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H. W. SEMON ET AL

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MINE ARMING MEANS

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FIG. 1.

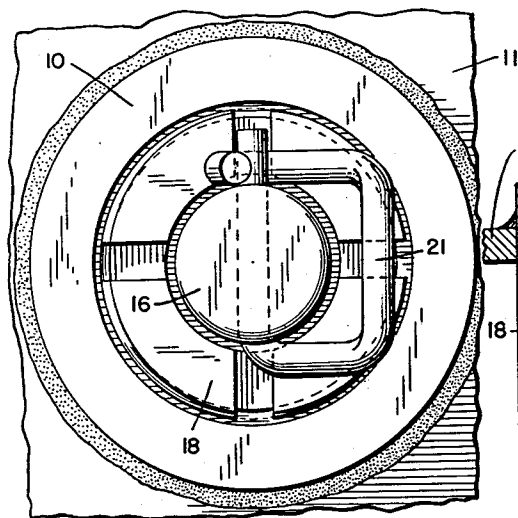


FIG. 2.

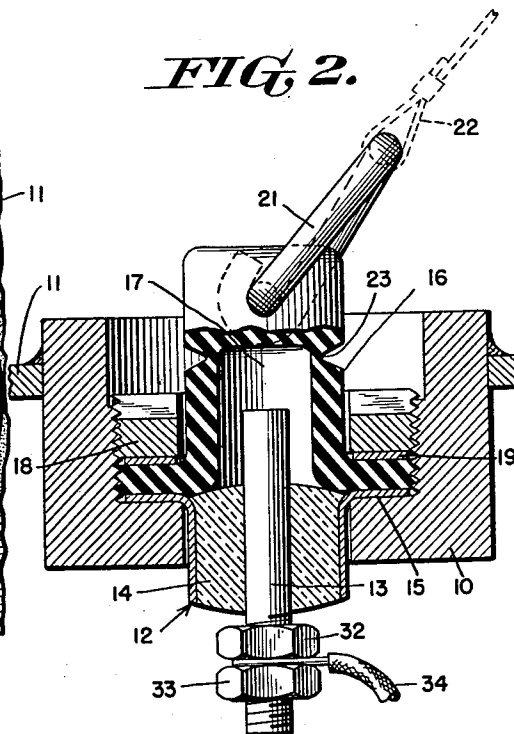


FIG. 3.

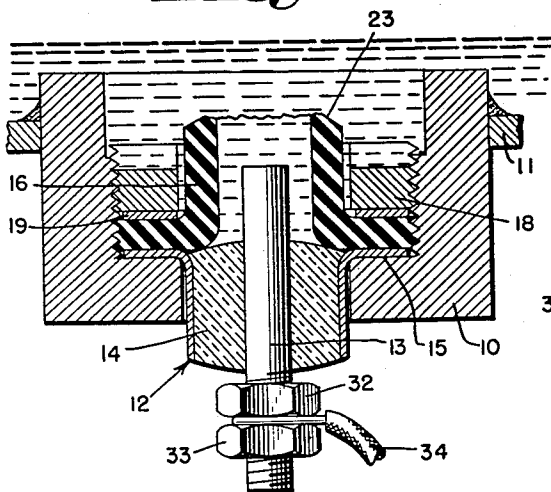
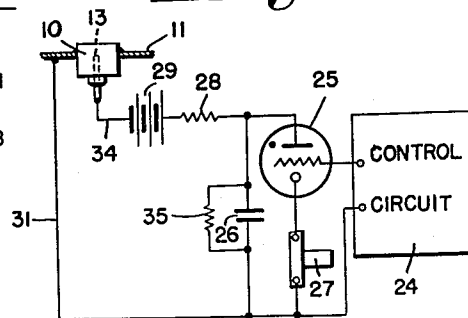


FIG. 4.



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MINE ARMING MEANS

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The present invention relates generally to underwater ordnance devices such, for example, as mines, depth charges and the like, adapted to be set into operation in response to a predetermined change in a physical variable. More specifically, the invention relates to a firing mechanism for a marine mine adapted to be planted from an aircraft in flight and in which the firing circuit thereof is electrically armed after the mine has been submerged in a body of water.

In certain types of firing control systems hitherto known or used in connection with underwater ordnance devices such, for example, as a marine mine, it has been the usual practice to employ an energy storage device adapted to render the firing circuit thereof effective when a signal corresponding to a predetermined change in a physical variable is received by the mine, energy being stored in the aforesaid energy storage device prior to the launching of the mine. Such systems have not proved entirely satisfactory under all conditions of operation and particularly in the use of a shallow water mine wherein the possibility arises of the mine landing on terra firma and exploding prematurely.

In the arrangement of the present invention, an energy storage device is utilized to supply energy to the firing circuit of a marine mine, energy being prevented from storing in the energy storage device, however, until an interval has elapsed after the mine has been planted in a body of water. The delay in storing energy in the energy storage device is provided by a conductivity switch connected in circuit with the energy storage device and comprising an insulated terminal located exteriorly of the mine case, the terminal being shorted to ground at the mine case by the conductivity of the water when the mine is submerged. A protective covering is provided for a portion of the terminal to prevent the terminal from shorting to ground in a moist atmosphere prior to the launching of a mine employing the device of the present invention, means further being provided for removing the covering during the launching operation of the mine thereby to expose the terminal to the surrounding medium.

It is an object of the present invention to provide new and improved means for arming the firing mechanism of a marine mine.

Another object is to provide a new and improved firing mechanism for a marine mine in which the firing circuit thereof is electrically armed a predetermined interval after the mine has been submerged in a body of water.

A further object is the provision of a mine firing mechanism in which an energy storage device is arranged to supply energy to the firing circuit thereof, energy being stored in the energy storage device after the mine is submerged in a body of water.

A still further object is the provision of an aircraft planted marine mine in which the mine is placed in a condition to be armed as it falls away from the aircraft.

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A still further object is to provide an aircraft planted marine mine in which arming of the mine in a moist atmosphere prior to planting thereof is prevented.

Additional objects, advantages and improvements will become more clearly apparent as the description proceeds, reference being had to the accompanying drawings of which:

Fig. 1 is a top plan view of the conductivity switch employed in the system of the present invention;

Fig. 2 is a vertical sectional view, with certain parts in elevation, of the switch shown in Fig. 1;

Fig. 3 is a view similar to that of Fig. 2 showing the conductivity switch submerged in water with the safety cap partially broken away; and,

Fig. 4 shows in diagrammatic form a complete electrical system suitable for use with a marine mine.

Referring now to the drawings wherein like characters of reference refer to like parts throughout the several views and more particularly to Figs. 1-3 inclusive, the numeral 10 designates a metallic cup-shaped member arranged within a suitable well in the mine case 11 and rigidly secured thereto in watertight relation therewith as by welding. An electrode assembly generally designated by the numeral 12 is arranged within an opening provided in the bottom of the member 10 and comprises an electrode 13 composed of any suitable conductive material and held in a fixed position by a seal 14. Seal 14 may be of any type suitable for the purpose such, for example, as a Kovar seal, the seal comprising a flanged portion 15 by means of which the electrode assembly is supported on the member 10. A cap 16 composed of any suitable resilient material such, for example, as rubber is arranged within the member 10 and is provided with a hollowed-out portion 17 adapted to receive the electrode 13, the member 10 being internally threaded to receive a ring nut 18 by means of which the cap 16 and electrode assembly 12 are secured to the member 10. A suitable washer 19 is disposed intermediate the nut 18 and cap 16 to facilitate adjustment of the ring nut. By reason of the foregoing arrangement, an effective seal is provided between the electrodes of the switch whereby water is prevented from seeping into the interior of the mine through the switch. Moreover, it will be appreciated that cap 16 provides a moisture-proof covering for that portion of electrode 13 disposed exteriorly of the mine case whereby conduction between the electrodes is prevented until the covering is removed.

The upper extremity of the cap 16 is provided with a hole through which extends a hook 21, the hook being adapted to be secured to a static line 22 of a parachute such that when a mine employing the conductivity switch is launched from an aircraft in flight the shock produced by the launching will cause the upper extremity of the cap 16 to be broken away at the point 23 where the cap is relieved for this purpose.

Fig. 4 illustrates in diagrammatic form a complete electrical system suitable for use with a marine mine and comprising a mine firing circuit, hereinafter to be described, and the aforescribed conductivity switch which is adapted to control arming of the firing circuit. The system further comprises a suitable control circuit 24 adapted to initiate the operation of the mine firing circuit when predetermined changes in a physical variable are detected thereby. The firing circuit comprises an electron discharge device 25, a condenser 26 and a suitable electroresponsive detonator 27. It will be understood that the control circuit may be of any type suitable for the purpose and may take the form of a circuit in which a control circuit responsive to sound signals received through the surrounding water is adapted to render an associated firing circuit effective when the sound signals received are of predetermined amplitude time char-

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acteristics. The electron discharge device 25 is preferably a three element, gaseous discharge tube adapted to be rendered conductive in a well known manner by the control circuit 24. The condenser 26 is normally discharged and is adapted to be charged through a suitable resistor 28 by battery 29 when the charging circuit of the condenser is completed through the conductivity switch to the negative terminal of battery 29 by way of a conductor 31 grounded to the mine case 11, the circuit continuing through the mine case, the cup-shaped member 10 and electrode 13 with the water in which the mine is submerged acting as an electrolyte therebetween and thence by way of conductor 34 to the battery. The lower extremity of the electrode 13 is threaded to receive the nut 32 which is arranged as a backstop for another nut 33, the conductor 34 being arranged therebetween.

For the purpose of description, let it be assumed that a marine mine employing the system shown in Fig. 4 is to be launched from an aircraft in flight, and that a parachute is secured thereto for this purpose, the static line 22 thereof being secured to the hook 21 of the conductivity switch. As the mine falls away from the aircraft, the resulting shock causes the upper extremity of the safety cap 16 to be broken away thereby exposing the electrode 13 to the surrounding medium. When the mine strikes the water and begins to descend therein, the charging circuit of condenser 26 is completed through the conductivity switch with the surrounding water acting as an electrolyte, the charging circuit being traced over the following path: positive terminal of battery 29, resistor 28, condenser 26, conductor 31, mine case 11, cup-shaped member 10, through the surrounding water, electrode 13, conductor 34, from whence the circuit is completed to the negative terminal of battery 29.

A predetermined interval after the mine has become submerged in the water, condenser 26 will have obtained its maximum charge, such predetermined interval being controlled substantially by the value of the resistor 28. When this occurs, the firing circuit is electrically armed. When the control circuit 24 thereafter detects a predetermined change in a physical variable the tube 25 is caused to conduct in a well known manner, thereby causing condenser 26 to discharge through the tube and the electroresponsive detonator 27 to fire the mine.

Under certain conditions, the arrangement of the component parts of the system shown in Fig. 4, may be such as to make it desirable to prevent a charge from building up on condenser 26 as a result of leakage paths. For this reason, resistor 35 is shunted across condenser 26 to bleed off any charge thereon resulting from current flow thereto by way of such leakage paths.

From the foregoing it should now be apparent that a system for the delayed arming of a mine has been provided which is well adapted to fulfill the aforesaid objects of the invention.

While the invention has been described in particularity with reference to an example thereof which gives satisfactory results, it readily will be apparent to those skilled in the art to which the invention appertains, after understanding the invention, that further embodiments, modifications, and changes may be made therein without departing from the spirit and scope thereof as defined by the claims appended hereto.

The present invention 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. A conductivity switch of the character disclosed comprising, an electrode of cylindrical configuration, a second electrode, means for detachably supporting the second electrode in concentric relation with respect to the cylindrical electrode, said supporting means including means for electrically insulating the electrodes from each other,

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and a cover for a portion of one of the electrodes for preventing conduction between the electrodes in a conducting medium and adapted to be held in position with respect thereto by said supporting means, said cover having a removable portion for exposing the said portion of one of the electrodes to the conducting medium upon removal thereof.

2. A conductivity switch of the character disclosed adapted for use with an underwater ordnance device and comprising, in combination, a member forming one electrode of said switch and carried by said device in such a manner to expose a portion of the electrode to the surrounding water, an elongated electrode carried by said first electrode and insulated therefrom, and means covering one end of said elongated electrode, said covering means being so constructed as to expose said one end of the elongated electrode to the surrounding water when a sudden force is applied to the covering means and adapted to prevent the other end of said elongated electrode from contacting said water.

3. In a marine mine, the combination of, a condenser, a discharge path for said condenser including electroresponsive detonating means, a charging circuit for said condenser, means included in said charging circuit for preventing the storing of energy in said condenser until after said mine is submerged in a body of water, and means for discharging said condenser when a predetermined change in a physical variable is produced within the surrounding water.

4. In a marine mine, the combination of, a firing circuit, a control circuit adapted to initiate the operation of said firing circuit when a predetermined change in a physical variable is detected thereby, a condenser included in said firing circuit and adapted to supply energy thereto when the operation of the firing circuit is initiated, a charging circuit for said condenser, and means included in said charging circuit and adapted to render the charging circuit effective to charge the condenser after said mine has been submerged in a body of water.

5. In a marine mine, a system for delaying arming of said mine comprising, in combination, a control circuit responsive to changes in a physical variable, a firing circuit adapted to be set into operation by said control circuit when a predetermined change in said physical variable is detected by said control circuit, a condenser included in said firing circuit for rendering the circuit effective to be set in operation when a predetermined charge obtains thereon, a source of power for charging the condenser, and means effective after said mine is submerged in a body of water for connecting electrically said source of power to said condenser.

6. In a marine mine, the combination of, a casing for said mine, an electrical terminal disposed exteriorly of said casing and insulated therefrom, a normally discharged condenser, a discharge path for said condenser including electroresponsive detonating means, a charging circuit for said condenser including said casing and said terminal and effective when said mine is immersed in a body of water to cause energy to be stored in the condenser, and means for discharging said condenser when a predetermined change in a physical variable is produced within the surrounding water.

7. In a marine mine adapted to be launched from an aircraft in flight, the combination of, a casing for said mine, an electrical terminal disposed exteriorly of said casing and insulated therefrom, a mine firing circuit, a condenser for arming said firing circuit when a predetermined amount of energy is stored therein, a charging circuit for said condenser including said casing and said terminal and effective when said mine is immersed in a body of water to store said predetermined amount of energy in the condenser thereby to arm said firing circuit, and means for sealing off said terminal from the surrounding medium until said mine is launched from said craft.

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8. In a marine mine adapted to be planted from an aircraft in flight, the combination of, a casing for said mine, an electrode disposed exteriorly of said casing and insulated therefrom, a normally discharged condenser, a discharge path for said condenser including electrore-
sponsive detonating means, a charging circuit for said condenser including said casing and said electrode and effective when said mine is immersed in a body of water to cause energy to be stored in the condenser, means for discharging said condenser when a predetermined change in a physical variable is produced within the surrounding water, and means for sealing off said electrode from the surrounding medium until said mine is launched from said craft.

9. In an underwater ordnance device, the combination of, a source of power; a firing circuit including power storage means; a control circuit adapted to initiate the operation of said firing circuit in response to a predetermined change in a physical variable; means for supplying a portion of said power to said power storage means comprising a pair of electrodes having portions adapted to be exposed to and electrically connected by surrounding water; means for electrically insulating said electrodes with respect to each other; frangible cover means for sealing off one of said electrode portions from the surrounding medium; and means for breaking said covering means to allow water to surround and electrically connect said electrodes.

10. A conductivity switch of the character disclosed adapted to operate in a conducting medium comprising, a pair of electrodes each having outer and inner portions, means for preventing the inner portions of the electrodes from contacting said conducting medium and for electrically insulating said electrodes with respect to each other, frangible cover means for sealing off one of said outer portions from the surrounding medium, and means for breaking said cover means to allow said conducting medium to surround and electrically connect said electrodes.

11. A conductivity switch of the character disclosed comprising an elongated electrode, means including an annular electrode for supporting said elongated electrode on said switch, frangible cover means for sealing off said

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elongated electrode from the surrounding medium, and means for breaking said cover means to allow a conducting medium to surround and electrically connect said electrodes.

12. A conductivity switch of the character disclosed adapted to operate in a conducting medium comprising, a pair of normally inactive electrodes electrically insulated from each other, frangible means for sealing off one of said electrodes from said medium, said electrodes being rendered effective by said medium as the frangible means is fractured and the medium contacts said electrodes, and means connected to said frangible means for fracturing the frangible means.

13. A conductivity switch of the character disclosed adapted to operate in a conductive medium comprising, an annular electrode, an elongated electrode supported on the switch and centrally disposed in said annular electrode, means for supporting and electrically insulating said elongated electrode from the annular electrode, frangible means for sealing of said elongated electrode from said medium, and means for fracturing said frangible means to allow said conducting medium to surround and electrically connect said electrodes.

14. A conductivity switch of the character disclosed adapted to be operated in a conductive medium comprising, an annular electrode, an elongated electrode centrally disposed in said annular electrode and insulated therefrom, a cover for sealing of said elongated electrode from said medium, an annular weakened portion on said cover, and means for fracturing the cover at said weakened portion to allow the medium to surround and electrically connect said electrodes.

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