April 3, 1945. V. N. VERTZINSKY 2,372,804

ANTIAIRCRAFT MINE

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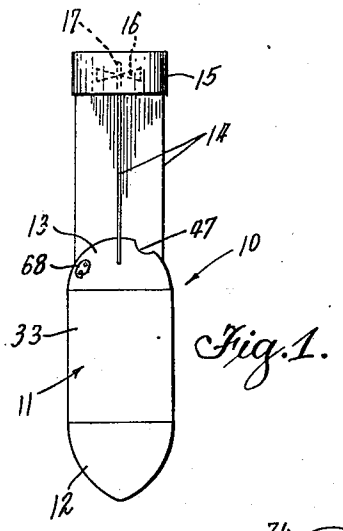


Fig. 1.

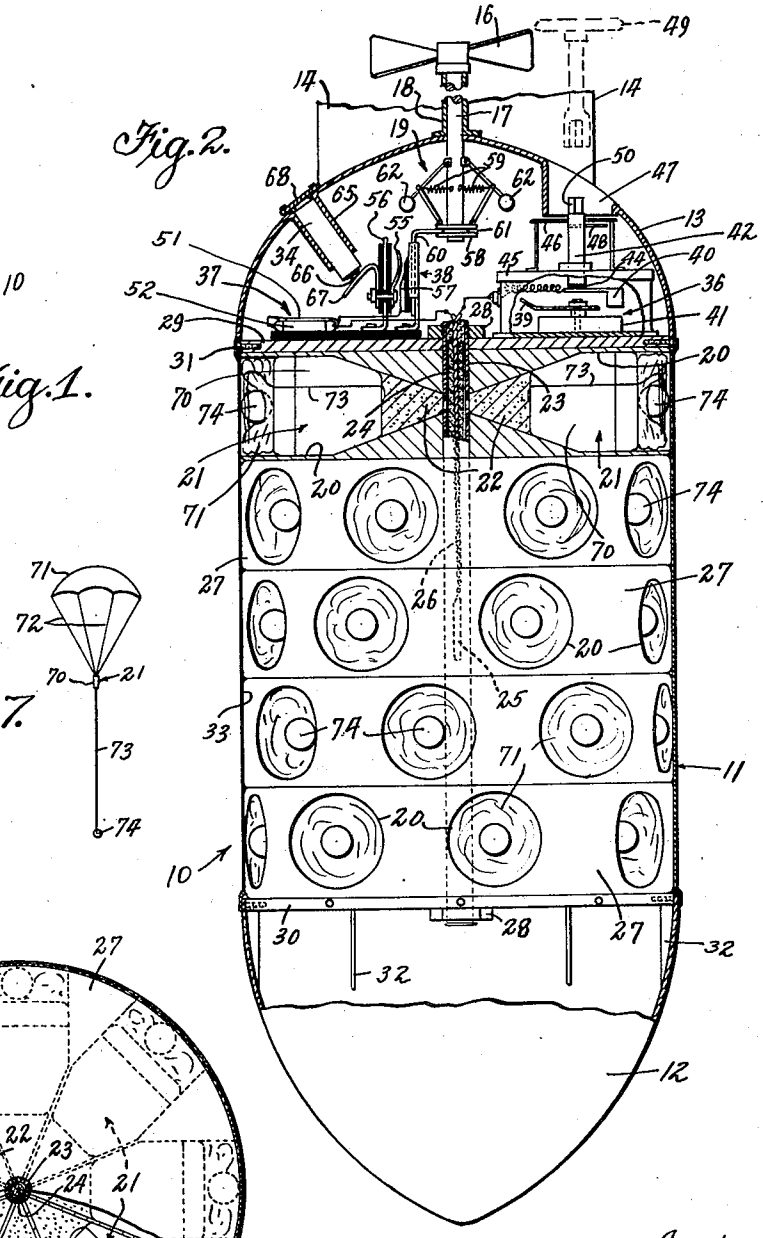
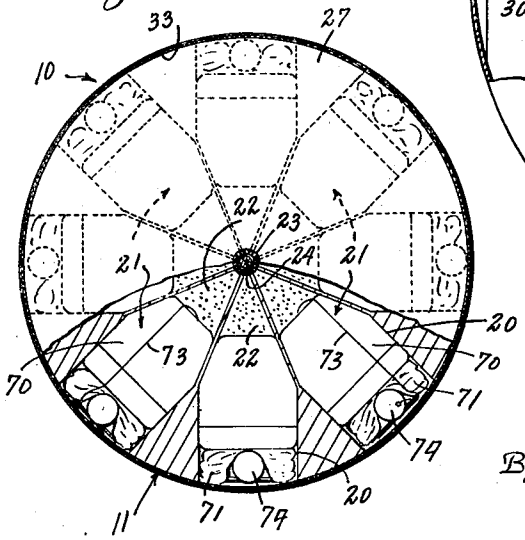


Fig. 2.

Fig. 7.

Fig. 3.



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Fig. 6.

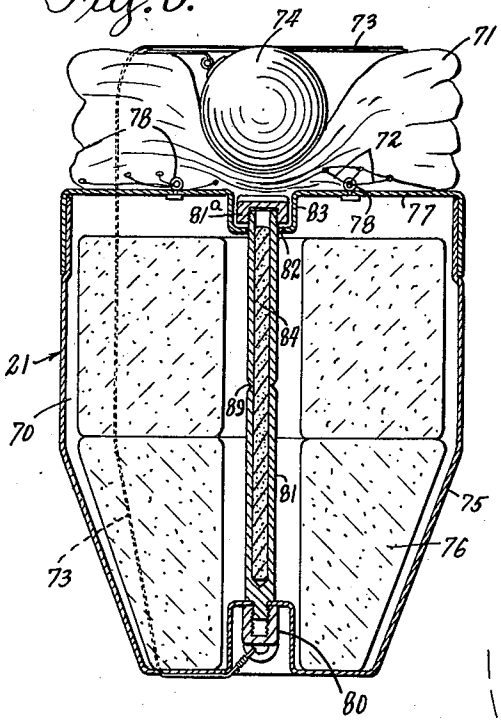


Fig. 4.

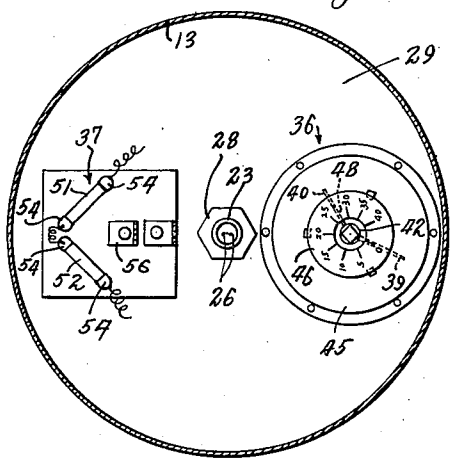
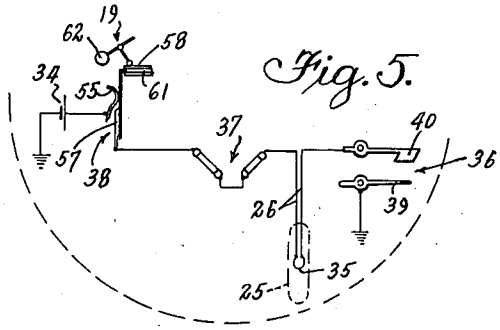
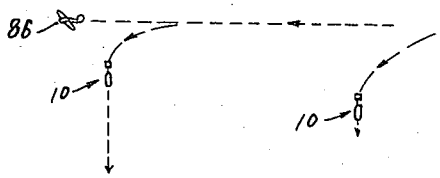


Fig. 5.





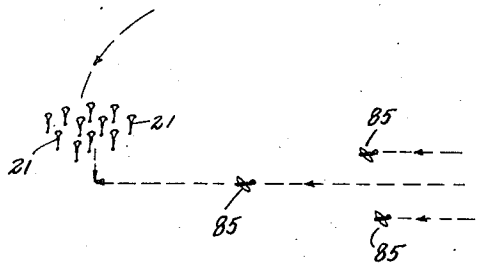


Fig. 8.

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UNITED STATES PATENT OFFICE

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ANTIAIRCRAFT MINE

Vladimiras N. Vertzinsky, Berkeley, Calif.

Application July 1, 1941, Serial No. 400,601

6 Claims. (Cl. 102—5)

This invention relates to aerial mines for use as weapons against aircraft, and it has, as a broad object, to rapidly provide effective air mines and effective apparatus for establishing fields of such mines in the air.

A more specific object is to provide an aerial mine that is subject to detonation by contact with an airplane in the air, but is substantially immune to detonation from impact with the ground, and during handling.

Another object is to provide a practicable method and apparatus for rapidly creating aerial mine fields without the use of ground artillery, and at altitudes above that at which ground artillery is effective.

A feature of the invention is a bomb or aerial torpedo containing aerial mines and adapted to be dropped from an airplane, the bomb having a detonating means for firing it in the air to distribute its load of mines in a predetermined, desired pattern.

Another feature is a detonating device for use in a bomb of the type referred to, which is controlled by barometric pressure to detonate at a desired elevation, irrespective of the elevation from which the bomb is dropped.

Still another feature of the invention is a bomb detonator that is relatively safe during handling, and after falling to the ground, should it fail to detonate in the air as intended.

Another feature of the invention is a detonator for a mine-laying bomb so designed that it will detonate only when the bomb is in vertical position, to thereby secure a desired distribution of the mines.

Briefly, my invention includes aerial mines adapted to be suspended on parachutes so that they fall slowly through a space where enemy airplanes may be present, with an aerial bomb adapted to carry a large number of such mines and distribute them in fields. The bomb is intended to be dropped from an airplane at an elevation above that at which the mine field is to be laid. It falls rapidly and invisibly, and is adapted to discharge its mines in a desired pattern when it reaches the elevation where the mine field is to be established.

The invention will now be more fully explained by describing in detail a particular embodiment thereof, with reference to the drawings, in which

Fig. 1 is an elevation view of a mine-carrying aerial bomb, in accordance with the invention;

Fig. 2 is a vertical section through the main body of the bomb shown in Fig. 1;

Fig. 3 is a horizontal section through the bomb;

Fig. 4 is a plan view of the bomb with the top cap removed;

Fig. 5 is a schematic diagram of the electric detonating circuit for the bomb;

Fig. 6 is a longitudinal section through one of the mines of the bomb in Fig. 2;

Fig. 7 is an elevation view of one of the mines as it appears when suspended in the air from its parachute; and

Fig. 8 is a diagram illustrating one manner of using the invention as a weapon against enemy airplanes.

Referring, first, to Fig. 1, the bomb 10 therein disclosed comprises a main body portion 11 having a nose cap 12 on the lower end thereof for promoting straight travel and having on its rear end a rear cap 13 to which tail vanes 14 are attached. A cylindrical shell or band 15 may be provided at the upper ends of the vanes 14 to protect a windmill 16 positioned therewithin. The windmill is mounted on a shaft 17 (Fig. 2), projecting through a tubular sleeve 18 positioned at the axis of the bomb, which is also the line of intersection of the vanes 14. The windmill 16 actuates a centrifugal device 19 positioned within the rear cap 13, for preventing detonation of the bomb unless the windmill is rotating in excess of a predetermined speed.

The main body 11 of the bomb contains a large number of radial bores or barrels 20 containing mines 21, which are discharged horizontally in various directions when the bomb is detonated. Each barrel 20, as shown, has an outer cylindrical portion and an inner conical portion. Each mine 21 is shaped to fill the cylindrical portion and extend partway into the conical portion. The inner part of the conical portion of each barrel contains an explosive charge 22, which, when detonated, blows the mine out of the barrel. The inner end of each barrel communicates, through the perforations in a perforated sleeve 23, with a detonating charge 24 contained within the sleeve, so that when the charge 24 explodes it fires all of the charges 22 to discharge the mines 21. The detonating charge 24 is exploded by an electrical fuse 25 positioned therein and connected by wires 26 to detonating apparatus within the rear cap 13, which apparatus will be described later.

As shown in Figs. 2 and 3, the main body 11 of the bomb is formed of vertically stacked sections 27, each of which may be a casting and each of which contains one tier of barrels 20 containing mines 21. The different sections 27 are maintained in alignment by the perforated cen-

tral sleeve 23, and are held together by nuts 26, which are threaded onto the opposite ends of the sleeve, and bear against upper and lower plates 29 and 30, respectively. The rear cap 13 is detachably secured to the rear plate 29 as by screws 31, and the cap 12 may be similarly secured to the front plate 30. The front cap 12 may be empty, but it may have reinforcing walls or flanges 32 therewithin to give it sufficient strength.

The explosive charges 22 are preferably of the same strength in all of the barrels of each section 27, so that all the mines 21 in each section are projected with the same force to the same distance, and the lateral recoil forces balance each other and do not produce any resultant lateral deflection of the mine. However, it is desirable to make the explosive charges 22 in different sections of different strengths, so that the mines 21 in the different tiers or sections, will be projected different distances from the tropedo and a better distribution of the mines will be effected.

The main body 11 preferably includes an outer covering or skin 33 of some thin, sheet material, which covers the outer ends of the barrels 20 and normally retains the mines in place in the barrel. However, this skin 33 is sufficiently thin and weak so that it is readily ruptured by the mines when they are discharged.

It is to be understood that it is not essential that the body 11 be formed in sections, as described. If found desirable, for any reason, the body 11 can be formed in one piece or in any desired number of sections. The body assembly remains intact at the time of firing, except for the outer skin 33.

The electrical fuse 25 is energized from a dry cell 34 under the control of three switches, all of which must be closed. The detonator 25 may consist of a short length 35 (Fig. 5) of very fine wire, capable of being heated to incandescence by current from the dry cell 34.

The three switches referred to are actuated by (1) an altimeter control switch 36; (2) a levelling switch 37; and (3), a centrifugally controlled switch 38, respectively.

The altimeter control switch 36 includes the needle 39 of an altimeter and a manually controlled switch contact 40. The altimeter itself may be of conventional construction and is not disclosed in Fig. 1 but is contained within a casing indicated at 41. This casing has an electrical connection with the plate 29 and the main frame of the bomb. The manually movable switch contact 40 extends into the path of movement of the altimeter needle 39 and is supported on a shaft 42, which is coaxial with the shaft of the altimeter needle 39 but positioned thereabove. The switch contact 40 is insulatingly supported on the shaft 42, as by insulation 44, so that the contact 40 is insulated from the frame of the bomb. The shaft 42 is rotatably supported in the cover 45 of the case of switch 36 and extends up through a transparent dial 46 visible through an opening 47 in the rear cap 13. The transparent dial 46 has altimeter graduations on it in proper cooperative position with respect to the altimeter needle 39, and a pointer 48 on the shaft 42 extends immediately below the dial 46 so as to make it possible to set the switch contact 40 in any desired position with respect to the dial. This setting may be accomplished by a removable key 49 adapted to fit on the squared end 50 of the shaft 42.

It will be obvious that the circuit is completed through the switch 36 when the altimeter needle 39 contacts the manually adjusted switch contact 40. This closure is produced during the descent of the bomb when it reaches the elevation corresponding to the setting of the contact 40. The contact 40 is always positioned below the pointer 39. Thus when the needle 39 is in zero position, as when the bomb is on the ground at sea level, the movable contact 40 would be positioned below the zero mark on the dial. The contact 40 is set only shortly before the bomb is discharged from the airplane. Thus suppose the mine field is to be created at an elevation of 30,000 feet by dropping the bomb from an airplane at 35,000 feet. The operator leaves the contact 40 in its initial position below the zero mark on the dial until he has reached an elevation substantially above 30,000 feet. Thereafter the shaft 42 is turned to position the indicator 48 at 30,000 feet. This can be done without contacting the needle 39 because the latter is in a higher position. After the bomb has been dropped, the needle 39 gradually moves back toward zero position as the bomb loses elevation, and when it reaches the 30,000 foot level, for which it was set, the needle 39 will contact the contact 40 and complete the circuit for detonating the bomb, provided, of course, that the other two switches mentioned are also closed.

The leveling switch 37 is provided for the purpose of opening the circuit and preventing the release of the mines unless the bomb is in vertical position. It consists of two horizontally extending tubes 51 and 52, respectively (Fig. 4), positioned at right angles to each other and both lying in a plane normal to the longitudinal axis of the bomb. The tubes 51 and 52 are partly filled with mercury and have metallic end caps 54 which complete the circuit through the mercury when the bomb is in vertical position. However, if the bomb is tilted substantially off vertical position, the mercury in tube 51 or tube 52 will flow into one end of the tube and leave the contact at the other end, thereby interrupting the detonating circuit.

The centrifugally actuated switch 38 includes a spring contact 55 (Fig. 2) mounted on a stationary insulating support 56 which cooperates with a contact 57 insulatingly mounted on a slide 60, one end of which projects into an annular groove 61 in the collar 58 of the centrifugal device 19. As previously mentioned, this device 19 is mounted on the shaft 17 which is rotated by the windmill 16 when the bomb is falling freely and has acquired substantial velocity. As the velocity of the shaft 17 increases, the governor balls 62 move outwardly and upwardly against the tension of return springs 59 to raise the collar 58 and swing the slide 60 to carry the contact 57 against the stationary contact 55.

The battery 34 is mounted on a sleeve 65 extending inwardly from the rear shell 13 and open at its outer end. The battery 34 is simply inserted into the sleeve 65 as far as it will go, causing the center terminal 66 of the battery to press against a contact spring 67 which is connected to the contact spring 55, previously mentioned. The battery is retained in position by an ordinary sliding door 68. When it is desired to change batteries, the door 68 is slid away from the opening therebelow, whereupon the spring 67 presses the battery 34 outwardly a sufficient distance to enable it to be grasped by the operator.

It is desirable to insert the battery 34 as the

last operation in preparing the bomb, since the bomb is safe without the battery. The insertion of the battery is a very simple and quickly-performed operation.

The mines 21 can be of various types of construction, some of which are disclosed in my copending application Serial No. 399,003, filed June 20, 1941.

In general, each mine comprises a mine body 70 (Fig. 7), a parachute 71 connected to the mine body 70 by shroud lines 72, and a wire 73 connecting a weight 74 to the body 70. The mines may be so designed as to detonate in response to any shock, and a mine construction of this type is disclosed in my copending application referred to above. However, it is often desirable to so construct the mines that they will be substantially safe against detonation on the ground, while being positively detonated when contacted in the air by an airplane.

In accordance with the present invention, I so design the mines that they are detonated by tension applied between the wires 73 and the shroud lines 72. A tension sufficient to detonate the mines results if either the shroud lines 72, the wire 73 or the mine body 70 is contacted by a rapidly moving object, such as an airplane.

Referring to Fig. 6, the mine body 70 comprises an open top container 75 containing the main explosive charge 76 and having a top 77 frictionally engaging the container. The shroud lines 72 are connected to rings 78 on the container top 77, so that when the parachute is in the extended condition shown in Fig. 7, it supports the body 70 through the top 77. The wire 73 is secured to a cap 80 screwed onto the lower, threaded end of a tube 81 which extends up through the center of the container 75 and through an aperture 82 in a recessed portion 83 of the top 77. The tube 81 contains a detonating material 84, such as fulminate of mercury, which explodes when broken. The upper end of the tube 81 has secured thereto a head 81*a* which fits within the recess portion 83 of the lid but may be spaced a short distance from the bottom wall of the recess.

As shown in Figs. 2 and 6, the parachute 71 may be folded against the upper end of the mine body 70 and the weight 74 may be placed in front of the parachute, the assembly being held in place by the outer skin 33 (Fig. 2) of the bomb. When the mine is blown out of its barrel 20, the parachute 71 and balls 74 are released, and the mine assumes the condition shown in Fig. 7. Under these circumstances, the weight 74 is connected through the cap 80 with the lower end of the detonating tube 81, but no tension is applied to the tube, because the shroud lines 72 are connected to the cap 77 which is frictionally engaged with the container 75.

However, if the mine body, the wire 73, or the shroud lines 72 is struck by a rapidly moving body, such as an airplane, the tension is immediately increased to a value sufficient to tear the cap 77 off the container 75, carrying the upper portion of the tube 81 with it. The tube 81 may be weakened near its center, as indicated at 89, so that it will be ruptured at that point. The rupture detonates the material 84 which in turn detonates the main charge 76.

If the mine falls to the ground without being struck by an airplane, it is relatively safe, because only a substantial tensile strain, applied between the container 75 and the cap 77, can tear the cap loose and thereby break the detonating tube 81.

As an example, one manner of using the invention is illustrated in Fig. 8, in which a group of enemy planes 85 is intercepted by mines laid by an airplane 86 flying at a higher elevation and in advance of the planes 85. The plane 86 has dropped three bombs 10, in accordance with the invention. The first bomb has burst and scattered its mines slightly above and in front of the planes 85. The second and third bombs have not yet exploded but are set to explode and distribute their mines at spaced intervals along the path of the enemy airplanes 85.

My bombs may be released in various ways to create different types of aerial mine fields. As an example, a number of bombs may be dropped simultaneously, but set to explode at different elevations so as to create a mine field of substantial vertical extent.

An important feature of the present invention is that mine fields can be quickly established in any location where they would be useful, because they do not require surface artillery for their use. Thus my fields might be established over enemy airdromes, deep in enemy territory, to hamper the use of the airdrome by the enemy.

It may be desirable in some instances to interconnect some of the mines in the bomb with wires, so as to form a net more apt to be struck by an enemy airplane.

An important feature of the invention is the fact that it makes possible rapid creation of aerial mine fields in any desired location so that the enemy cannot prepare in advance against them.

The expression "parachute mine" as used in the claims, defines a mine having a parachute connected thereto for causing the mine to slow the descent of the mine through the air. Furthermore, where the expression "in folded condition" is used in the claims to describe a parachute mine, it means that the parachute is collapsed into a small space closely adjacent the mine.

Many variations from the exact constructions shown and described will occur to those skilled in the art, and the invention is, therefore, to be limited only to the extent set forth in the appended claims.

I claim:

1. An aerial mine comprising a body member containing an explosive charge and a detonating element, said detonating element extending longitudinally of the body member and being adapted to detonate in response to tensile disruption thereof, a parachute, means connecting said parachute to the upper end of said detonating element, means connecting the lower end of said detonating element to said body member, whereby said detonating element is disrupted and detonated in response to abnormal tensile force between said body member and said parachute.

2. An aerial mine comprising a body member containing an explosive charge and a detonating element, a parachute, means for permanently connecting said parachute to the upper end of said detonating element and yieldably connecting it to said body member, means connecting the lower end of said detonating element to said body member, said detonating element detonating in response to tensile disruption and being subject to tensile disruption by predetermined tensile force between said parachute and said body member.

3. An aerial mine comprising in combination:

a body member containing an explosive charge and a detonating element that detonates in response to tensile disruption, a cap yieldably retained on said body member, means connecting said detonating element between said cap and said body member, whereby it is disrupted in response to pulling away of said cap, and a parachute connected to said cap.

4. An aerial mine comprising a body member containing an explosive charge, a detonating element for detonating said charge, a parachute, means for normally supporting said body member from said parachute, a weight, filamentary means connecting said weight to the lower end of said detonating element, and means connecting the upper end of said detonating element to said parachute, said detonating element detonating in response to tensile disruption thereof, and being disruptable in response to tension between said weight and said parachute in excess of a predetermined value.

5. An apparatus of the type described, comprising: a body member adapted to be dropped from an aircraft and having means for aligning itself in its path of flight, said body member defining a plurality of laterally directed barrels, each containing a mine incorporating a parachute, and explosive means for projecting said mines from said barrels during descent of said body member through the air, and means operative during descent to detonate the said explosive means.

6. Apparatus as described in claim 5, in which said body member has a longitudinal axis and said barrels project radially from said axis.

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