

[54] **HOLLOW CHARGE MINES FOR MULTIPLE DEPLOYMENT**

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[58] Field of Search 102/70.2, 70.2 P, 70, 19.2, 102/4, 7.4, 8, 18, 74, 75, 82, 9, 70.2 C, 6 A

[56] **References Cited**

UNITED STATES PATENTS

1,682,560	8/1928	Gruber.....	102/8
3,001,476	9/1961	Boykin.....	102/19.2 X
3,089,421	5/1963	Robinson, Jr.	102/70.2 P

3,125,953	3/1964	Foerster.....	102/19.2 X
3,252,418	5/1966	Terrioux.....	102/18 X
3,282,211	11/1966	Winston.....	102/70.2 R X
3,557,697	1/1971	Joyner.....	102/4 X

FOREIGN PATENTS OR APPLICATIONS

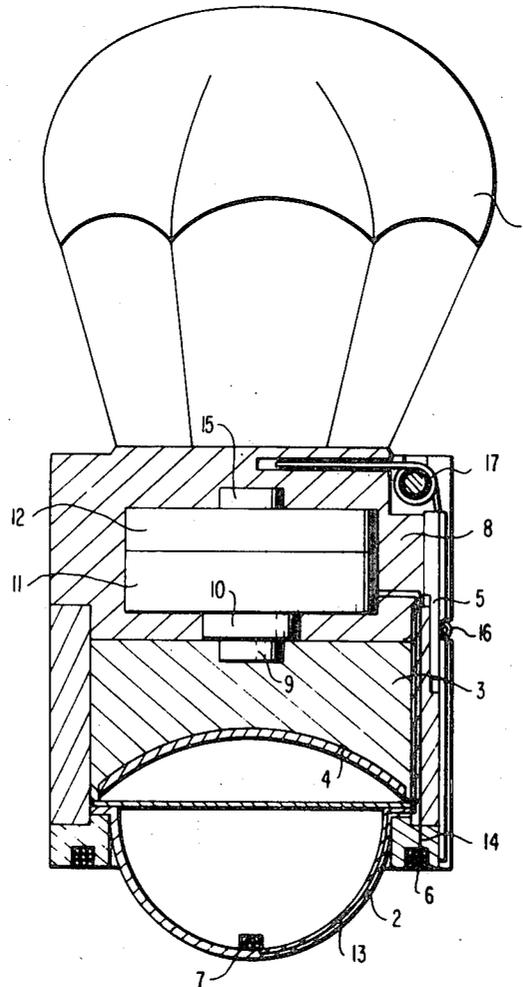
2,071,291	8/1971	France.....	102/8
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[57] **ABSTRACT**

A hollow charge mine for multiple deployment situations having positioning elements, primary sensor system and at least one secondary sensor system. In one deployment situation, the secondary sensor system is operational for sensing a target and detonating the mine and in another deployment situation the primary sensor system is operational for sensing a target and detonating the mine. The mine includes a timing device for controlling the operation of the positioning elements for positioning the mine and for activating the primary sensor system after a predetermined time interval as well as for deactivating the secondary sensor system.

17 Claims, 4 Drawing Figures



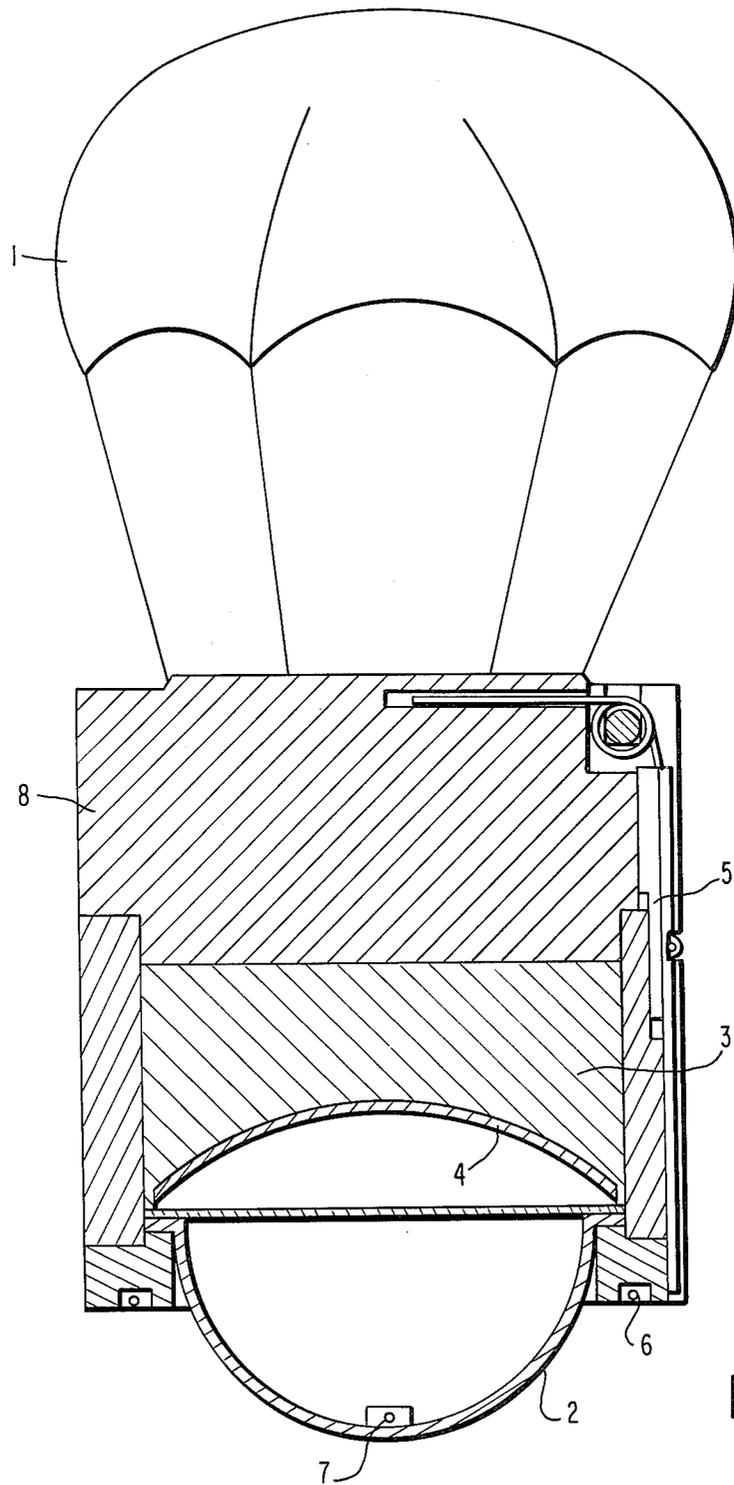


FIG 1

FIG 2

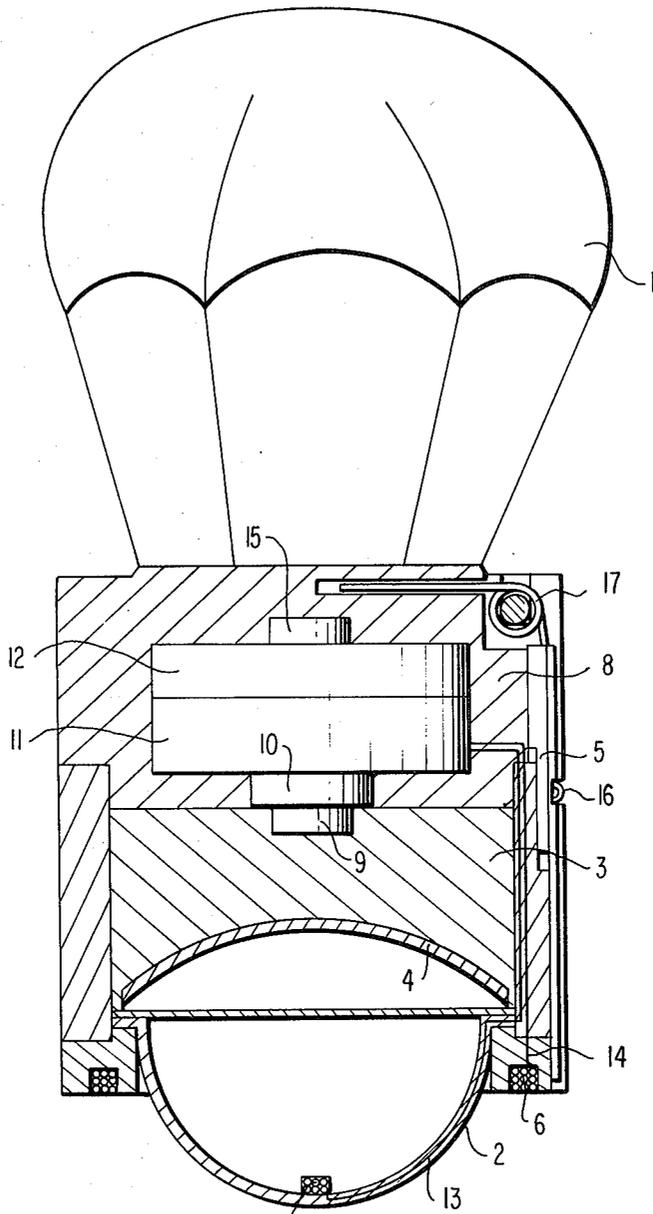


FIG 4

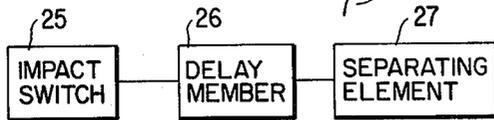
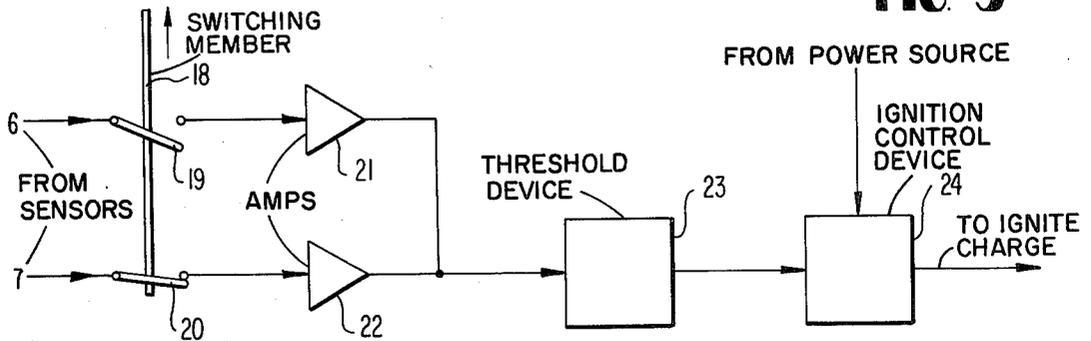


FIG 3



HOLLOW CHARGE MINES FOR MULTIPLE DEPLOYMENT

The present invention relates to hollow charge mines having positioning elements and at least two sensor systems for multiple deployment of the mine especially for use as antitank mines.

Hollow charge antitank mines have been known which are laid by missiles, airplanes, projectiles, or other carrier systems and position themselves on the ground, after a preselectable time after hitting the ground, in such a manner that the effective direction of the hollow charge mine points upward to the target or object to be attacked such that the target contacts the stationary mine for detonation. On the other hand, effective hollow charge elements are known which hit or detonate in the region of the target to be attacked from above, as well as hollow charge missiles and hollow charge projectiles which become effective upon direct impingement in the target.

These conventional types of hollow charge elements heretofore have offered only one possibility of deployment, i.e. as a stationary mine or as a deliverable mine, so that the logistics had to contend with storage and the bringing up of supplies of various types of hollow charge ammunition.

It is therefore an object of the present invention to reduce the large variety of hollow charge ammunition required for different purposes and thus simplify the storage and supply thereof.

It is another object of the present invention to provide multiple deployment possibilities for hollow charge ammunition and thereby simplify the logistics in effective hollow charge material.

According to a feature of the present invention hollow charge ammunition such as hollow charge antitank mines are provided with positioning elements and a conventional sensor system and with at least one further, secondary sensor system effective in case of a direct-hit or impact position, so that additional utilization and deployment of the mine is effected.

In accordance with the present invention, the hollow charge mine is first carried, as a hollow charge ammunition, to the object or target to be attacked and in response to a suitable secondary sensor system, becomes effective and detonates in case of a good target hit position. However, in case the target has been missed, the mine is then automatically brought into the desired stationary position by means of the positioning elements, and simultaneously the primary sensor system is rendered functional.

According to the present invention, a great variety of carrier systems can be utilized for delivering the hollow charge mines of this invention to the target to be attacked. The mines can be dropped, for example, from airplanes, missiles, projectiles, or by hand. In this connection, the type of secondary sensor system is dependent on the effective direction and/or impingement position of the hollow charge mine, such as, for example, after the direct hit or impact position in case of projectiles or after impingement from above in case of bombs, and on the type of the object to be attacked. In the case of antitank action, for example, a conventional secondary approximation sensor responsive to metals can be employed which, after missing the target is optionally disarmed during the stationary positioning of the mine, while the primary sensor is armed at the same time.

The advantages attainable by the present invention reside, in particular, in that the diversity of the types of hollow charge ammunition required can be reduced, and a single hollow charge element is available for several uses and which is capable of selectively assuming a different operational use due to the combination of two sensor systems.

These and further objects, features and advantages of the present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, several embodiments in accordance with the present invention, and wherein

FIG. 1 is a schematic sectional view of hollow charge ammunition in accordance with an embodiment of the present invention;

FIG. 2 is a schematic sectional view of hollow charge ammunition in accordance with another embodiment of the present invention and illustrating further features of the present invention;

FIG. 3 is a schematic block diagram of the electronic circuit arrangement in accordance with the present invention; and

FIG. 4 is a schematic block diagram of the impact detecting and separating arrangement according to the present invention.

Referring now to the drawings wherein like reference numerals are utilized to designate like parts throughout the several views, and in particular to FIG. 1, wherein there is illustrated hollow charge ammunition in the form of a hollow charge antitank mine intended for being dropped from missiles or like carriers. The mine which may have a cylindrical configuration includes a mine body 8, a primary contact sensor and detonator system 6, and positioning elements 5 for setting the mine upright in a stationary position after impinging on the ground, while simultaneously causing the primary sensor system 6 to be positioned and activated for arming the mine.

In order to reduce the energy of the fall from the carrier, the mine is provided with a parachute 1 or like member and, for reducing the accelerative forces upon impingement on the ground and thus for preserving the explosive charge and the remaining elements, the mine is provided with an elastic hemispherical or cup member 2 disposed above the hollow charge 3 having an insert member 4. The member 2 also ensures that the mine will always lay on its lateral surface after impingement on the ground so that the positioning elements 5 can function properly. The parachute is attached to the hollow charge mine in such a manner that the hollow charge is oriented toward the object to be attacked during falling and may either remain attached to the mine or be released in the manner known in the art. The positioning elements 5 which are arranged about the lateral surface of the mine are folded inwardly during the dropping of the mine. The secondary sensor system 7, including for example an electronic proximity detector or like detector, is arranged at the elastic hemispherical member 2 (oriented downwardly during the fall). Such detectors, which are conventional in the art, respond to metals at a distance of 10-50 mm. and trigger the hollow charge mine upon a direct impact or hit position of the mine onto the target. If the mine impinges on the ground rather than on the metallic target, the mine is set upright by the positioning elements 5 which may be of the type disclosed in German Offenlegungsschrift

1800121. The positioning elements are activated after a given time predetermined by a timing device which can consist, for example, essentially of an RC-member and the primary sensor system responsive to moving targets to be attacked from below is positioned or extended, i.e. the normal deployment for an antitank mine. Optionally, coupled with the electrical impulse for positioning the hollow charge mine, the proximity detector is inactivated. Although the sensor 6 is illustrated as being adjacent the member 2, the sensor may also be positioned on the lateral surface of the mine or on the positioning elements and extended thereby.

As shown in FIG. 2, the mine is further provided with a primer charge 9, an initiating charge 10, an electronic circuit 11, an electrical energy supply source 12 such as a battery or the like interconnected with electronic circuit 11, and leads 13 and 14 connected respectively to the secondary sensor 7 and the primary sensor 6. The secondary sensor which may be a contact detector, a proximity detector of the inductive or capacitive type, or like detector is illustrated as an inductive proximity detector having a small annular coil which is influenced by the target object to be attached from above. The small annular coil is connected to the electronic circuit 11, which also includes the remaining sensor system components via the leads 13. The leads 13 are, in part, vulcanized within the elastic cup member and are also guided through the mine body 8 through corresponding bores. Similarly the leads 14 pass through the mine body 8 for connection with the electronic circuit 11 and the primary sensor 6. The primary sensor which may include a contact detector, proximity detector or like detector, is illustrated in FIG. 2 as an inductive proximity detector having an annular coil. However, the primary sensor is provided with an increased detection range over that of the secondary sensor. That is, the secondary sensor is arranged for small distance operation requiring practically impingement or contact situations with the target, whereas the primary sensor is operational at larger distances as for example, when a tank rolls over the mine without actually contacting the mine. Of course, the primary sensor may also be in the form of a contact sensor as in the FIG. 1 arrangement.

If the mine, when dropped, impinges directly or is in close proximity to a tank, for example, the secondary sensor responds and effects detonation. However, if the mine falls to the ground so that the coil of the sensor 7 does not respond, a switch device 15 including an impact switch 28 which is closed by the deceleration during impingement and which switch initiates via an optionally adjustable time delay member 26 e.g. electronically by means of an RC-member of the switch device or pyrotechnically by means of a pyrotechnical delay line, a separating element 27 which releases a restraining cord 16 or the like for the positioning elements 5, so that the elements unfold laterally under the effect of the springs 17 and thus position the mine into its combat position. The time delay member of the switch device 15 for releasing the restraining cord 16 is provided to ensure that the mine has come to rest on the ground, in any event, prior to the positioning process. Suitable separating elements are known and may for example be of the type disclosed in British Pat. No. 1,263,771 and which are extended through eyes arranged at the two ends of the restraining cord.

Upon the unfolding of the positioning elements 5, a switching member 18, as shown in FIG. 3, which is under spring tension is released and is thereby displaced for example, radially toward the outside in the mine housing, closing the switch 19 and opening switch 20 and thereby switching the electronic circuit over from the secondary sensor 7 to the primary sensor 6. Each sensor 6 and 7, as shown in FIG. 3 which is a block circuit diagram of the electronic circuit 11, is provided with a respective amplifier 21 and 22 adapted to its characteristic. However, it is also possible to use the same amplifier for both sensors in certain cases. By means of the switch-over process, the primary sensor 6 is activated or armed, while the secondary sensor is deactivated or disarmed. This disarming has the advantage that at least part of the electronic circuit can be utilized for both types of sensors. As shown in FIG. 3, the armed or activated sensor provides an output signal via the respective amplifier to a threshold device 23 such as a Schmitt trigger circuit which provides an output signal when the predetermined threshold value is attained. The output signal of the threshold device is supplied to an ignition control device 24 such as the control electrode of a thyristor for turning on the thyristor and permitting current flow from the power source 12 to the detonating arrangement as for example, igniting the primary charge 9.

It can thus be seen that in accordance with the present invention, a conventional hollow charge mine is provided with at least one additional, secondary sensor system which becomes effective upon a direct hit position. Thus, it is possible to employ a single type of ammunition as an attack ammunition, as well as an "ambush" ammunition. If the mine of the present invention, when dropped from the air, does not hit a tank or the like, the secondary sensor system does not respond, i.e. a direct attack does not take place. Instead, the mine then assumes its combat position on the ground and remains in ambush until the primary sensor system responds, for example due to a tank rolling over the mine, thereby triggering the detonation of the mine. In addition to the fact that the present invention provides a simplification in military material logistics since it is no longer necessary to supply troops with two different types of ammunition, there is an additional, substantial advantage that heretofore an attack ammunition was in effect lost without military worth upon missing the target, while it is now possible to make this ammunition fully effective as an ambush ammunition.

It should also be noted that in accordance with the present invention a guided or unguided missile may be equipped with a hollow charge as the warhead, constructed identically or similarly to the above-described mines and the secondary sensor system can be a conventional impact detonator or one of the aforementioned proximity detectors. Such warheads are detached after impingement on the ground, from the carrier portion and extend the positioning elements and a contact sensor as a primary sensor system. At the same time, the secondary sensor system can be deactivated in the manner indicated above.

The invention, of course, is not limited to the combination of the above-described sensor systems since any possible sensor system combination can be chosen, depending on the type of deployment of the hollow charge mine. Additionally, the hollow charge mines of the present invention are not only utilizable for com-

bating targets on land, but are also suitable for combating submarines and ships, wherein the mine is watertight and in the first deployment situation is placed on the sea bottom while in the second deployment situation, is made boyant in the manner known in the art. For example, weighting members may be released after a predetermined time interval permitting the bouyant mine to float upwardly. The positioning in the combating of surface vessels can be accomplished by means of the elastic hemispherical member 2 illustrated in FIGS. 1 and 2, which can also be constructed to ensure the buoyancy of the hollow charge mine.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It should therefore be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

We claim:

1. A hollow charge mine for multiple deployment situations comprising a hollow charge, positioning means for positioning said mine in a position corresponding to a first deployment situation in which said mine is substantially stationary and a movable target moves toward said mine, primary sensor means being operational in at least said at least said first mine deployment situation for detonating said mine in response to the detection of the movable target, and at least one secondary sensor means being operational in at least a second deployment situation of said mine in which said mine is moving toward a selected target for detonating said mine in response to the detection of the selected target, whereby upon nondetonation of said mine in the second deployment situation, said positioning means positions said mine in the first deployment situation.

2. A hollow charge mine according to claim 1, wherein said secondary sensor means includes means responsive to a direct impact position of the mine onto the target for detonating said mine.

3. A hollow charge mine according to claim 1, wherein one of said primary and secondary sensor means includes proximity detecting means, and the other of said primary and secondary sensor means includes contact detecting means.

4. A hollow charge mine according to claim 1, wherein said primary and secondary sensor means each include proximity detector means having different operational ranges.

5. A hollow charge mine according to claim 1, further comprising timing means for activating said primary sensor means after a predetermined time interval.

6. A hollow charge mine according to claim 5, wherein said timing means includes deactivating means for deactivating said secondary sensor means.

7. A hollow charge mine according to claim 5, wherein said timing means is a resistor-capacitor means.

8. A hollow charge mine according to claim 5, wherein said timing means is adjustable to provide for

different predetermined time intervals.

9. A hollow charge mine according to claim 1, further comprising parachute means connected to said mine for enabling said mine to be dropped onto a target.

10. A hollow charge mine according to claim 1, further comprising an elastic hemispherical member connected to said mine.

11. A hollow charge mine according to claim 1, wherein said mine is constructed as a watertight bouyant body.

12. A hollow charge mine according to claim 9, wherein said mine has first and second end surface portions and a lateral surface portion, said parachute means being connected at said first end surface portion and an elastic hemispherical member being connected at said second end surface portion, said positioning means being arranged on said lateral surface portion of said mine.

13. A hollow charge mine according to claim 5, further comprising impact detecting means for detecting the impingement of said mine onto a surface for activation said timing means, said timing means also serving for activating said positioning means after said predetermined time interval.

14. A hollow charge mine according to claim 13, wherein said primary and secondary sensor means each include detector means connected to an amplifier means via a switching means, said amplifier means providing an output to a threshold switching means for providing an output to an initiating means in response to a predetermined threshold value being attained.

15. A hollow charge mine according to claim 14, wherein said switching means includes first and second contact means for connecting a respective amplifier means to a respective detector means of said primary and secondary sensor means, said switching means having an initial position wherein said detector means and amplifier means of said secondary sensor means is connected and said detector means and amplifier means of said primary sensor means is disconnected, said timing means controlling the operation of said switching means for connecting said detector means and amplifier means of said primary sensor means and disconnecting said detector means and amplifier means of said secondary sensor means after said predetermined time interval.

16. A hollow charge mine according to claim 14, wherein said threshold switching means includes trigger circuit means and said initiating means includes thyristor means.

17. A hollow charge mine according to claim 12, wherein said secondary sensor means includes detector means positioned on said elastic hemispherical member and said primary sensor means includes detector means positioned on one of said second end surface and said lateral surface portion of the mine.

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