Nov. 12, 1968 B. E. DRIMMER 3,410,212

ANTI-TANK MINE WITH BINARY EXPLOSIVE CHARGE

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Fig. 1.

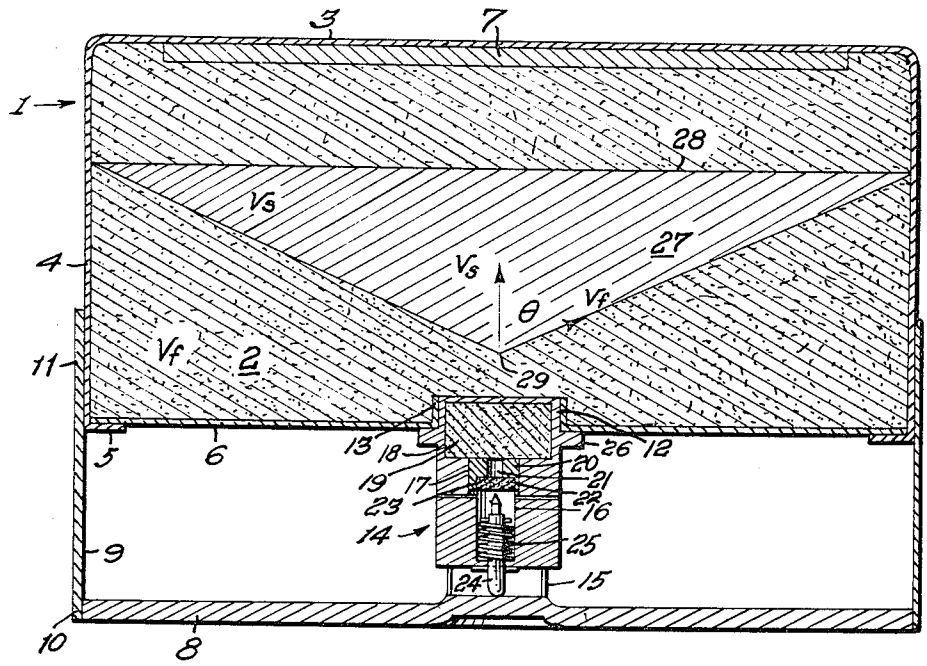


Fig. 2.

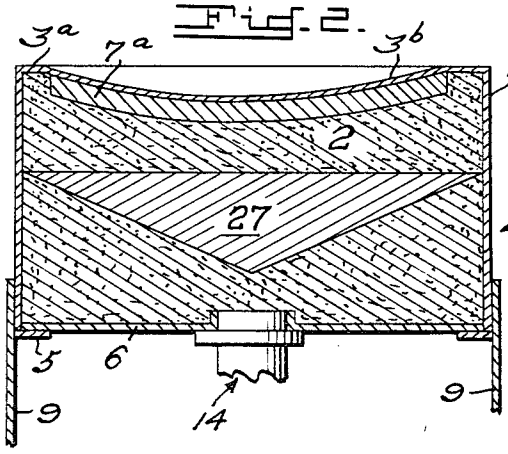
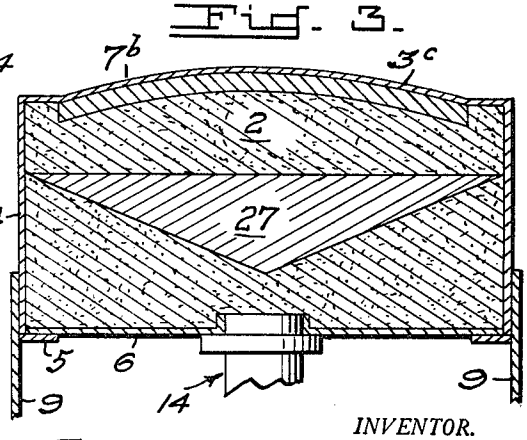


Fig. 3.



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ANTI-TANK MINE WITH BINARY EXPLOSIVE CHARGE

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7 Claims. (Cl. 102—8)

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

This invention relates to improvements in land mines.

More particularly this invention relates to a land mine of the type in which a relatively dense and heavy plate or disc is projected forwardly or upwardly, intact, and at a high velocity when the mine is exploded.

A mine of the type which forms the basis of this invention may or may not be concealed and camouflaged by being buried beneath the surface of the earth and is generally actuated by the weight of a vehicle, as a tank, setting off a fuze attached to the mine. The fuze in turn detonates a high explosive which produces a shock wave or advancing detonation front. In a homogeneous explosive charge, the detonation rate within the charge is constant for all practical purposes. The detonation front is concave and assumes the shape of an expanding sphere with its center at the point of initiation. Since the center of the plate is first subjected to the wave front, this portion of the plate is propelled forwardly ahead of the outer sections, thereby causing fragmentation of the plate. However, experience has indicated that optimum penetration and devastation of a target is obtained when the plate remains intact.

It is accordingly an object of this invention to provide a land mine in which a facing plate is propelled forwardly and in one piece.

It is also an object of this invention to provide a land mine in which a facing plate is propelled forwardly and in one piece by the explosion of the mine.

It is also a further object of this invention to provide for a novel arrangement of an explosive charge in a land mine to alter the shape of the detonation wave in a manner to obtain a shock wave to propel the facing plate, which is more favorable to such propulsion than the normally occurring, spherically expanding wave. This new shock wave can be flat or convex as seen from the point of initiation.

It is also a further and additional object of this invention to provide a land mine having an explosive charge of relatively narrow depth and including an explosive insert within a high explosive charge which has a comparatively slower detonation rate, such that the shock wave is altered from a concave shape as seen from the point of initiation to a flat wave or even a convex shape, as it impinges against the facing plate, whereby the increased energy concentration of the shock wave propels the facing plate without fragmentizing it, and with materially increased velocity and penetrating or destructive effect.

Still another object of this invention is to provide a binary explosive system for shaping a wave from a spherically expanding one to a flat, or even convergent configuration as it impinges against the facing plate, whereby the plate is propelled as a flat projectile toward the target.

Other features and advantages of this invention will presently become apparent from consideration of the following specification and the drawing included therein, and wherein,

FIGURE 1 of the drawing is a longitudinal section through a land mine showing a typical arrangement of facing plate, explosive charge, explosive insert and charge initiating means.

FIGURE 2 is a modification of FIGURE 1 in which the facing plate is made concave coextensively with the depressed or concave central portion of the top wall of the land mines and,

FIGURE 3 is another modification in which the facing plate is made convex coextensively with the bulging or convex central portion of the top wall of the land mine.

Referring to the drawing, reference character **1** designates the land mine generally in its entirety, and which includes a relatively shallow, cylindrical container filled with a high velocity (V_f) explosive **2**, such as Pentolite, TNT, or Composition B, which is a mixture of RDX and TNT, and having a top wall **3** and side wall **4**, the side wall being flanged or struck inwardly as at **5** to provide a support for a bottom wall **6**. A flat disc-shaped heavy plate **7** of metal or of any suitably dense substance having a thickness greater than the container wall, and of slightly reduced diameter, is secured to the underside of top wall **3** in any convenient manner, as by spot welding.

A spider or support for the entire land mine is provided which accommodates a detonator for initiating the main explosive charge at the central point of its lower surface. The support comprises a substantially heavy disc-like plate **8**, of the same outer dimensions as land mine **1**, and axially spaced from lower wall **6**. A sleeve **9** provided with louvres (not shown) and having an inner diameter equal to the outer diameter of land mine **1**, has its inner and lower end **10**, secured as by spot welding, to the peripheral edge of plate **8**, and its upper end **11** overlapping side wall **4** for a substantial distance and secured thereto in any convenient manner.

Bottom wall **6** is provided with a central opening **12**, and is struck up about opening **12** to provide a flange **13**. A cylindrical fuze or detonator body **14** snugly engages flange **13** and extends downwardly to within a short distance of flat plate **8**, being supported thereabove by a spider **15** collapsible by the weight of a vehicle. Detonator body **14** is provided in its lower half with a small diameter axial bore **16**, communicating with a central, shallow counterbore **17** of larger diameter, which in turn opens at its upper end into a second counterbore **18** again of larger diameter than counterbore **17**, for receiving a detonating substance **19** of relatively high sensitivity. An insert **20** is received within counterbore **17** and is provided with an upper flash passage **21**, and a lower space **22** for receiving an impact responsive igniter **23** of low sensitivity. A firing pin **24** is received within bore **16** and is urged into normally safe position by a spring **25**, with its lower end abutting plate **8** and its upper end axially spaced from and below igniter **23**. An annular ring **26** snugly encircling detonator body **14**, has its upper surface engaging the lower surface of bottom wall **6** to provide additional means for securing the detonator or fuze body to the mine.

In order to shape the detonation wave so as to alter it from a concave configuration with respect to the point of initiation to a flat wave, an insert **27** is imbedded completely within the high explosive charge. Insert **27** is a low velocity (V_s) explosive of the type such as granular TNT, nitroguanadine or baratol, which is a mixture of TNT and barium nitrate. Together with the high velocity explosive, the latter forms a binary explosive system for shaping a wave from a concave to a flat configuration. Insert **27** is preferebly formed as a cone (seen in section as a triangle in FIGURE 1) with its base **28** having the same approximate size as and disposed so as to be parallel to upper wall **3** of the mine and its apex **29** spaced above and in axial alinement with the center of detonator body **14**.

To achieve specific types of wave shaping, the apex angle of the cone is critical. If the detonation velocity of the high velocity explosive is designated V_f, the low velocity explosive by V_s and the angle subtended by a vertical line through the axis of the cone and the side of the cone is designed θ, a plane, or flat wave is obtained when $\cos\theta$ (½ apex angle)$=V_s/V_f$. Detonation of the high velocity explosive produces a spherical wave which is concave with respect to its point of initiation. As the wave front progresses through this high explosive, its central portion arrives at the cone apex first, then as part of the wave goes through the explosive insert at a velocity equal to the detonation velocity (V_s) of the insert, and the remaining wave travels along the lower sides of the insert at a velocity equal to the detonation velocity (V_f) of the high velocity explosive, it becomes obvious that the detonation wave will reach all points of the surface defined by the base of the cone substantially at the same time. The result is a wave close to a plane wave as it strikes facing plate **7**, causing the plate to be propelled in one piece toward the target.

The land mine of FIGURE 2 is substantially similar in construction and arrangement to the land mine in FIGURE 1 with the exception that the central portion of **3***b* of the top wall **3***a* is depressed or concave, the depression or concavity extending radially to within a short distance of side wall **4**. A facing plate **7***a* shaped to conform coextensively with concavity **3***b*, is secured in any convenient manner to the under side of top wall **3***a*.

FIGURE 3 is another modification similar in construction and arrangement to FIGURES 1 and 2 except that top wall **3***c* is made to bulge outwardly to assume a convex configuration, and plate **7***d* secured to the under side of top wall **3***c* in the manner of plates **7** and **7***a*, is also coextensively convex therewith.

Although the mine has been shown as cylindrical the illustration is intended to be merely exemplary. It is also within the purview of this invention to make the mine square, triangular or any other suitable regular ploygonal configuration. In like manner the shape of the insert may be altered to conform to the configuration of the mine. The container may be of any suitable metal, and the facing plate may be a dense steel or iron. Additionally it is contemplated that the mine may be non-metallic to avoid detection, and the facing plate may be a non-metallic substance of sufficient density. Other modifications and alterations of the structure disclosed herein will be apparent to one skilled in the art, and it is obvious that the same may be made without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. In a demolition unit, a closed container having a shallow depth relative to its transverse cross-section and having a high velocity explosive charge received therein, an insert comprising a low velocity explosive completely embedded within said high velocity explosive and extending laterally to the side walls of said container, a heavy facing plate projectile substantially coextensive with the top wall of said container, and means below said insert for initiating said high velocity explosive charge, said insert retarding the peak velocity of the detonation wave formed by said high velocity explosive charge to alter the shape of said wave from a concave to a flat wave whereby said facing plate is propelled in one piece toward a target.

2. The demolition unit of claim **1** wherein said top wall and facing plate are planar.

3. The demolition unit of claim **1** in which the top wall and facing plate are concave.

4. The demolition unit of claim **1** in which the top wall and facing plate are convex.

5. In a land mine a container formed by a side wall, a top wall and a bottom wall, said container having a shallow depth relative to its transverse cross-section, a high velocity explosive charge occupying the space formed by said container, a substantially heavy facing plate projectile secured to the under surface of said top wall and extending to within a short distance of said side wall, a low velocity explosive charge insert completely embedded within said high explosive charge, and having a flat base spaced from and disposed in parallel relation to said top wall and a rearwardly tapering side wall ending in an apex in axial alinement with the longitudinal axis of said mine, and a fuze secured to said bottom wall centrally thereof and below said insert for initiating said high velocity explosive charge, said insert degrading the rate of propagation of the peak portion of the detonation wave of said high velocity explosive charge, whereby said wave is altered from a concave to a flat wave as it impinges against said facing plate to propel said plate intact as a missile toward a target.

6. A demolition unit comprising a container having a top, flat bottom and side walls of uniform height extending upwardly from the periphery of said bottom to define a chamber having a vertical central axis of symmetry, said chamber having a shallow depth relative to its transverse cross-section, a high velocity explosive charge filling said chamber, an insert comprising a low velocity explosive charge completely embedded within said high explosive charge, said insert having a vertical axis of symmetry coincident with the axis of symmetry of said container, a flat base spaced from, parallel to and of substantially the same outer dimension as said top wall, and a rearwardly tapering side wall ending in an apex on said vertical axis of symmetry and spaced from said bottom, a plate projectile of uniform thickness secured to the undersurface of said top wall and in contact with said high velocity explosive charge, and means operable to detonate said charge at a point on said axis below said insert, said insert degrading the rate of propagation of the peak portions of the detonating wave of said high velocity explosive charge, whereby the wave is altered from a concave to a flat wave as it impinges against said flat plate to propel said plate intact as a missile toward a target.

7. In a land mine, a container comprising a side wall and top and bottom walls, a spider supporting said container, a binary explosive charge within said container, a plate projectile secured to the under surface of said top wall, said binary explosive charge comprising a first high velocity explosive component in contact with said side and bottom walls and with said plate projectile, and a second low velocity explosive component completely embedded in said high velocity explosive component, a fuze centrally positioned in the bottom wall of said container and extending between said bottom wall and said spider, a firing pin in said fuze responsive to relative movement of said container and said spider for actuating said fuze to initiate said high velocity explosive component, said low velocity explosive component being arranged to degrade the rate of propagation of the peak portions of the shock wave formed by detonation of said high velocity explosive charge, whereby the shock wave is

altered from a concave to a flat wave to propel said plate projectile as a missile toward a target.

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