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ANTITANK LAND MINE

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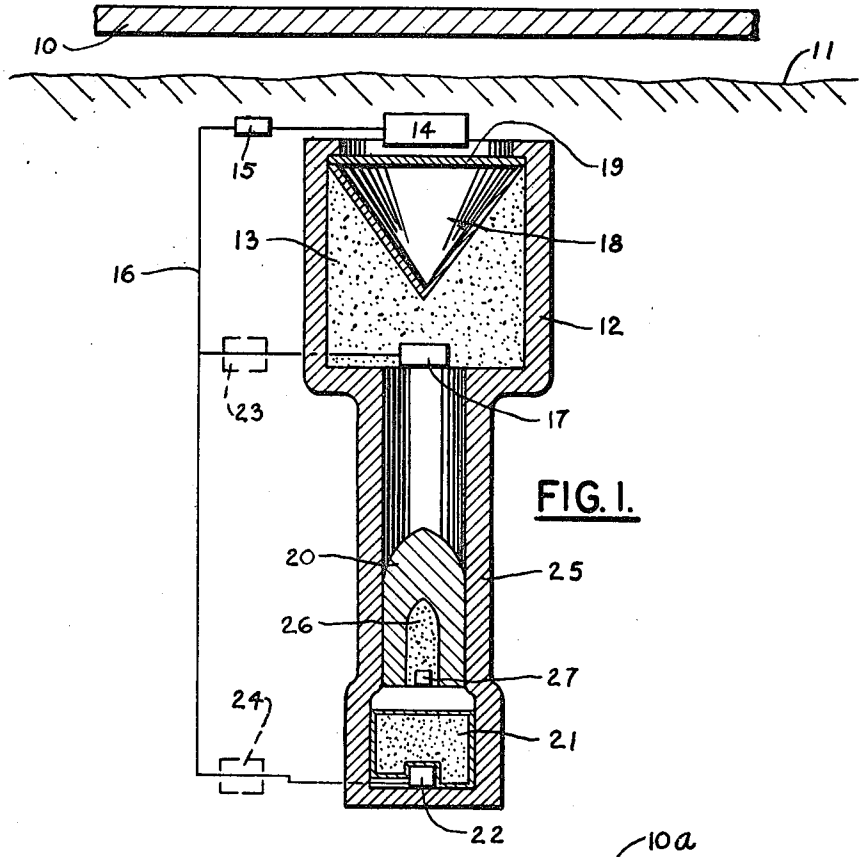


FIG. 1.

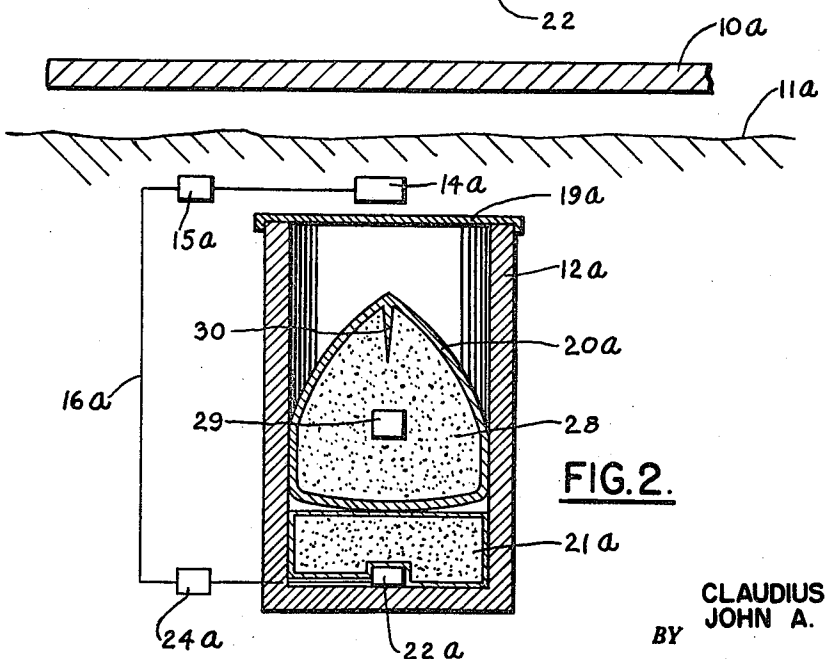


FIG. 2.

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ANTITANK LAND MINE

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U.S. Cl. 102—8 4 Claims

The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment of any royalty thereon.

This invention relates to novel designs of land mines and has for an object to render the same more effective against a tank. Another object is to provide a method of and an apparatus for tank destruction which is capable for utilizing the efficiency of modern projectiles.

Land mines of the heretofore conventionally used types, in general, consist of an explosive charge designed especially to damage or destroy the tracks, rollers, road wheels or other portions of a tank that are normally in contact with the ground. These mines, when effective, will often damage and immobilize a tank, rendering it more vulnerable to attack and destruction by artillery, aircraft or other means, but are rarely effective alone in destroying the tank and its crew. Furthermore, such damaged tanks may often be recovered and repaired, while their screws frequently escape even though their tank may be destroyed. To destroy tanks and their crews directly and effectively by land mines alone, it is usually necessary to damage or penetrate the body of the tank, which houses the crew, ammunition, gasoline, etc., and to set it on fire and/or detonate the ammunition. Conventional mines, when detonated under the body of a tank, are generally ineffective to accomplish these objectives, because its body is normally spaced some 10–18″ above the ground and is protected by armor; to be resonably effective in "belly" attack of tanks, conventional mines must be excessively heavy and bulky, hence expensive and difficult to emplace, conceal and protect against detection. If planted sufficiently deep to escape detection, the shielding effect of the over-burden of dirt, plus the cushioning effect of the air space between the tank and ground, so reduce their efficiency as to make them uneconomical or ineffective.

To overcome these disadvantages of conventional mines, it is proposed to provide: (a) projectile-type mines, capable of being propelled from the ground, without being substantially retarded by considerable depths of overburden under which they may be emplaced; (b) in combination with these mines, means for effective removal of said over-burden at the instant of discharge; (c) mines of types analogous to the most effective armor-defeating projectiles, that function on contact with the "belly" or other armor of the tank and/or are not rendered ineffective by the cushioning air space between the tank and the ground; (d) mines that will be effective in immediate and complete destruction of the tank, by fire, fragmentation or explosive effect, rather than merely damaging or immobilizing it; and (e) mines of the type described that will be of reasonable size, weight and cost and will be capable of effective emplacement to avoid ready detection.

Heretofore, the more efficient projectiles when not of the kinetic energy type, have not been adapted for use as land mines. Two such types of projectiles are the "shaped charge" and the "high explosive plastic" or "squash head" projectile. Neither of these has been adapated for use as a land mine without great loss of efficiency. One possible way for overcoming such loss of

efficiency is the location of these mines close to the surface of the ground and making them of nonmetallic or plastic material not suspectible of detection magnetically as is a mine containing substantial magnetic material. The difficulty with this line of approach to a more efficient tank mine is the fact that other than magnetic types of detectors have been used. Plastic mines have not been satisfactory for a variety of reasons. One type of detector for mines depends on uniformity of density of the ground and it has been difficult to sink a mine and expect its overburden, even if packed, to be of the same density as the undisturbed surrounding ground. Burial of the mine to a depth great enough to be immune to magnetic detection does not permit the squash head or shaped charge type of projectile to be used against tanks, because of excessive retardation of the former in passing through the overburden and exhaustion of the jet of the latter in penetrating the overburden.

According to this invention, anti-tank land mines have been provided of the shaped charge and also of the squash head variety for use against the underside of a tank without having their efficiency lowered by their penetration of the overburden. Specifically, this has been accomplished by first removal of the overburden by an auxiliary charge before firing an explosive charge for propelling a projectile out of the ground. For firing the explosive charge up against the bottom of a tank in the case of the squash head shell and at an efficient distance from the tank bottom in the case of the shaped charge projectile, this invention contempaltes a shaped charge being fired almost immediately after the upsurge of the overburden in order that the target may not have moved beyond the mine. After a shaped charge blast has cut a hole in the tank bottom, the propelling charge for an armor piercing projectile with incendiary or other charge damaging to personnel is fired soon enough to get into at least part of the hole cut by the shaped charge jet when the tank is moving rapidly.

FIG. 1 shows one embodiment of this invention in which a shaped charge is located above an armor piercing projectile and all within a land mine buried in the ground.

FIG. 2 illustrates another embodiment in which a squash head or high explosive plastic type projectile is used in this antitank mine.

Referring to FIG. 1, the bottom portion **10** of an enemy tank is moving over the surface **11** of the ground within which is buried an antitank land mine **12** carrying in its upper portion a shaped charge **13**. This shaped charge is of TNT or composition B and functions in much the same manner as does a shaped charge in an artillery shell. Between the top of this antitank mine and the surface of the ground is located a container **14** holding an explosive charge for removal of the ground or overburden above it prior to the firing of the shaped charge or the armor piercing shell. Within the container **14** is located a prima cord or any other of a variety of types of explosive materials. This container is preferably so shaped that the bottom of it is stronger than any upper portion so that on firing there is a substantial throwing upwardly of the ground without any substantial movement of the explosive force downwardly. Connected to the chamber **14** in which the explosive charge is located, is a fuse **15** preferably of the influence type responsive to either vibration, the weight of the tank, magnetic influence of the passing tank, or to remote control for firing the explosive in the container **14**. In order that the shaped charge may be fired a small fraction of a second following the removal of the overburden, a delay action primer **17** is located as shown in FIG. 1 to set off shaped charge **13** at the desired time. The metal

cone **18** is of copper or aluminum or steel and the included angle is approximately 60 degrees as is well known in the art, the wall thickness being about ⅛ of an inch and the diameter of the base of this cone is about 4½ inches. This cone collapses, in the usual way, on firing the shaped charge, beginning first at the apex, and forms a high velocity jet or stream of minute metal particles capable of penetrating armor. Any appropriate cover **19** is provided to keep dirt out from within cone **18**. No closure **19** is necessary where the base of the container **14** is resiliently mounted on top of the land mine as a closure so that after being fired the container will bounce out from and leave the top of the land mine uncovered. It is desirable that the cover **19** and the container **14** should be moved out of the way so that on firing the shaped charge the efficiency of the high velocity jet does not have to use some of its energy to penetrate and remove even the light cover. Beneath the shaped charge is shown an armor piercing projectile **20** having beneath it a propelling charge **21** capable of being fired by delay action primer **22**, in order that this propelling charge **21** may be fired after the firing of the shaped charge and soon enough thereafter for the projectile to be driven upwardly toward the bottom **10** of the enemy tank and at sufficient velocity to be capable of entering and enlarging the hole made by the shaped charge, before the tank has moved too far. Where further delay action is desired it may be needed to have both the delay action primers **17** and **22** fired at a still later time with respect to the removal of the overburden, in which case delay action fuzes **23** and **24** are located as illustrated in the electrical or pyrotechnic connection **16** to the primers **17** and **22**, respectively. A heavy walled receptacle **25** is provided for the projectile and its propelling charge so that this receptacle is in the nature of a gun and therefore necessarily guiding the projectile outwardly as shown. An explosive charge **26** in the projectile **20** is fired in the usual manner by an appropriate fuze **27**.

In operation, after a part of the tank **10** has passed over the land mine, the fuze **15** is actuated to fire the explosive charge **14** for removal of the overburden in order that the efficiency of this antitank mine may be at its best and not impeded by the presence of a substantial amount of overburden. Immediately thereafter, fuze **23** and primer **17** are actuated to fire shaped charge **13**. A very small fraction of a second after the firing of the shaped charge, the armor piercing projectile **20** is fired by the delay action primer **22** firing the propelling charge **21** beneath projectile **20**. The shaped charge is fired almost immediately after the overburden has been raised and before it has settled back unto neighboring ground. The armor piercing projectile is also fired almost immediately after the shaped charge has pierced a hole in the tank and before the tank has advanced any appreciable distance, in order that the projectile **20** may enter the hole pierced by the shaped charge and enlarge it. The precise time delays between the firing of the explosive charge in the receptacle **14**, the firing of the primer **17** and the shaped charge **13**, and the firing of the armor piercing projectile **20**, have not been measured in as precise a manner as is desired but it is believed that this measurement and the adjustment of these time intervals will be readily determined by those skilled in this art. For purposes of this invention, they may be considered to be comprised between the approximate limits of $\frac{1}{100}$ and $\frac{1}{10}$ second.

In FIG. 2 is shown a squash head or high explosive plastic type projectile located within an antitank mine. The bottom **10***a* of the tank is spaced above the surface **11***a* of the ground as was the case in FIG. 1. The receptacle **12***a* is provided with an expolsive charge **14***a* for removal of the overburden in response to actuation by the fuze **15***a*. Promptly thereafter the connection **16***a* leading from the fuze **15***a* to the delay action primer **22***a* fires the propelling charge **21***a* for driving the projectile **20***a* out of the container **12***a* and into and up against the bottom **10***a* of the tank. Cover **19***a* of the receptacle **12***a* is just thick enough to prevent the dirt from the ground falling into and over the squash head projectile **20***a*. The projectile **20***a* consists of a thin metal container, or plastic walled receptacle about ⅛ of an inch thick of polystyrene, fibre glass, or other plastic. Within this projectile the high explosive plastic or squash head charge **28** is provided with a primer **29** adapted to fire the explosive charge **28** after the probe or stabber **30** has been engaged with this primer by impact of the projectile against a wall of the tank. Here again, if a further delay between the removal of the over-burden and firing of the propelling charge **21***a* is desired, a delay action fuze **24***a* is provided. As well known in the artillery art the squash head or high explosive palstic projectile moves with a comparatively slow velocity of 200 to 400 feet a second upward to contact with the target material, where it is deformed by impact and the squash head charge is detonated by contact between the probe **30** and the primer **29**, with the result that high intensity shock waves are set up in the armored target, causing spalling of the inner surface of the armor and rupture or formation of a hole where the spalling has occurred.

Mines of the types described herein will be effective in immediately destroying tanks and their crews by the separate or combined effects of blast, fragmentation or fire. The type exemplified by FIG. 1 is effective in that the shaped charge jet penetrating the tank will ignite gasoline and the propelling charges of ammunition in its path, while particles of the jet and fragments of metal spalled from the inside surface of the armor will kill or wound personnel, to which will be added the blast and fragmentation effects of the following projectile that enters through the shaped charge hole. The type exemplified by FIG. 2 is effective by transmitted shock wave in detonating ammunition in the tank, and by the lethal effects of the massive, high velocity fragments spalled from the inside surface of the armor, which are capable of killing personnel, penetrating gasoline tanks and igniting the fuel, and igniting or detonating ammunition in the tank.

Among the advantages of this invention may be mentioned the fact that new and effective land mines have now been made available for use against the underside of enemy tanks inasmuch as this portion of the tank is customarily armored to a much less thickness than are the side walls. The removal of the overburden prior to firing of either the shaped charge or the squash head projectile, reduces the possibility of the overburden impeding or increasing resistance to these weapons. A shaped charge may also be carried in the projectile of FIG. 1 if desired. Weapons in each figure are compact and effective. The embodiment illustrated in FIG. 1 has a diameter of about 4½ or 5 inches while its total length is around 12 or 14 inches. The cone in FIG. 1 has a wall thickness of about ⅛ of an inch. The projectile in FIG. 1 is preferably given a higher velocity than is the squash head projectile in FIG. 2. Perhaps the chief advantage of the present invention resides in the fact that at least these two types of previously known artillery weapons namely the shaped charge and the squash head, have now for the first time been made available for use in land mines against tanks, without the hindrance of the overburden reducing their effectiveness.

We claim:

1. The combination with an antitank land mine for burial in the ground, of an explosive charge for location below the surface of the ground but above and adjacent to the top of said mine, means for firing said charge in response to movement of a tank above said mine and removal of overburden above said mine and charge, means for firing said mine in response to movement of a tank after firing said charge and removal of the overburden, said mine including a propelling charge within the

mine with a projectile to be fired upwardly by said propelling charge, and means for firing said propelling charge in response to movement of a tank but after firing of said first-mentioned charge and after firing said mine.

2. The combination with an antitank land mine for burial in the ground, of an explosive charge for location below the surface of the ground but above and adjacent to the top of said mine, means for firing said charge in response to movement of a tank above said mine and removal of overburden above said mine and charge, means for firing said mine in response to movement of a tank after firing said charge and removal of the overburden, said mine including a propelling charge within the mine with a projectile to be fired upwardly by said propelling charge, a shaped charge included in said mine above said projectile, means for firing said shaped charge upwardly after removal of the overburden for cutting a hole in an underportion of a tank in response to movement of a tank after firing said first-mentioned charge, and means for firing said propelling charge in response to movement of a tank but after firing of said first-mentioned charge and after firing said shaped charge.

3. The combination with an antitank land mine for burial in the ground, of an explosive charge for location below the surface of the ground but above and adjacent to the top of said mine, means for firing said charge in response to movement of a tank above said mine and removal of overburden above said mine and charge, means for firing said mine in response to movement of a tank after firing said charge and removal of the overburden, said mine including a propelling charge within the mine with a projectile to be fired upwardly by said propelling charge, a shaped charge included in said mine above said projectile, means for firing said shaped charge upwardly after removal of the overburden for cutting a hole in an underportion of a tank in response to movement of a tank after firing said first-mentioned charge, and means for firing said propelling charge in response to movement of a tank but after firing of said first-mentioned charge and after firing said shaped charge, said projectile being of an armor piercing type to be fired upwardly after firing said shaped charge and in response to firing said propelling charge.

4. The combination with an antitank land mine for burial in the ground, of an explosive charge for location below the surface of the ground but above and adjacent to the top of said mine, means for firing said charge in response to movement of a tank above said mine and removal of overburden above said mine and charge, means for firing said mine in response to movement of a tank after firing said charge and removal of the overburden, said mine including a propelling charge within the mine with a projectile to be fired upwardly by said propelling charge, said projectile being of a squash head type to be fired upwardly by said propelling charge after removal of the overburden, and means for firing said propelling charge in response to movement of a tank but after firing of said first-mentioned charge.

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