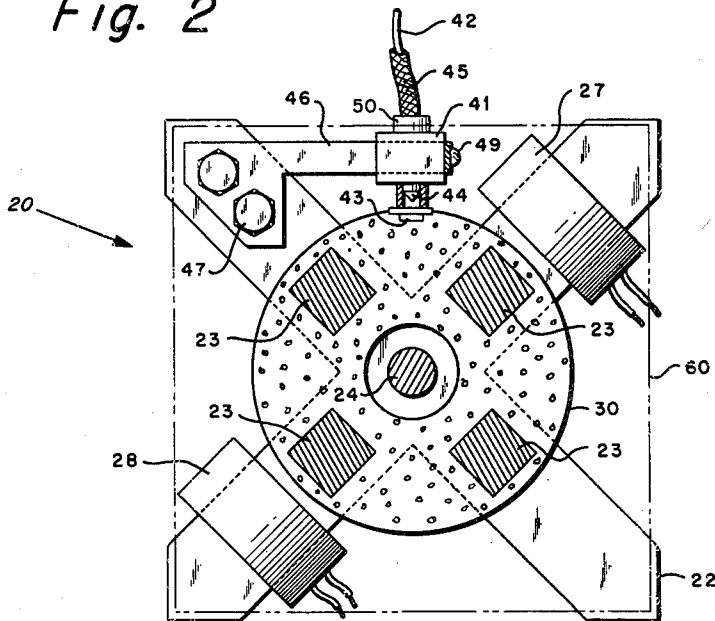


Fig. 1

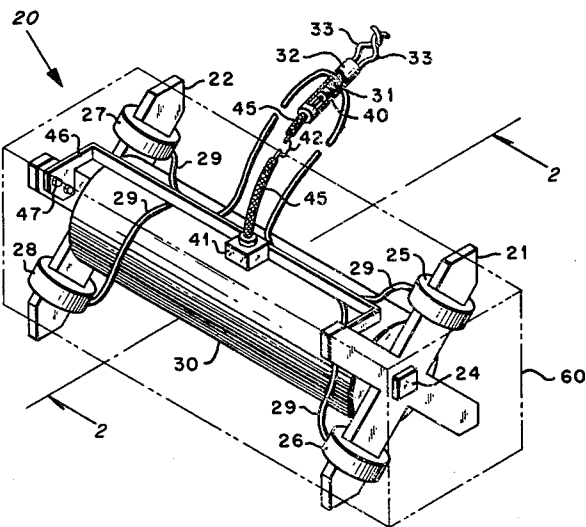
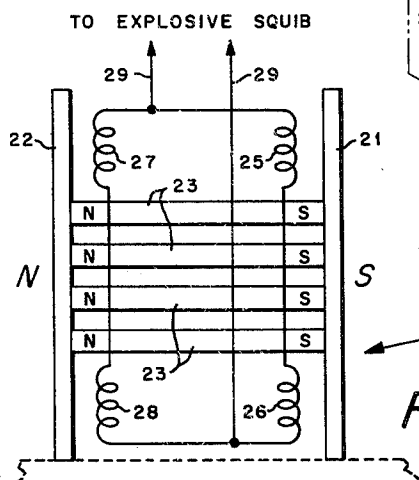


Fig. 3

INVENTOR.
DONALD F. SMITH

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ANTIMINE WEAPON

Donald F. Smith, Norristown, Pa., assignor to the United States of America as represented by the Secretary of the Navy

Original application Feb. 17, 1959, Ser. No. 793,939. Divided and this application Aug. 29, 1960, Ser. No. 52,746.

2 Claims. (Cl. 102—18)

(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 application is a division of application Serial No. 793,939, filed February 17, 1959 for Antimine Weapon.

This invention relates to an antimine weapon, and more particularly to apparatus for detecting and destroying mines.

One of the problems associated with detecting and destroying mines is that in recent decades there has been developed a multitude of different types of mines which function differently and which consist of a considerable number of different configurations. Also, the mines may be located in different places in a body of water. Therefore, one of the problems associated with developing a mine sweeper which will be operative against all types of mines is to determine a common denominator among the mines that can be used for clearing the seas of them. This will include mines which are cabled or anchored to the bottom of the water as well as mines which float or are submerged at different depths.

Obviously, it is highly uneconomical to develop several methods of detecting and destroying mines, each of the methods not being capable of detecting all the various types of mines. As a result, repetitive or multiple mine sweeping operations are required in order to clear water lanes of the mines. For example, some of the methods and the apparatus for effecting the same are designed to be effective against only magnetic mines. Other sweepers combat against only physical contact type mines. One of the methods is known as the paravane type which employs a cable cutting apparatus towed by a surface vessel. This method is effective against extended cable anchored mines that are anchored just beneath the water surface. After the cable is severed, the mines float to the surface and are subsequently destroyed by the use of high powered rifles. The above known mine sweeping methods all involve the use of a surface vessel and hence present a constant hazard to the surface vessel so used.

The present invention contemplates a method of wider scope of effectiveness in that it deals with a feature common to all presently known types of mines, namely the ferromagnetic material of the mines. Also it is desirable, in order to eliminate hazards to surface vessels, to provide an aircraft, such as a helicopter, as a towing craft.

Accordingly, an object of the invention is the provision of an antimine weapon, referred to as a magnetic leech device having magnetic means for the attraction thereof taching itself to any type of mine having a substantial iron content for locating and/or destroying the mine.

Another object of the invention is to provide a leech device having magnetic means for the attraction thereof to a mine having a substantial ferrous content for automatically destroying the mine, preferably after a predetermined length of time has elapsed.

Still a further object of the invention is to provide an antimine type of weapon employing assemblies each in-

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cluding a permanent magnet arrangement and a demolition charge adapted to be detonated by the shorting out of the North and South poles of the permanent magnet arrangement resulting in the formation of a keeper circuit therewith, wherein each assembly is arranged to be magnetically attracted to a mine having a substantial ferrous content, cling to the outer surface of the mine and destroy the same when the ferrous content of the mine is of sufficient magnitude to provide a keeper effect for shorting out the North and South poles of the permanent magnet arrangement portion of the assembly, firing the demolition charge, and thereby destroying the mine.

Still another object of the invention is to provide an antimine weapon, as set forth in the preceding object, which weapon needs not be supplied with electrical energy from an outside source but which depends upon the cutting, the shorting out, or the collapsing of the magnetic lines of flux between the opposite poles of the permanent magnet for creating a voltage in a circuit of the antimine weapon and exploding the demolition charge, which destroys the mine.

The invention further provides certain novel features of construction, combinations and arrangements of parts, and further objects and advantages thereof will be apparent to those skilled in the art to which it pertains from the following description of the presently preferred embodiment thereof described with reference to the accompanying drawings in which similar reference characters represent corresponding parts throughout the several views, and in which:

FIG. 1 is a generally pictorial view of a portion of the invention comprising a magnetic leech device;

FIG. 2 is a sectional view of the leech device along line 2—2 in FIG. 1; and

FIG. 3 is a schematic electrical diagram for illustrating the electrical system employed in the leech device.

It is to be understood that the invention is not limited to the details of construction and arrangements of parts shown in the drawings and hereinafter described in detail but is capable of being otherwise embodied and of being practiced or carried out in various ways. It is to be further understood that the phraseology or terminology employed herein is for the purpose of description and there is no intention to herein limit the invention beyond the requirements of the prior art.

In the illustrated embodiment of the invention, a leech device 20 is shown which seeks out and attracted to mines having a substantial content of magnetic material. A plurality of these devices are depended from a mine sweeping apparatus having the configuration disclosed in patent application Serial No. 793,939, supra. In brief, the mine sweeping apparatus comprises a hydrofoil adapted to be towed through water from a vehicle such as a helicopter. The leech devices depend from so-called streamer rods spaced approximately 2 feet apart along the breadth of the hydrofoil to insure uninterrupted traverse of a shipping lane swept by the hydrofoil. The hydrofoil is capable of operating at any depth below the water surface. For example, the hydrofoil can be controlled at a fixed distance above an ocean bottom by apparatus as disclosed in U.S. Patent 3,062,171 for "Wing Tip Tow" to J. Somerville issued November 6, 1962.

More particularly, each leech device 20 is comprised of two end plates 21, 22, preferably of a magnetic material such as a ferromagnetic material, spaced apart by four parallel permanent magnets 23 with poles aligned so as to have the North N and South S poles each at discrete ends thereof. More particularly, the end plates 21, 22, are respectively connected to the North and South poles of the magnets 23, FIG. 3. The end plates 21, 22, are each in the shape of a Maltese cross with the outer ex-

tremities thereof being pented so as to form apices. The end plates 21, 22 and the magnets 23 are held in assembly by means of a central, longitudinally or axially extending bolt 24 having a suitable fastening means such as a nut, not shown, at the threaded end thereof. The magnets 23 are encased within a cylindrically-shaped mass of explosive charge 30 between the end plates 21, 22.

Two induction coils 25, 26 are disposed about and secured to a pair of the oppositely extending legs of the end plate 21. Similarly, two induction coils 27, 28 are disposed about and secured to a pair of the oppositely extending legs of the end plate 22. Two electrically conducting wire leads 29 extend from across the closed loop, series connected coils 25, 26, 27, 28 to a squib 31, FIGS. 1 and 3. The squib 31 is housed within a generally cylindrical or cup-shaped frangible element 32 having an eye ring 33 preferably formed by two separate semi-circular interhooked wires at the outer and closed end thereof. The semicircular wires of the ring 33 are interhooked so that upon the destruction of the squib 31 and the element 32 the wires will part and fall away from a hooked lower end of the streamer rod.

The firing of the squib 31 is caused by the physical attraction and the attachment of the leech device 20 to a mine, not shown, having a substantial content of magnetic material. In most instances, the device 20 must come into actual physical contact with the metallic outer surface of a mine before the squib 31 is fired and the charge 30 is detonated. The mine's outer surface is generally comprised of a ferromagnetic material capable of readily transmitting magnetic lines of flux, but is not such a good conductor as to be nonmagnetic which would cause the device to fail to operate. As the leech device 20 is attracted to the mine, there must be sufficient ferromagnetic material in the mine so as to provide a keeper effect for shorting out the North and South poles 21 and 22 of the leech device 20. The sudden change of flux lines induces voltage in the coils 25, 26, 27, 28, FIG. 3, which will result in a current of sufficient magnitude through the coil leads 29 to fire the squib 31. The shorting out of the magnetic lines of flux between the end plates 21 and 22 and the subsequent firing of the squib 31 causes a piston 40 to be driven outwardly of the cup-shaped housing 32 for actuating a timer 41 by means of an interconnecting flexible shaft 42 and subsequently detonating a percussion cap 43, FIG. 2, imbedded in the explosive 30.

More particularly, the protective flexible wire shield 45 enclosing and closely encircling the flexible shaft 42 and interconnecting housing 32 and timer 41 acts to constrain the housing 32 relative to the timer 42 so that displacement of one end of shaft 42 responsive to displacement of piston 40 produces the requisite actuating movement of the other end of the shaft 42 relative to the timer 41.

The timer assembly 41 may comprise any suitable conventional timing mechanism. For example, it may include an escapement mechanism (not shown) set in motion by the movement of the end of shaft 42 toward the timer 41, as described above. After a predetermined amount of time, controlled by the escapement mechanism, has elapsed, a sear (not shown) is released and the spring loaded firing pin 44, FIG. 2, is free to strike the percussion cap 43.

The assembly of the timer 41 and the firing pin 44 is held in position by means of a nonmagnetic bracket 46 of generally U-shaped configuration, the bracket 46 having the parallel end legs thereof rigidly secured to parallel and opposed legs of the end plates 21, 22 by suitable fastener means such as bolts 47. Preferably, the bracket 46 is plastic. The timer 41 is enclosed in a housing which is rigidly secured to the intermediate portion of the bracket 46 by suitable fastener means such as a screw 49. The housing of the timer 41 supports a guide sleeve 50 which encloses and guides the firing pin 44 to the percussion cap 43. Immediately upon the firing of the squib

31, the frangible housing 32 is bursted or fractured so that the eye ring 33 which is attached to a streamer rod 34 is parted in the manner described above and the leech device 20 is released from its streamer rod.

Simultaneously with the bursting of the housing 32 caused by the firing of the squib 31, the piston 40 by means of the flexible shaft 42 energizes the timer 41 which subsequently releases the firing pin 44. The firing pin 44 then strikes the detonator cap 43 and detonates the explosive charge 30.

Preferably the leech 20 is encased in a water-proof plastic mold outlined with dotted lines and indicated by the reference numeral 60 for the purpose of water-proofing the device 20. However, the end plates 21 and 22 are not completely encased by the plastic casing 60 and the outer ends of the end plates 21, 22 will remain exposed. It is also contemplated that the bracket 46 could be dispensed with and the timer 41 can be held in place by the casing 60. It is contemplated that the control surfaces for hydrofoil and the streamer rods depending therefrom be made of a nonmagnetic and corrosive resistant materials, such as stainless steel and aluminum, respectively.

A nondestructive application of the invention resides in the utilization of a releasable float or dye marker to pin-point the location of an underwater object having a substantial magnetic content, such as iron. This would be of considerable benefit in locating sunken vessels or in submarine warfare. For example, a water soluble dye, such as fluorescein, can be packaged within the mold 60 in substantially the same cylindrical mold as the explosive charge 30 and upon the percussion cap 43 being fired, the plastic casing 60 would be blasted away sufficiently to permit the dye to be released therefrom. The dye will then mark the location of the underwater object.

While a specific embodiment has been shown and described in accordance with the invention, it is understood that the same is susceptible of many changes and modifications as known to a person skilled in the art and it is intended to cover all such changes and modifications coming within the scope of the appended claims.

What is claimed is:

1. In an explosive device submersible to any water depth and operable only after contact with an object of magnetic material, the combination, comprising:
 - a plurality of permanent magnets arranged in parallel with like magnetic poles thereof adjacently aligned, magnetic cores respectively connecting the adjacent poles at each end of said magnets,
 - coils inductively associated with each of said cores for generating an electric current due to a sudden change in magnetic flux created when each of said cores simultaneously contact a magnetic object, said magnets having sufficient attraction force for self-maintaining contact,
 - frangible means having a fastener means made of wire partially embedded therein for attachment to a supporting apparatus,
 - squib means housed within said frangible means and in electrical contact with said coils detonated by said electric current for detaching said fastener means from the supporting apparatus,
 - an explosive charge structurally secured about said magnet means for destroying the object,
 - detonator cap embedded in said charge for detonating said charge means,
 - timer means fixed adjacent to said charge means for providing a timed interval,
 - a plunger operatively connected between said frangible means and said timer for initiating the time interval when said squib means detonates, and
 - and said detonator cap for firing said detonator cap a firing pin operatively connected between said timer at the expiration of the time interval.

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2. The combination of claim 1 in which said magnetic cores comprise cross-shaped end plates fixed at each end of said magnets in planes normal to the longitudinal axis of said magnets, and wherein said coils comprise a pair of coils respectively wound about only two oppositely extending legs of each of said end plates, said legs oriented such that not more than two adjacent legs of each of said end plates can simultaneously contact said object but at least one of said coil wound legs of each end plate must contact said object.

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SAMUEL FEINBERG, *Primary Examiner*.

10 SAMUEL BOYD, *Examiner*.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,211,092

October 12, 1965

Donald F. Smith

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, lines 73 and 74, strike out "and said detonator cap for firing said detonator cap a firing pin operatively connected between said timer" and insert instead -- a firing pin operatively connected between said timer and said detonator cap for firing said detonator cap --.

Signed and sealed this 26th day of July 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents