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LAND MINE

Filed June 22, 1944

Fig. 1.

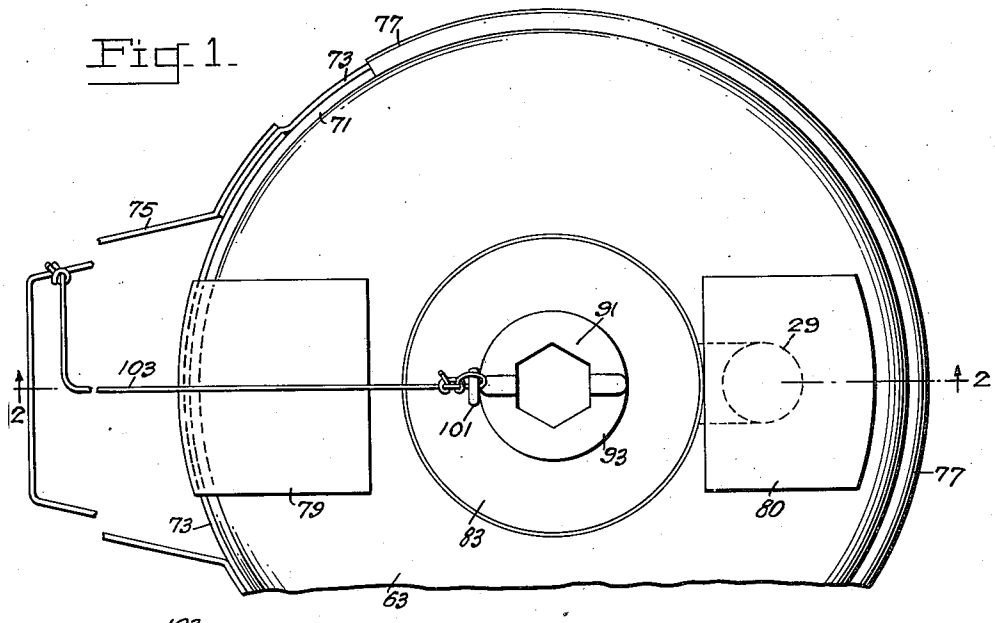


Fig. 2.

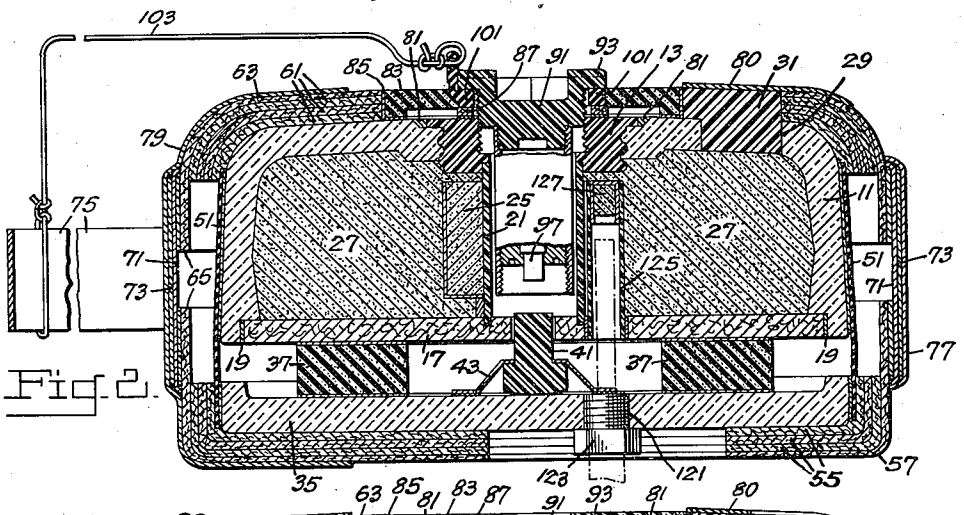
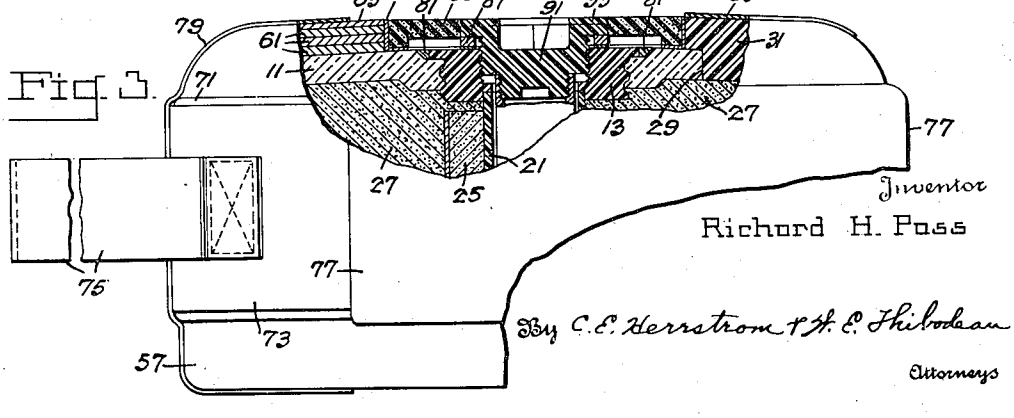


Fig. 3.



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LAND MINE

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14 Claims. (Cl. 102—8)

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This invention relates to an explosive land mine and has for one of its objects the provision of a generally improved and more satisfactory mine of the land type.

Another object of the invention is the provision of a mine constructed entirely of nonmetallic material, so that its presence cannot be detected by the usual types of magnetic or electrical detecting devices.

Still another object is the provision of a mine so designed and constructed as to be set off by sustained weight of a predetermined amount, and yet not to be set off or damaged by non-sustained pressure caused by sudden blows (as by certain types of mine-exploding apparatus, for example) or by adjacent explosions.

A further object is the provision of a mine of relatively light weight, which may be easily and quickly installed in place.

A still further object is the provision of a mine so shaped and proportioned that even if placed on the surface of the ground rather than buried therein, it is relatively stable against tipping and thus remains effective against tanks or other vehicles driven over it.

Other objects of the invention will be apparent from the detailed description which follows, which description and the accompanying drawings are merely exemplary and are not intended to limit the invention to the specific construction described.

In the drawing:

Figure 1 is a top plan view of a mine constructed according to the preferred embodiment of the invention, with the safety ring in place and the fuze in safe or unarmed position;

Figure 2 is a vertical section through the same, taken substantially on the line 2—2 of Figure 1; and

Figure 3 is a side elevation of the mine with parts broken away and parts in vertical section, showing the safety ring removed and the fuze in armed position.

The same reference numerals throughout the several views of the drawings indicate the same parts.

Referring now to the drawings and particularly to Figure 2 thereof, the mine in its preferred form comprises a main body 11 of inverted cup shape, circular in horizontal cross section, constructed of rigid nonmetallic materials, preferably of a ceramic nature such as vitreous china or porcelain, or glass, it being intended to include all of these substances within the broad term "ceramic material" as hereinafter used. At its

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top, the body 11 has a central opening internally threaded, into which is screwed an annular adapter 13 of nonmetallic material such as molded plastic material (Bakelite or some similar molded plastic) externally threaded to engage the threads of the body 11, and internally threaded to receive external threads on the fuze, as described below.

The bottom edge of the body 11 has an annular stepped shoulder, as shown, in which is seated the marginal edge of a diaphragm or partition 17 of suitable nonmetallic material, such as a disc of hard-pressed fiberboard, for example. The edges of the diaphragm 17 are cemented tightly to its seat in the body 11, by suitable cement indicated at 19, such as calcined gypsum cement, for example. In axial alignment with the opening through the adapter 13 there is an annular groove in the top surface of the diaphragm 17, and in this annular groove is seated and cemented the lower end of a hollow cylindrical member or sleeve 21, the upper end of which is seated in an annular step formed in the adapter 13. This sleeve 21 is likewise of suitable non-metallic material such as molded plastic material, or laminated paper treated with plastic material such as Bakelite.

Within the cavity or space inclosed between the body 11 and the diaphragm 17, externally of the sleeve 21, are the explosive elements of the mine. These may be of any suitable known composition or ingredients, such for example as an annular booster pellet 25 of tetryl, surrounding or partially surrounding the sleeve 21, and a charge 27 of TNT or tetrytol or other suitable high explosive, filling substantially the rest of the annular space around the sleeve 21 and between the body 11 and the diaphragm 17. The main explosive charge may be introduced through a filling opening 29 formed in the upper part of the body 11 and later filled with a suitable plug 31 of plastic cement, for example.

Beneath and spaced from the diaphragm 17 is a base 35, preferably of ceramic material in the form of a circular flat disc with a slightly raised marginal rim on its upper surface, as shown. Interposed between the base 35 and the diaphragm 17 is a substance normally spacing these two elements at a predetermined distance from each other, but capable of compressing under the influence of sustained pressure, to enable the base and the diaphragm to move closer to each other. It is important that this spacing material offer relatively great resistance to compression by pressure of instantaneous duration, such as that

caused by an explosion, or by the beating action of mine-exploding flails, and yet be capable of compressing readily under the influence of pressure or weight sustained for at least a brief interval, such as the pressure caused by a moving vehicle driven over the mine. In other words, the substance interposed between base 35 and the diaphragm 17 should be capable of acting somewhat on the principle of a dash pot or door check, being relatively insensitive to sudden blows without sustained load, but being sensitive to sustained pressure. The preferred material having these characteristics is an annular ring 37 of synthetic sponge rubber, the top surface of the ring being cemented to the bottom of the diaphragm 17 and the bottom surface of the ring being cemented to the top of the base 35. Resting on the top of the base 35 at the center thereof, is the head of a pressure pin 41 of molded plastic material, having a shank extended upwardly through and freely slideable in a central opening in the diaphragm 17. A flexible strap 43 of fabric or other suitable nonmetallic material overlies the shoulder between the shank and the head of the pin 41 and has its ends cemented to the upper surface of the base 35, thus holding the pressure pin in place.

The space between the diaphragm 17 and the base 35 is sealed laterally by a watertight flexible band 51 of synthetic rubber, for example, wrapped circumferentially around the body 11 and base 35 and cemented to both of them. This band 51 is sufficiently flexible so that the free unsupported portion thereof bridging the space between the bottom of the body 11 and the top of the base 35 may readily buckle when axial pressure causes the body and base to tend to move toward each other, and the band may also bulge inwardly or outwardly due to changes in temperature of the air entrapped in the mine within the band 51, thus substantially equalizing the air pressure within the mine with the external atmospheric pressure.

A protective covering or jacket encloses the mine to guard it against damage by accidental dropping or minor blows. This jacket may comprise a lower cup-shaped section and an upper cup-shaped section. The lower section includes a plurality of layers 55 of somewhat resilient material such as asphalt-impregnated soft felt (either paper felt or hair felt), and an outer covering 57 of asphalt-impregnated hard pressed felt. The inner layers 55 extend across the bottom of the base 35 and up the side edges thereof approximately to the level of the top of the base, as shown, but do not extend above this level in order to avoid interference with such outward bulging of the flexible band 51 as may be necessary in case the air pressure within the mine tends to rise. The outer layer 57, however, extends upwardly a substantial distance above the inner layers 55 and overlaps the lower portion of the body 11, as shown.

The upper section of the protective covering or jacket is similarly formed by a plurality of layers of soft resilient material 61 similar to the layers 55, and an outer layer 63 similar to the layer 57. The layers 61 and 63 cover the top of the body 11, except for the central part thereof and except for the vicinity of the filling opening 29, and extend part-way down the side walls of the body 11, the inner layers 61 stopping near the top of the side walls and the outer layers 63 continuing downward to a level somewhat above the top edge of the layer 57 of the bottom section of the jacket, leaving a gap 65 between the upper and lower jackets so that the jackets will not interfere with the movement of the base 35 and the body 11 toward each other, when axial pressure is applied to the mine.

A layer of adhesive tape 71, of a non-hygroscopic nature, is wrapped circumferentially around the upper and lower jacket sections and overlaps both of them, thus holding them together. Around this is a carrying strap 73 of textile webbing having a loop 75 forming a handle. Another adhesive tape 77, wider than the strap 73, extends part-way around the circumference of the mine, overlapping the carrying strap 73 except at the handle portion thereof, and a short section of adhesive tape 79 extends axially of the mine, across the carrying strap 73, inside the handle loop 75. The tapes 71, 77, and 79 together with the strap 73 are sufficiently flexible so that they buckle readily when axial pressure is applied to compress the member 37 and to move the base 35 and body 11 toward each other, without adding substantial resistance to such movement. Another piece of adhesive tape 80 preferably covers the sealing plug 31 of the filling opening 29.

After the mine has been loaded with the booster pellet 25, the adapter 13 is screwed into place and sealed by plastic bituminous sealing substance 81 around the marginal edges of the adapter, similar to the sealing substance 31 which is later placed in the filling opening 29 when the main explosive charge has been loaded in the mine. The sealing ring 83 is inserted over the top of the adapter 13, the marginal edges of the ring 83 resting upon and being cemented to the top of the body 11. This sealing ring 83 is conveniently made of reclaimed or synthetic sponge rubber and the periphery thereof substantially meets the edges of the layers 61 and 63 of the covering jacket, any slight space between them being filled with bituminous plastic cement or sealing compound 85.

Placed on and cemented to the top of the adapter 13, surrounding the threaded opening therein, is a gasket 87, preferably of cork composition or synthetic rubber or a combination of both. The fuze to be used with this mine has a head 91 threaded to engage the threads in the adapter 13, the head having a top flange 93 which is of substantially the same diameter as the central opening in the sealing ring 83, and which, when fully screwed down into effective operating position, rests tightly against the gasket 87 and substantially fills the entire central opening in the sealing ring 83.

The specific construction of the fuze forms no part of the present invention, but is disclosed in a separate copending patent application. For present purposes it is sufficient to say that the fuze may be of any suitable pressure-actuated type, set off by upward movement of a firing pin 97 near the bottom of the fuze, arranged in axial alignment with the plunger 41 of the mine. When the fuze is to be assembled to the mine in safe or unarmed position, a safety ring 101 is placed around the head of the fuze under the flange 93. This ring may be made of any suitable material, metallic or nonmetallic. If metallic, it must be removed from the vicinity of the mine when the mine is finally installed, so as to leave no metal which might be detected by sensitive electrical or magnetic detecting means in the hands of the enemy. Preferably the safety ring is of nonmetallic material such

as rubber, in which event it need not be removed far from the mine when the mine is installed, and it may be conveniently tied to the mine as for example by a nonmetallic string or cord 103, so as to be readily available for use if and when it is desired to disarm and take up mines previously planted.

In either event, whether of metallic or nonmetallic material, the safety ring 101 is preferably made sufficiently stretchable or resilient so that, when the head 91 of the fuze is slightly unscrewed to release the pressure on the safety ring, the safety ring may be pulled off right over the flange 93 of the fuze, expanding or stretching sufficiently to enable this. The function of the safety ring is to form a blocking member or abutment preventing the fuze from being screwed far enough into the adapter 13 to bring the firing pin 97 into the range of travel of the plunger 41. With the safety ring 101 in place, the firing pin 97 is maintained in a sufficiently elevated position so that the plunger 41 cannot come into contact with it. The shoulder of the enlarged head of the plunger 41 will contact with the bottom surface of the diaphragm 17, before the upper end of the plunger meets the firing pin 97. This, of course, is not true when the safety ring 101 is removed, for then the head 91 of the fuze can be screwed down into the adapter 13 far enough so that a slight upward movement of the plunger 41 relative to the diaphragm 17 and body 11 will cause pressure on the lower end of the firing pin 97 and will fire the fuze, which in turn will explode the mine.

In some instances it may be desired to install in the mine a second fuze, so constructed as to fire the mine if it is lifted from the position in which it has been planted by one unacquainted with the installation, the mine thus forming what is commonly known as a booby trap, in addition to its main function of serving as a mine set off by a tank or other vehicle passing over. To enable installation of such second fuze device, the base 35 may be provided, slightly eccentrically, with a threaded opening 121 normally closed by a threaded plug 123 of molded plastic material. Aligned axially with this opening 121 is an opening in the diaphragm 17, from which opening rises a small tube 125 cemented to the diaphragm 17 and made of solid or laminated plastic material. The upper end of the tube 125 contains a detonator 127 of any suitable detonating material such as that commonly known as PETN.

If it is desired to install the anti-lifting device, the plug 123 is removed and a fuze of suitable known type, forming no part of the present invention, is screwed into the threaded opening 121, the fuze parts being of tubular form extending upwardly into the tube 125. Such a fuze, as well understood in the art, can be so arranged as to be activated upon any attempt to lift the mine from the position in which it is planted. If such a fuze is not desired at any particular installation, the plug 123 is left in place when the mine is planted, instead of being removed.

The installation of the mine and its action may be summarized as follows:

When a loaded but unfuzed mine reaches the vicinity where it is to be used, a fuze is inserted by screwing the head 91 of the fuze partly into the threaded opening in the adapter 13, the safety ring 101 meanwhile being around the head of the fuze, beneath the flange 93, as shown

in Fig. 2. This safety ring prevents the fuze from being screwed far enough into the adapter to bring the firing pin 97 into the range of travel of the plunger 41, even when the plunger is moved inwardly to its maximum extent (that is, with the flange of the plunger seated against the under side of the diaphragm 17). In this condition, the mine is substantially safe even against rough handling. The felt jackets 55, 57, 61, and 63 protect the mine (particularly the brittle ceramic parts 11 and 35 thereof) from damage if handled roughly or even if dropped several feet on to a hard surface such as a concrete roadway. The mine, in this safe condition, is carried by the carrying strap or handle 75 to the position where it is to be used, and ordinarily is buried in the ground with its top surface approximately flush with or slightly below the ground level, and with a light sprinkling of dirt over the mine. The safety ring 101 in combination with the seal 83 keeps dust or dirt from entering the mine while it is being inserted in the ground and while dirt is being filled in around it.

When the mine has been placed in the ground and dirt filled in around it, the fuze 91 is unscrewed a turn or two, enough to loosen the safety ring 101, which is then pulled right off the top or head of the fuze, over the flange 93, the resilient ring expanding enough to permit this. Then the fuze is screwed home into the mine, from the safe position shown in Fig. 2 to the armed position or effective position shown in Fig. 3, wherein the top of the fuze is approximately flush with the top of the sealing ring 83 and in peripheral contact therewith. In this lower or armed position of the fuze, the firing pin 97 at the bottom of the fuze lies just above the top of the plunger 41, in position to be contacted and moved by slight upward movement of the plunger relative to the body 11 and diaphragm 17 of the mine. A sprinkling of dirt is then placed over the entire top of the mine, which completes the installation. The safety ring 101 and its attaching cord 103 are, of course, either removed entirely and carried away, or buried in the hole beside the mine.

If a tank or other vehicle passes over the mine, the weight thereof presses downwardly on the top of the mine, this pressure causing compression of the resilient member 37 so that the entire upper portion of the mine (body 11, diaphragm 17, and all parts mounted thereon) moves downwardly toward the base 35. This relative movement of the upper and lower parts toward each other causes the plunger 41 to project farther into the upper part of the mine, contacting with and causing upward pressure on the firing pin. If the pressure exerted on the mine by the vehicle or other object passing over it is sufficiently great, there will be sufficient upward force on the firing pin 97 to actuate the fuze, which will produce an explosive force (as well known in the art) sufficient to set off the booster pellet 25 and this will explode the main explosive charge 27. By manufacturing the compression ring 37 of different dimensions, the pressure at which the mine will explode can be varied.

Although the mine is extremely sensitive and effective with respect to any pressure exerted for an appreciable length of time, such as by a vehicle passing over it, yet the mine of the present invention is very insensitive to a momentary or instantaneous blow not followed by sustained pressure. This is an extremely desirable characteristic constituting a substantial advance over

the prior art. As a result of this characteristic, the mine of the present invention is particularly insensitive with regard to explosion of adjacent mines, and it is found in practice that when mines of the present invention are planted even as close to each other as about four feet, center to center, the explosion of one mine will not explode an adjacent mine. This enables the present mines to be planted much more closely than mines of prior construction, which are readily set off by adjacent explosions. Moreover, the insensitivity to momentary blows has the further advantage that the mines of the present invention are ordinarily not exploded by so-called mine exploders working on the principle of beating or flailing the ground with chains or cables or similar implements. The blows delivered by such implements, while sufficiently great in magnitude to set off the mine, are of such short duration that the compression ring 37 does not have time to compress sufficient to fire the mine, before the pressure is relieved.

This mine is particularly satisfactory as compared with prior mines, when planted in wet or swampy ground. The mine is completely sealed against entrance of moisture at any point; yet, in spite of the complete sealing, it is so designed that any change in temperature after the mine is armed and planted will not cause any appreciable change in the operating pressure required to set off the mine. If the temperature rises after the mine is sealed (by screwing home the fuze head 91 after removing the safety ring) this will cause expansion of the air entrapped within the mine, and, if special provision therefore were not made, would tend to increase the pressure within the mine and thus to increase the magnitude of external pressure required to fire the mine. However, the tendency to increase the pressure within the mine is readily relieved by outward bulging of the thin flexible sealing band 51 where it bridges the space between the members 11 and 35, so that the actual pressure within the mine is not appreciably increased and the external pressure needed to set off the mine is not appreciably increased. Conversely, if the temperature falls after the mine is sealed and planted, the sealing band 51 may bulge inwardly, thus avoiding any substantial decrease in the internal air pressure within the mine or any substantial decrease in the external pressure needed to operate the mine.

From the foregoing explanations, it will be seen that the mine of the present invention is particularly effective and satisfactory under a great variety of conditions. For convenience of description the portion of the mine which is uppermost in Figs. 2 and 3 has been described as the "top," but the mine is equally effective if planted or laid upside down, with the "base" 35 beneath and the body 11 above. It may also be noted that the proportions of the mine are such that it does not readily tip over if planted directly on the surface of the ground rather than being imbedded therein. To give the mine the necessary stability against tipping, it is desirable that the smallest dimension of the ground-engaging or bottom surface of the mine (or the diameter thereof, if the mine is circular as in the preferred form) be at least one and one-half times the height of the mine. In the preferred form, it is seen from Figs. 2 and 3 (which are drawn substantially to correct scale) that the diameter of the bottom is approximately twice the height of the mine, thus providing an exterior shape which is very stable.

While one embodiment of the invention has been disclosed, it should be understood that the invention may be carried out in a number of ways. This invention is not to be limited to the precise details disclosed, but is intended to include all variations and modifications thereof falling within the scope of the appended claims.

What is claimed is:

1. A mine comprising a hollow cup-shaped nonmetallic body for containing an explosive, a nonmetallic closure member associated with said body to inclose and confine the explosive therein, a nonmetallic base member mounted substantially parallel to and spaced from said closure member, cellular compressible material interposed between said closure member and said base member to resist sudden movement of said members toward each other while permitting them to move toward each other under the influence of sustained pressure, a fuze part associated with said body, and means operated by movement of said closure member and base member toward each other for actuating said fuze part.

2. A mine comprising a hollow cup-shaped body for containing an explosive, a closure member associated with said body to inclose and confine the explosive therein, a base member mounted substantially parallel to and spaced from said closure member, cellular compressible material interposed between said closure member and said base member to resist sudden movement of said members toward each other while permitting them to move toward each other under the influence of sustained pressure, a fuze part within said body, an opening through said closure member in approximate alignment with said fuze part, and a plunger member associated with said base member and projecting through said opening in said closure member to move therethrough and to actuate said fuze part when said base member and said closure member move toward each other.

3. A mine comprising a body having an opening therein for receiving a fuze member including a head positioned exteriorly of said body when said fuze member is seated in operative position, a jacket of shock-resisting material overlying said body around and spaced from said fuze head, and a sealing member of flexible resilient material secured to said body and substantially filling the space between said jacket and said fuze head when said fuze member is seated in operative position.

4. A mine comprising a body including a wall of nonmetallic material having a threaded opening therein, a bushing mounted in said opening, a fuze member mounted in said bushing, said fuze member including a head portion projecting exteriorly of said bushing, a jacket overlying a portion of said wall around said bushing and having an opening larger than said bushing, and a sealing member of flexible resilient material in the opening in said jacket and substantially filling the space between said jacket and the head of said fuze member, said sealing member being adhesively secured to said nonmetallic wall.

5. A mine comprising a hollow body member for containing an explosive, said body member having an opening in one wall into which a fuze may be inserted and also having a second opening in an opposite wall, a fuze actuating member extending into said second opening and having a limited range of travel through said second opening, a fuze inserted in said first-mentioned opening and including a portion adapted to make

contact with and be actuated by said actuating member when the fuze is seated in effective position, and a removable safety member limiting the extent to which said fuze may be inserted in said first-mentioned opening to hold said fuze in a position out of the limited range of travel of said actuating member.

6. In an explosive device, the combination of a body having a threaded opening therein, a fuze actuating member having a limited range of travel within said body, a fuze including a threaded portion to be screwed into said threaded opening in said body and also having an enlarged head exteriorly of said body, and a removable safety device comprising a resilient member arranged, when in safety position, to surround said fuze exteriorly of said body and underlying said enlarged head, to limit the extent to which said fuze may be screwed into said body in order to maintain said fuze out of the range of travel of said actuating member, said safety member being adapted to be removed to permit said fuze to be screwed farther into said body to bring said fuze within the range of travel of said actuating member.

7. A nonmetallic mine comprising a generally cup-shaped hollow nonmetallic body open at one side, a partition of nonmetallic material extending across and substantially closing said open side, a plate of nonmetallic material substantially parallel to said partition and spaced exteriorly therefrom, a resilient annular ring interposed between said partition and said plate and resiliently tending to hold them at a predetermined distance from each other, said ring being capable of deformation under the influence of sustained pressure to allow said plate and said partition to move closer to each other, an opening in said partition, and a fuze actuating member associated with said plate and having a portion extending through said opening into said body to actuate a fuze located therein when said partition and said plate move toward each other to a predetermined extent.

8. A construction as described in claim 7, further including a flexible band of relatively thin, rubber-like material extending around the perimeter of both said body and said plate, bridging the space between them and sealed both to said body and said plate.

9. A construction as described in claim 7 further including a flexible sealing band extending around the perimeters of both said body and said plate to inclose the space between them in a substantially airtight manner, and a shock-absorbing jacket of felt-like material having a part covering a substantial portion of the outer surfaces of said body and said plate to protect them against damage by blows, said jacket being out of contact with at least a substantial portion of the area of said flexible band to permit said band to bulge outwardly without interference by said jacket, if air pressure within said mine tends to rise above the surrounding atmospheric pressure.

10. A construction as described in claim 7 in which said nonmetallic body is made of ceramic material.

11. A construction as described in claim 7 in which said plate is made of ceramic material.

12. A construction as described in claim 7 in which said partition is made of fibrous material.

13. A construction as described in claim 7 in which said body and said plate are both made of ceramic material and in which said partition is made of fibrous material.

14. A construction as described in claim 7 in which said annular ring is of relatively thick cellular rubber-like material so placed as to be compressed by movement of said plate and partition closer to each other under the influence of pressure.

RICHARD H. PASS.

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