G. E. ELIA.

MINE.

APPLICATION FILED FEB. 21, 1917.

1,430,161.

Patented Sept. 26, 1922.

2 SHEETS—SHEET 1.

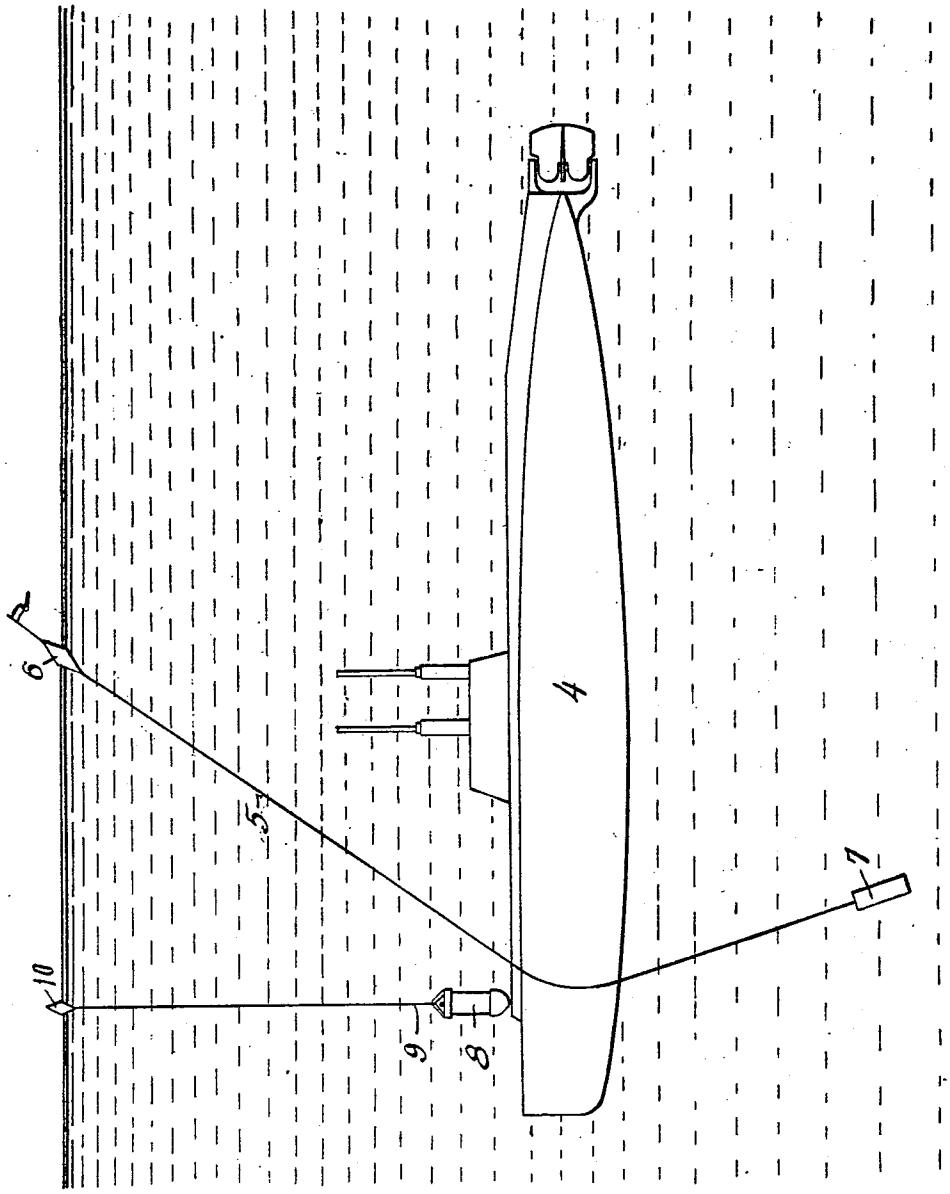


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

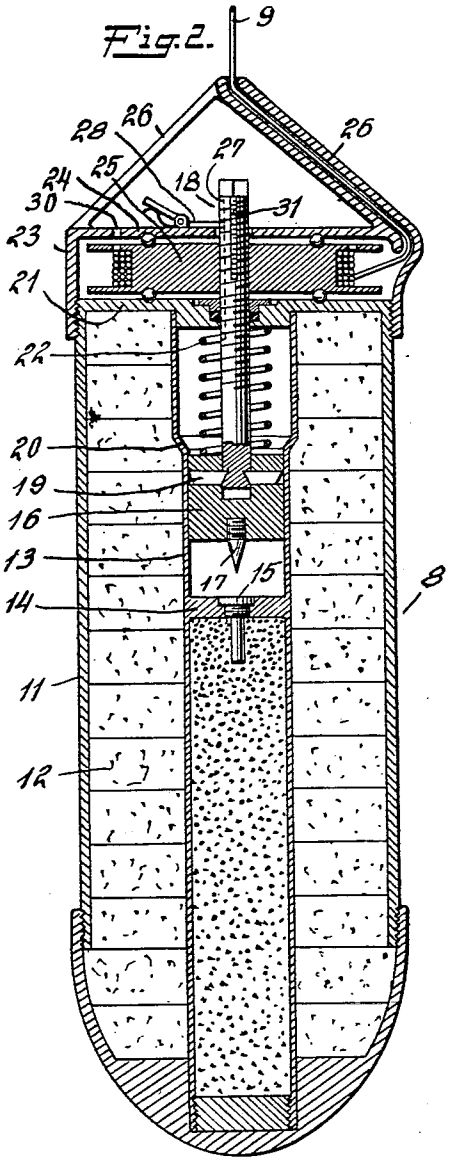
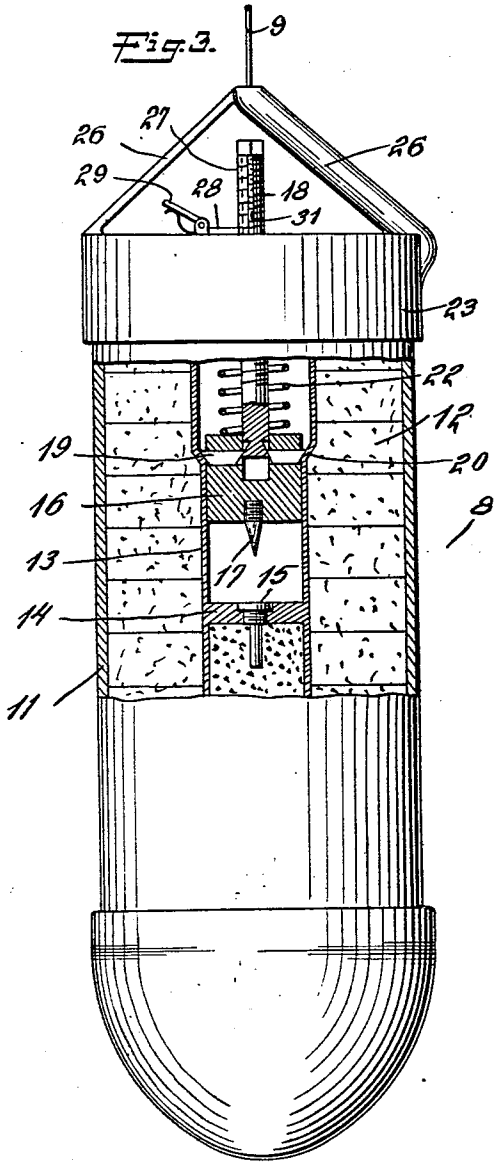


Fig. 3.



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UNITED STATES PATENT OFFICE.

GIOVANNI EMANUELE ELIA, OF NEW YORK, N. Y.

MINE.

Application filed February 21, 1917. Serial No. 149,978.

To all whom it may concern:

Be it known that I, GIOVANNI EMANUELE ELIA, a subject of the King of Italy, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Mines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to apparatus for destroying submarine boats and more particularly it involves the provision of a submarine mine which sinks when released in the sea and which is provided with automatic means for causing the mine to explode when it has sunk to a predetermined depth.

In order to catch and detain submarine boats, it has been common to provide nets of considerable length which are submerged in the sea from suitable buoys in positions where they would be apt to be encountered by hostile submarine boats. When a submarine under way engages such a net, its prow is projected between elements of the net until these parts of the net become wedged upon the sides of the boat and grip it so tightly that the boat cannot release itself by backing off and frequently an effort to detach the boat from the net results in more securely entangling it in the net. It has been proposed to provide in conjunction with such nets automatic signal transmitting devices which are set in operation when the net is drawn through the water by a submarine boat so as to transmit a signal to a receiving station indicating the presence of the boat in the net and its approximate location. On receipt of such a signal at the receiving station, a patrol boat would be immediately despatched to the locality indicated by the signal. On its arrival at the net, the men in charge of the patrol boat would be able to determine the location of the boat with sufficient accuracy, from the movement of the net, from the position it assumed in the water, from the positions assumed by buoys connected with the net and in other ways, except that they might not be able to determine the depth to which the boat was submerged.

The present invention involves the provision of a mine which could be used by the man in the patrol boat to destroy the submarine boat so caught in the net. The mine is of such a weight that when released in the water it sinks and it is provided with means for exploding it which are operated automatically when the mine has sunk to a predetermined depth. Such a mine would be released from the patrol boat, would sink to the depth for which it had been set, and would then explode. The men in the patrol boat would be able to determine whether or not the explosion of the mine had caused the destruction of the submarine boat for if it had been successful, great bubbles of air would rise to the surface and also oil would appear upon the surface of the water. If there were no such indication of success in the destruction of the submarine boat, a similar mine would be set for explosion at a different depth and would be similarly released. This procedure would be continued until it was apparent that the successful destruction of the submarine boat had been accomplished.

There are a number of different constructions which may be employed for effecting the automatic explosion of the mine when it has reached the desired depth. That which I prefer to employ is a firing mechanism which is caused to be operated by devices whose movement is effected by the sinking of the mine through a flexible connection from the mine to a buoy floating on the surface of the water. Such a flexible connection may be wound a predetermined number of times around a reel or sheave in the mine casing and attached at one end to the sheave, its other end being secured to the buoy. When the mine sinks in the water, this flexible connection causes the sheave to rotate and after a predetermined amount of rotational movement, the sheave may be caused to operate or to release the automatic firing mechanism. It will be understod, however, that the invention is not limited to this specific form of automatic firing mechansm except as to those claims wherein this construction is specifically set forth. In its broader aspects, the invention involves the provision of a mine having automatically operated firing mechanism therein which is actuated to cause the explosion of the mine when the latter has sunk to a predetermined depth, irrespective of the specific form of the mechanism employed for this purpose.

The embodiment of the invention which is at present preferred is illustrated in the accompanying drawings, wherein Fig. 1 is a diagrammatic view showing a submarine

boat caught in a net and a depth mine sinking in the water adjacent to the boat from a buoy floating on the surface of the water. Fig. 2 is a central section of the mine and Fig. 3 is a sectional elevation corresponding to Fig. 2 and showing a different position of the firing mechanism.

Referring to these drawings, a submarine boat is indicated at 4 in Fig. 1 as caught in a net 5 which is suspended in the sea from suitable buoys 6. The net is normally held in a substantially vertical position by weights 7 secured to its lower edge. The mine is shown at 8. It is of such weight with relation to its displacement that it sinks when released. A flexible cable 9 extends from the mine to a buoy 10 and this cable is unwound from a reel in the casing of the mine as the mine sinks. The automatic firing mechanism in the mine is actuated after the reel has been unwound by the sinking of the mine to a predetermined extent.

The construction of the mine itself is illustrated in Figs. 2 and 3. It consists of a cylindrical casing 11, and the major portion of the space within this casing is filled with the explosive 12. At the center of the casing is a tube 13 having a support 14 therein for a primer 15. Above the primer is a cylindrical weight 16 carrying a hammer 17 in such a position that when the weight 16 is released and descends, the hammer 17 strikes the primer 15 and thus explodes the mine. Above the weight 16 is a threaded shaft 18 whose end enters an opening provided therefor in the upper face of the weight 16. The lower end of the shaft 18 is detachably connected to the weight 16 by means of two or more pieces 19 located in radial openings in the weight 16. The inner ends of these pieces 19 are bevelled off as shown in Figs. 2 and 3 and these bevelled inner ends are adapted to enter a circumferential groove in the lower end of the shaft. Near its upper end the tubular member 13 is enlarged in cross-section and the two portions of the tube of different diameters are connected by a portion 20 whose inner surface is inclined relatively to the axis of the tube. The outer ends of the pieces 19 are bevelled like their inner ends and are adapted to coact with the inclined surface of the portion 20 of the tube. The upper end of the casing 11 is closed by a wall 21 and between this wall and the top of the weight 16 is a spring 22 coiled about the shaft 18.

A cap 23 is secured to the top of the casing 11 and is provided with a horizontal wall 24. In the space between the walls 24 and 21 is a reel 25. This reel is provided with a central threaded opening which receives the threaded shaft 18 and the upper end of the shaft projects through an opening the wall 24. The cap 23 is also provided with two or more radial inclined arms 26, one of which is hollow so as to provide a passage for the flexible cable 9. This cable passes through the passage in the arm 26 and is wound around the reel 25, its end being secured to the reel. If desired, the reel may be provided with ball bearings, as is indicated in Fig. 2.

Means are preferably provided for guarding against rotational movement of the shaft 18 when the reel 25 is rotated. This may consist of a projection entering an axial groove in the threaded shaft 18 and provision may be made for withdrawing this projection to permit of turning shaft 18 manually independent of reel 25 for adjusting the depth at which the mine will be exploded. In the drawings, the axial groove in the shaft 18 is indicated at 27 and a projection is shown at 28 mounted upon the wall 24 and entering the groove 27. This projection 28 is pivoted so that it may be turned by a handle 29 to a position in which its end is withdrawn from the groove 27. Also, the upper end of the shaft 18 is squared so that a wrench may be applied thereto for turning it and the wall 24 is provided with an opening so that rotation of reel 25 may be prevented while turning the shaft 18 manually.

Fig. 2 shows the parts of the mine in the positions which they would occupy when the mine is released on the surface of the water. By reason of its weight relative to its displacement, the mine sinks but as the upper end of the cable 9 is secured to a buoy 10 of adequate size, the cable 9 is drawn out through the passage in the arm 26 and causes rotation of the reel 25. Turning movement of the shaft 18 with reel 25 is prevented by the projection 28 entering the axial groove 27 in the shaft 18. The turning of reel 25 as the mine sinks, therefore causes upward movement of the shaft 18 and the latter carries with it the weight 16 compressing the spring 22. When the weight 16 has been raised by the turning movement of reel 25 so far that the pieces 19 come opposite the inclined surface 20, the pieces 19 are moved outwardly by the inclined surfaces upon the inner ends of the pieces 19 and the surfaces at the lower end of shaft 18 with which they coact. Until the weight 16 has been raised to this extent, outward movement of the pieces 19 is prevented as their outer ends abut against the wall of the portion of tube 13 which is of the smaller diameter. The outward movement of the pieces 19 after the weight has been raised releases the detachable connection between the shaft 18 and the weight 16 and when the lower end of shaft 18 passes upward beyond the pieces 19, the weight 16 moves downwardly, the pieces 19 being moved in-

ward slightly by the engagement of their inclined outer ends with the inclined wall 20. When this occurs, the weight 16 is moved downwardly with great force by gravity and by the spring 22 and the hammer 17 engages the primer 15, thereby exploding the mine. Fig. 3 shows the positions of the parts when the weight has been raised far enough to permit the outward movement of the pieces 19 and just before the weight is released.

The mounting of the projection 28 so that it may be withdrawn from coaction with the axial groove 27 in the shaft 18, permits of adjusting the mine for explosion at any desired depth. To effect such adjustment, the projection 28 is withdrawn from groove 27 by depressing the handle 29 on the projection. Then rotation of the reel 25 is prevented by reaching through the opening 30 in the wall 24 or by passing a short detent through the opening 30 and into one of a plurality of openings provided therefor in the flange of the reel. A wrench is then applied to the upper squared end of shaft 18 so as to turn the shaft relatively to the reel. The pitch of the coacting threads on the shaft and reel may be such that each rotation of the shaft or each quarter rotation of the shaft relatively to the reel will change the depth at which the mine is exploded a given amount, as for instance, one foot. To facilitate obtaining the desired adjustment, the upper end of the shaft 18 may have a suitable scale marked thereon as is indicated at 31, in Figs. 2 and 3.

Another way by which an adjustment can be effected to cause explosion of the mine at the desired depth is by adding to the length of the cable 9 in such a way that the reel 25 will not be actuated while the mine is sinking in the water the distance necessary to take up this added length of cable. For instance, a patrol boat might carry an adequate supply of these depth mines all set for automatic firing at a depth of thirty feet. If it were found that firing at a greater depth was necessary by reason of the failure of the explosion of a mine at a depth of thirty feet to accomplish the desired result, another mine, similarly adjusted, would be prepared for launching by inserting a length of cable, say ten feet of cable, between the upper end of the cable 9 and the buoy 10. The mine and buoy would then be launched and while the mine was sinking ten feet, the reel 25 would not be rotated to cause vertical movement of the shaft 18. After the mine had descended ten feet, further descent would cause rotation of the reel in the manner heretofore described and the mine would be exploded at a depth of forty feet.

It will be appreciated that a depth mine of the character above described may be launched from an aeroplane as well as from a boat adapted to travel on the surface of the sea. The mine and its buoy may be dropped from an aeroplane into the sea, whereupon the mine would sink in the water while the buoy remains afloat, thus causing actuation of the automatic mechanism for firing the mine.

Submarine boats are sometimes attacked while resting upon the bottom of the sea. If a depth mine of the type above described were launched in an attack against a submarine resting on the bottom and the mine came in contact with the bottom before its firing mechanism was automatically actuated, the fact that the mine had not exploded would be known to the operators in the attacking boat on the surface from the absence of any bubble of gas rising to the surface, such as would follow the explosion of the mine under water. By simple tests, it could be determined whether or not the mine was resting on bottom and if this were found to be the fact, it would only be necessary for the operators in the patrol boat to pick up the buoy and pull in on the cable 9. This would cause actuation of the mechanism in the mine just as would occur as a result of sinking of the mine to a greater depth and the mine would be exploded while on the bottom at a depth somewhat less than that for which its automatic firing mechanism had been set. In this connection it may be pointed out that when a mine of the type referred to is exploded in the water at a substantial depth, as for instance, a depth of 100 feet, its explosion would involve no danger to the persons in a boat upon the surface of the sea directly over the mine.

When attacking a submarine boat with a depth mine of the type referred to, it sometimes occurs that as the mine sinks through the water it strikes the submarine boat and is supported thereby. This might result in failure of the mine to explode. With the construction of mine herein described, the operators of the patrol boat, on noting that the mine had not exploded, could return to the buoy and take it in tow, thereby drawing the cable 9 out from the casing of the mine. This would result in automatic firing of the mine although it had not sunk to the depth for which it had been set. This construction of mine therefore possesses this advantage over a construction in which the automatic firing of the mine is accomplished by hydrostatic means responsive to differences in the pressure of the water at different depths.

In the foregoing I have illustrated and described the construction and operation of the embodiment of my invention which at present seems best adapted for the attainment of the ends in view. This construction, however, may be changed in many re-

spects while still retaining the broader features of the invention. Furthermore, the invention is in no way limited with respect to the manner in which the mine embodying the invention is used or the particular purposes sought to be accomplished thereby. I have described the use of mines embodying the invention in destroying submarine boats which have been caught in submerged nets and while such mines are of special utility for that purpose, they are also adapted for various other uses.

I claim:

1. The combination of a mine which sinks when released in the water, a buoy, a flexible connection from the buoy to the mine, a reel in the mine with which the flexible connection cooperates, a threaded member which is moved axially by the rotation of the reel, and means for exploding the mine operated automatically in response to the axial movement of said member; substantially as described.

2. The combination of a mine which sinks when released in the water, a buoy, a flexible connection from the buoy to the mine, a reel in the mine with which the flexible connection cooperates, a threaded member which is moved axially by the rotation of the reel, a firing mechanism for the mine controlled by the axial movement of the threaded member, and means for adjusting the threaded member and the reel relatively to establish any one of a plurality of relations between them so as to regulate the depth at which the mine will be exploded; substantially as described.

3. A mine having a reel, a threaded shaft coacting with a threaded opening in the reel, a firing member detachably connected to the shaft, a primer for the mine with which the member cooperates, and means operated by a predetermined amount of axial movement of the shaft for operating the detachable connection between the shaft and the firing member so as to release the firing member and permit the same to operate; substantially as described.

In testimony whereof I affix my signature.

GIOVANNI EMANUELE ELIA.