Feb. 4, 1958 A. H. SELLMAN 2,821,920

MINE

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Fig. 1.

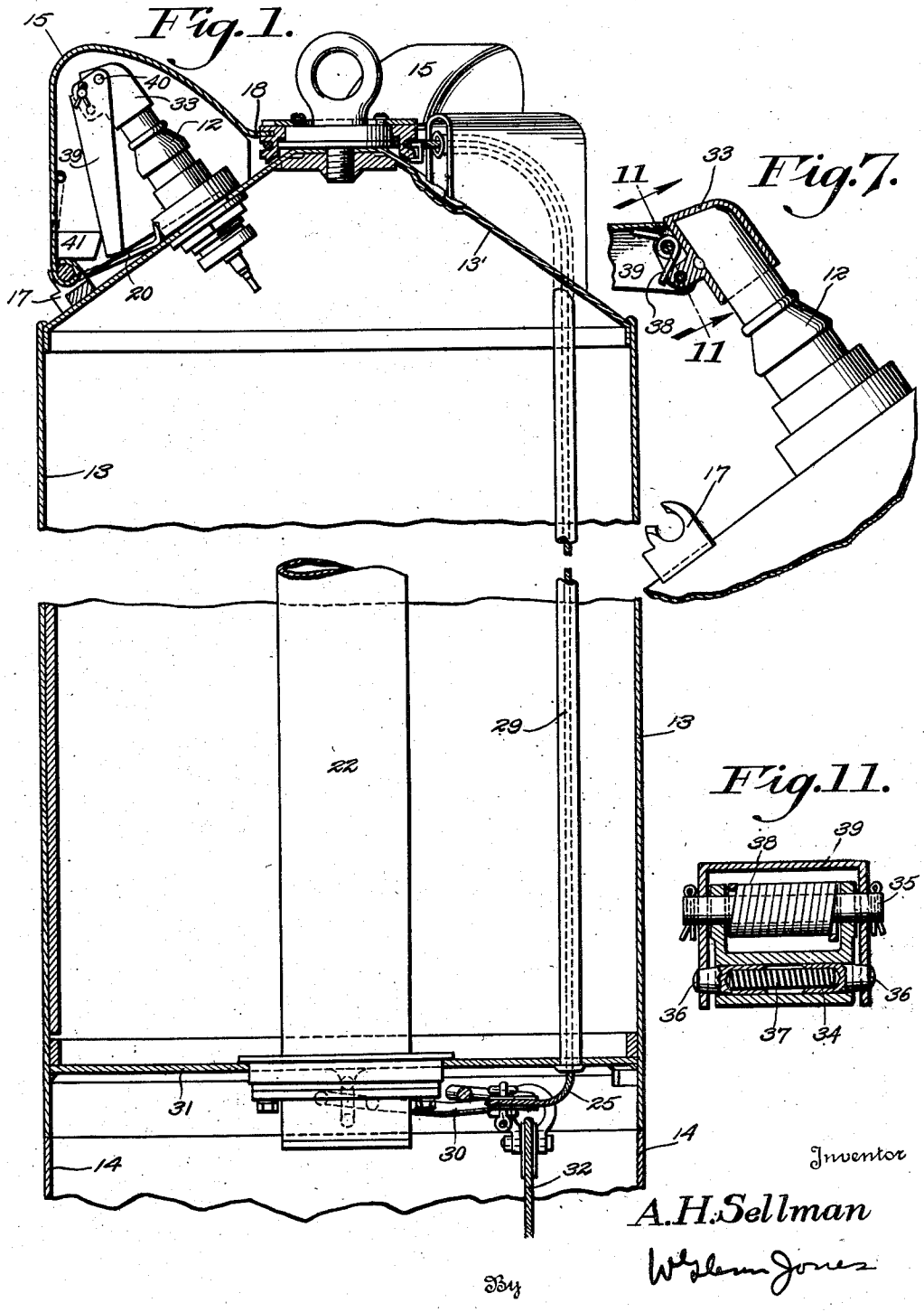

Fig. 7.

Fig. 11.

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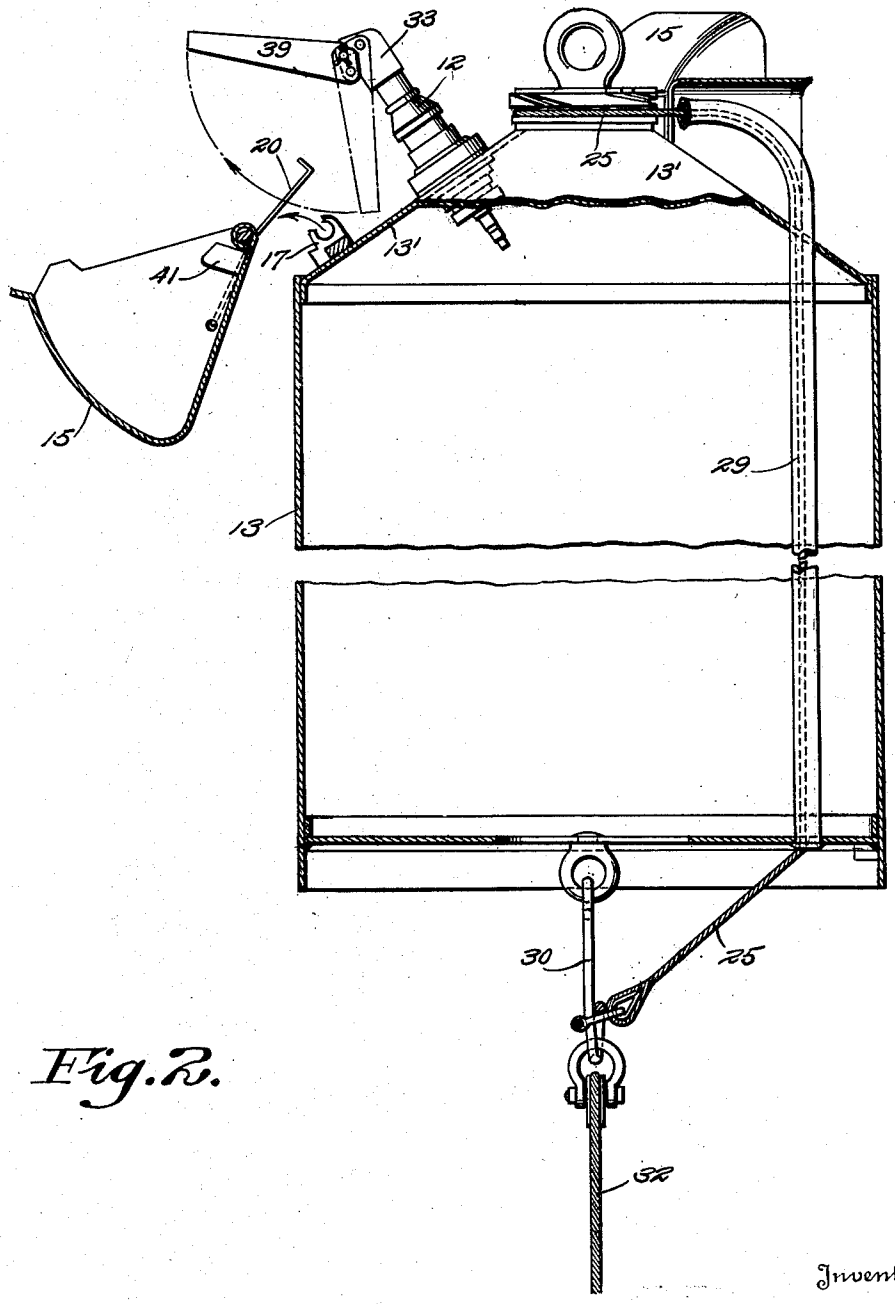

Fig. 2.

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Fig. 3.

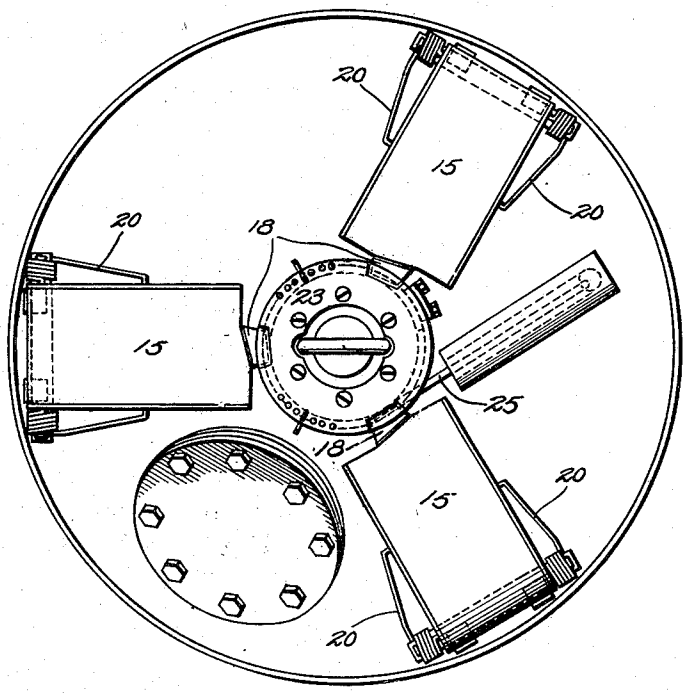

Fig. 4.

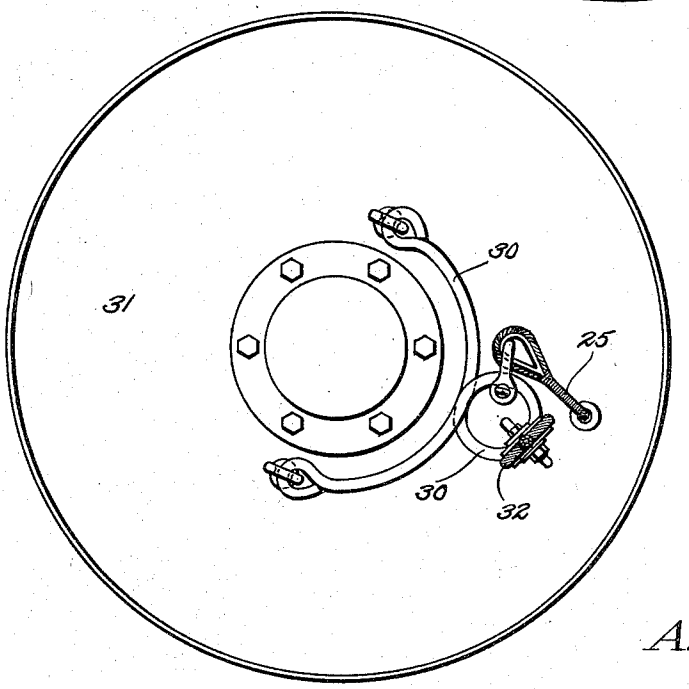

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Fig. 5.

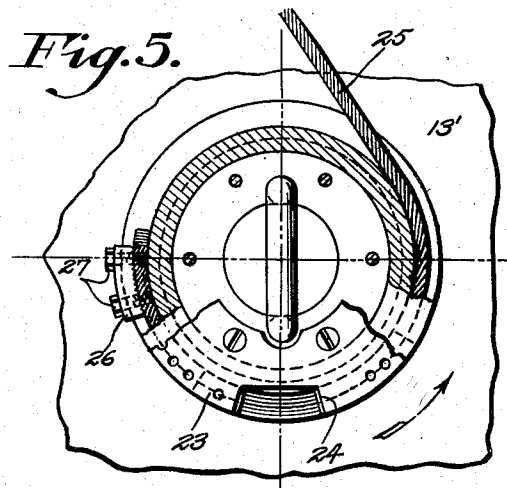


Fig. 9.

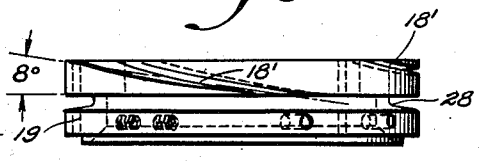


Fig. 10.

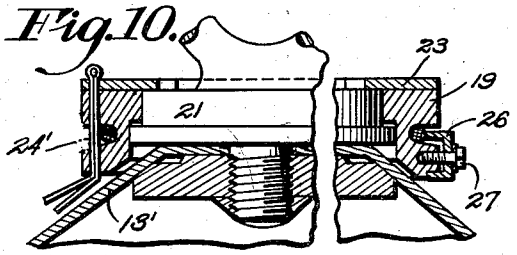


Fig. 8.

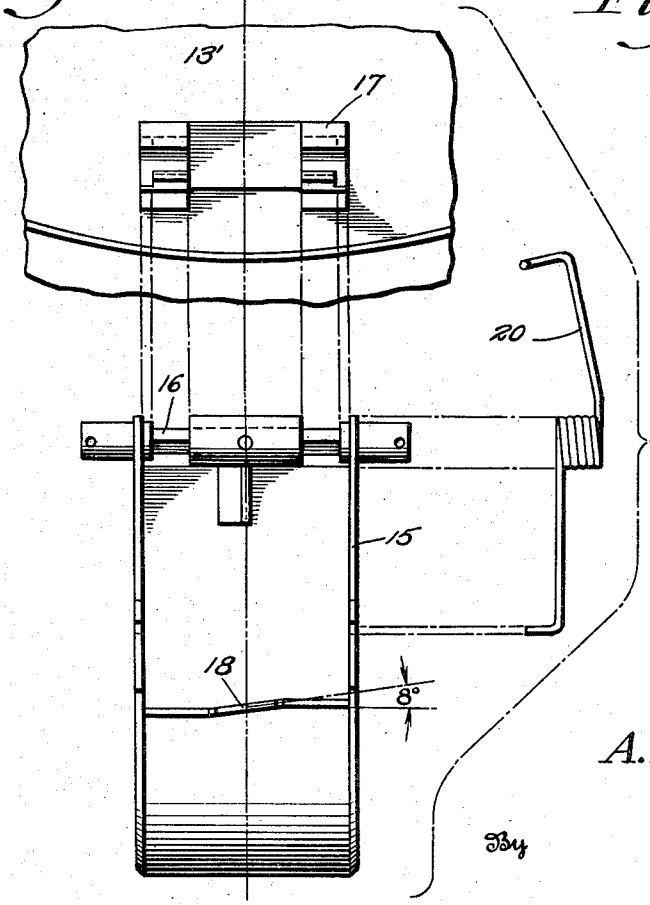
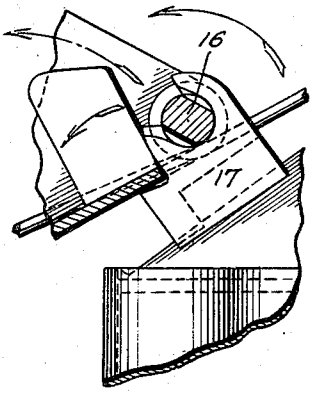


Fig. 6.



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United States Patent Office

2,821,920

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2,821,920

MINE

Albert H. Sellman, Washington, D. C.

Application August 5, 1940, Serial No. 351,481

14 Claims. (Cl. 102—17)

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

My invention relates generally to mines. It relates particularly to mines launched from torpedo tubes and to mines fitted with a firing device of the bendable horn type.

An object of my invention is to provide an improved device which increases the efficiency and sensitivity of mines having a bendable horn type of firing device.

Another object of my invention is to provide an improved device that increases the safety of mines having a bendable horn type of firing device, before such mines are launched and up to the time they reach their planted depth.

A further object of my invention is to provide an improved device that simplifies and accelerates mine planting procedure in the case of mines having a bendable horn type of firing device.

My invention is applicable to any type of mine using a bendable horn type of firing device, and is particularly applicable to mines utilizing the electro-chemical horn. This type of horn has a lead casing and a glass container which is partially filled with electrolyte. When a movable object strikes the horn with sufficient force to bend the horn, the container is broken and the electrolyte flows into a cell in the bottom of the horn. The addition of electrolyte to the cell produces an electromotive force which electrically fires the mine.

These horns must be sufficiently sensitive that they will be bent and the glass container broken when they are struck by a ship traveling at a low rate of speed. With horns of such sensitivity, it is necessary to provide protective covers for them to make mines using such horns as safe as possible during handling and storage. The prior practice has been to provide each such horn with a protective screw cover which is removed manually at the latest opportunity before the mine is launched.

The removal of such screw covers complicates and delays the mine planting procedure. Further, after the covers are removed, the horns are exposed to any bump or blow they may receive during the planting operation, such as, for example, the impact of the horn against the water when the mine is launched from the deck of a moving ship, or the accidental impact against the launching submarine itself when the mines are launched from the submerged torpedo tubes of this type of vessel.

Further, on torpedo tube mines, i. e., mines launched from torpedo tubes, the horns obviously must be so mounted as not to protrude radially past the contour of the mine case, not only for reasons of safety, but also to permit free movement of the mines through the tubes. However, with horns so mounted, it is possible that, after the mine is planted, a vessel may come in contact with the side of the mine case without touching the horns, and that the mine will roll along the side of the vessel without being detonated.

In order to avoid the above described undesirable features found on prior mines, I have invented a new and improved device which permits leaving the protective horn covers in place during the launching operation and

which removes these covers automatically when the mine reaches its set depth; and which further provides for each of the horns, an extension arm which automatically extends beyond the contour of the mine case when the horn cover is automatically removed.

My invention will be described as applied to a torpedo tube mine, as it is especially useful with mines of this type. However, my invention can be used with mines of other types using bendable horns as the means for firing the mine.

My invention will be described in connection with the following drawings, in which,

Fig. 1 is a longitudinal vertical sectional view of a torpedo tube mine fitted with my invention, with parts broken away and with the anchorage case, shown fragmentally, secured to the bottom thereof. Members are shown in their respective positions before launching;

Fig. 2 is a vertical sectional view of the mine of Fig. 1, showing the mine in the armed condition immediately after reaching its set depth;

Fig. 3 is a top plan view of the mine of Fig. 1, with the mine in the unarmed or safe condition;

Fig. 4 is a bottom plan view of the mine of Fig. 1, also in the unarmed condition;

Fig. 5 is a top plan view of the screw lock sheave, partially in section;

Fig. 6 is an enlarged detail view of a protective cover hinge, with a protective cover, shown fragmentally, in the position where it is about to spring out of the bearing in the hinge;

Fig. 7 is a side elevation of one of the mine horns, with the extension arm secured thereto, shown in fragmental section; in the armed position;

Fig. 8 is an exploded view showing a protective cover hinge, the protective cover projected outward therefrom, and with one of the protective cover springs shown projected to the right thereof;

Fig. 9 is a side elevation of the screw lock sheave;

Fig. 10 is a vertical sectional view through the sheave and locking ring showing the details of the cable clamping clip and also one of the split pins which lock the screw lock sheave against accidental rotation; and

Fig. 11 is a sectional view along line 11—11 of Fig. 7 and shows the details of the locking pins and actuating spring of a horn extension arm.

Referring to Figs. 1, 2, 6, 7 and 8, one or more electro-chemical horns 12, are mounted in the conical top 13' of mine case 13. The mine shown is fitted with three such horns 12. Anchorage case 14 is shown secured to the bottom of the mine case 13. Each horn 12 is provided with a removable protective cover 15, each cover being secured to a flattened hinge pin 16, Fig. 6, which rotates in a slotted hinge 17, secured to the conical top 13' of the mine case 13, near the outer edge thereof.

Each cover 15 has an integral tongue 18 which is a slidable fit in a spiral groove 18', Fig. 9, in rotatable screw lock sheave 19. Sheave 19 rotates about journal 21, Fig. 10, which is rigidly secured to the top 13' of mine case 13 and also to a vertical central shaft 22. Each cover 15 is provided with a pair of springs 20, Figs. 1, 2 and 8, which, when covers 15 are in place on the conical top 13' of case 13, tend to force such covers outward and upward away from the top 13' of case 13. Tongues 18 are so shaped as to slide freely in spiral grooves 18' in sheave 19, when the sheave is rotated.

A cover plate 23, Figs. 5 and 10, having three slots 24 therein through which tongues 18 pass freely, is secured to journal 21, above sheave 19. One or more slender split pins 24' pass through both cover 23 and sheave 19 to prevent accidental rotation of the sheave. These split pins are sheared by the action of the mine in seeking its

set level after it has been launched, as will be explained below.

A flexible cable 25, Fig. 5, one end of which is rigidly secured to sheave 19 by clamp 26 and bolts 27, Fig. 10, passes partially around sheave 19, fitting in a circumferential groove 28 therein, and then passes through a guard tube 29 to the bottom of the mine where its other end is secured to a loop in bail 30 in anchor case 14. Bail 30 is fastened to the bottom shell 31 of the mine, in such manner that it may oscillate freely in its fastenings. One end of anchor cable 32 is also secured to the loop of bail 30, the other end of such cable being secured to the mine anchor (not shown).

A cap 33, Figs. 1, 2 and 7, is rigidly secured to each horn 12 at its outer end. An integral extension 34, Fig. 11, of cap 33 is drilled to receive journal 35, spring pins 36 and spring 37, and is recessed to receive extension arm spring 38, which fits around journal 35, where the latter passes through the recessed portion of extension 34. An extension arm 39, a cross-section thereof having the general shape of an inverted U, Fig. 11, is pivoted on journal 35 and rotates freely thereon, except when locked by pins 36 as noted below. A pair of oppositely drilled holes 40, Fig. 1, in arm 39 receive tapered pins 36 when arm 39 is in its extended (armed) position, to prevent rotation of arm 39 about journal 35 after the mine is launched and has reached its set depth. Springs 38, Figs. 7 and 11, tend to force arms 39 outward and upward into their extended (armed) position, but when horn covers 15 are in place on the mine, a lug 41, Fig. 1, on each cover bears against the extension arm 39 contained therein and holds such arm in unarmed position within such cover, against the force of spring 38.

In operation, with the mine in the unarmed condition shown in Fig. 1, when the mine is planted, either from a torpedo tube or from the deck of a vessel, it sinks toward the bottom on account of the weight of the anchor contained within anchor case 14, there being, at this stage, no pull or strain on anchor cable 32. When the anchor is released (by a well known mechanism described in the prior art) after the mine has reached the bottom, or after the mine has sunk below a certain set depth, the anchor remains on or sinks to the bottom and the mine itself, being relieved of the weight of the anchor, rises toward the surface and continues to rise until there is a strain on anchor cable 32. When this occurs, bail 30 is pulled downward to the position shown in Fig. 2. Bail 30 pulls cable 25 with it, this movement of cable 25 causing sheave 19 to shear split pins 24' and to rotate in such direction as to cause tongues 18 to move upward in spiral grooves 18', until tongues 18 are free from grooves 18'. Actuated by springs 20, tongues 18 are caused to move upward and outward through slots 24, covers 15 and flattened hinge pins 16 rotating in slotted hinges 17. When hinge pins 16 have rotated through approximately 100 degrees (in the specific mine shown), the flattened portions of hinge pins 16 are in position to pass through the slotted portions of hinges 17, whereupon springs 20 force hinge pins 16 out of hinges 17 through such slots. With hinge pins 16 clear of hinges 17, springs 20 force the assembly of covers 15, hinge pins 16 and springs 20 clear of the mine case, Fig. 2, such assembly sinking to the bottom.

As covers 15 rotate outward with hinge pins 16, lugs 41 rotate with them, this movement of the lugs permitting the outer ends of extension arms 39 to move upward, actuated by springs 38. When covers 15 are ejected clear of the mine case, extension arms 39 rotate upward and outward about journal 35, until holes 40 are opposite pins 36. When this occurs, pins 36 are forced by springs 37 outward into holes 40 as far as the taper of pins 36 permits, such rigidly securing extension arm 39 against further rotation about journal 35, Fig. 11.

With covers 15 removed, and with extension arms 39 in the position shown in Fig. 2, the mine is fully armed, extension arms 39 now extending laterally past the contour of the mine case. As movement of the extension arms 39 is now restricted in all directions relative to horns 12, a vessel coming into contact with one of the extension arms will cause the upper end of the horn to which such arm is attached to be bent, such breaking the glass container within the horn, and detonating the mine as described above.

It will be noted that when the horn covers are in place on the mine, the horns and the extension arms connected thereto are fully protected from contact with external objects. After the mine is launched, and has reached its set depth, with horn covers automatically removed and extension arms 39 automatically fully extended in the armed position, the mine is much more likely to be detonated by a vessel coming into contact with it than it would be if extension arms 39 were not provided. It is thus evident that all the aforementioned objects have been fully attained in my invention.

Other modifications and changes in the number and arrangement of the parts may be made by those skilled in the art without departing from the nature of the invention, within the scope of what is hereinafter claimed.

The invention described herein may be manufactured and/or used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. In a mine having an anchor, an anchor cable and one or more bendable firing horns, a removable cover for each horn, each said cover having a flattened hinge pin and a tongue, a slotted hinge for each said pin secured to said mine, a sheave having a spiral groove therein for each said tongue, a journal rigidly secured to said mine, said sheave rotatable about said journal, said hinge pins engaging said hinges and said tongues engaging said grooves to hold said covers in place on said mine, means for rotating said sheave including a cable means connecting said sheave to said anchor cable, whereby after said mine has been launched and has risen to its set depth the strain on its anchor cable produces movement of said cable means and rotation of said sheave, the rotation of said sheave releasing said tongues from said grooves, spring means operative to disengage said hinge pins from said hinges and to eject said covers from said mine upon said tongues being released from said grooves, an extension arm hinged to each said horn, means including a spring operative upon the ejectment of said covers to extend each said arm laterally beyond the contour of said mine, and spring operated pin means for locking each said arm in extended position, said horns and said extension arms being contained within said covers while said covers are in place on said mines.

2. In a mine having an anchoring means and one or more bendable firing horns, a disengageably hinged cover over each said horn, each said cover including a tongued portion, a rotatable sheave secured to said mine, said sheave having a segmental groove arranged to receive the tongued portion of each said cover in releasable engagement, cable means arranged to rotate said sheave to disengage said tongues, spring means operable upon such disengagement to eject each said cover from said mine upon said mine rising to its set depth after being launched, said cable means being connected to said anchoring means, a spring operated extension arm for each said horn, said arms and said horns being contained within said covers while said covers are in place on said mine, said extension arms extending laterally beyond the contour of said mine upon the ejectment of said covers from said mine, and a spring operated means for locking each said arm in extended position.

3. In a mine having an anchoring means and one or more bendable firing horns, a removable protection cover over each said horn, each said cover including a tongued portion, means securing each said cover in protective position over the horn associated therewith, said securing

means including detachable hinge means and rotatable locking means secured to said mine and releasably engaging the tongued portion of each said cover, cable means arranged to rotate said locking means to release the cover tongued portion, spring means operable upon release of the tongued portion of each said cover to eject said covers from said mine upon said mine rising to its set depth after being launched, said cable means being connected to said anchoring means, a spring operated extension arm for each said horn, said horns and said arms being contained within said covers while said covers are in place on said mine, said arms extending laterally beyond the contour of said mine upon the ejectment of said covers, and a spring operated means to lock said arms in extended position.

4. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a cover therefor, releasable means connecting one side of the cover to the chamber, rotatable locking means journaled to said chamber, means releasably engaging the opposite side of each cover by said locking means, means controlled by the tension in the cable as the flotation chamber and anchoring means separate for rotating said locking means and means operable upon disengagement of the cover from said locking means to eject said cover from said flotation chamber and thereby expose said firing device.

5. The combination of claim 4 and including a shear pin assembly connecting said locking means to said chamber to prevent premature rotation thereof.

6. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a disengageably hinged cover including a tongued portion, rotatable locking means journaled to said chamber for releasably engaging the tongued portion of each cover, means for rotating said locking means, means connecting said rotating means to said mooring cable for operation in conjunction therewith, and means operable upon disengagement of the cover tongues to eject said covers from said flotation chamber and thereby expose said firing means.

7. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a disengageably hinged cover including a tongued portion, rotatable locking means journaled to said chamber for releasably engaging the tongued portion of each cover, a shear pin assembly for preventing premature rotation of said locking means, means for rotating said locking means, means connecting said rotating means to said mooring cable for operation in conjunction therewith and means operable upon disengagement of the cover tongues to eject said covers from said flotation chamber and thereby expose said firing devices.

8. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a disengageably hinged cover including a tongued portion, rotatable locking means secured to said chamber and releasably engaging the tongued portions of each cover, control cable means for rotating said locking means, means connecting said control cable to said mooring cable for operation in conjunction therewith, and means operable upon disengagement of the tongues to eject said covers from said flotation chamber and thereby expose said firing devices.

9. A submarine mine comprising an explodable flotation chamber, anchoring means connected to the chamber by a mooring cable, a plurality of firing devices on said chamber and protective apparatus for each said device comprising a cover therefor, releasable means connecting one side of said cover to said chamber and a tongue formed on the opposite side thereof, a rotatable sheave journaled to the chamber, said sheave including segmental grooves therein arranged to receive the tongued portion of each cover in releasable engagement, control cable means arranged to rotate said sheave to release said cover tongues, means arranging said control cable means for actuation in conjunction with the tensioning of said mooring cable upon separation of the flotation chamber and the anchoring means and means operable upon disengagement of the cover tongues to eject said covers from said flotation chamber and thereby expose said firing devices.

10. In a submarine mine, the combination comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable, one or more firing devices on said chamber and protective apparatus for each of said firing devices comprising a cover therefor, releasable means connecting one side of said cover to said chamber and a tongued portion formed on the opposite side thereof, a rotatable sheave journaled to the chamber, said sheave including segmental grooves therein for receiving the cover tongued portion in releasable engagement, control cable means for rotating the sheave, means connecting said control cable to said mooring cable for operation in conjunction therewith upon separation of the flotation chamber and anchoring means, and means operable upon disengagement of the tongues to eject said covers from said flotation chamber and thereby expose said firing devices.

11. The combination of claim 10 including a shear pin assembly engaging said sheave for preventing premature rotation thereof.

12. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a disengageably hinged cover including a tongued portion, a rotatable sheave having a segmental groove cut therein for receiving the tongued portion of each cover in releasable engagement, control cable means for rotating said sheave to disengage said tongues, means connecting said control cable to said mooring table for operation in conjunction therewith, and means operable upon disengagement of the tongues to eject said covers from said flotation chamber and thereby expose said firing devices.

13. In a submarine mine comprising an explodable flotation chamber, anchoring means connected to the flotation chamber by a mooring cable and one or more firing devices on said chamber, protective apparatus for each of said firing devices comprising a disengageably hinged cover including a tongued portion, a rotatable sheave having a spiral groove therein for receiving the tongued portion of each cover in releasable engagement, means for preventing premature rotation of said sheave comprising a stationary sheave cover plate and shear pin means engaging said plate and sheave, control cable means for rotating said sheave to disengage said tongues, means connecting said control cable to said mooring cable for operation in conjunction therewith whereby after said mine has been launched and the flotation chamber has risen to its set depth, the strain on the mooring cable will pull on the control cable, shearing said pin and permitting said sheave to rotate, and spring means operable upon disengagement of the tongues to eject said covers from said flotation chamber to thereby expose said firing devices.

14. The combination of claim 13 characterized by the fact that each said firing device comprises a bendable horn and a spring operated extension arm therefor, said arm being extended beyond the contour of the flotation

chamber after said cover plate has been ejected, and including means for locking said arm in its extended position.

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