C. R. KEERAN.

BOMB.

APPLICATION FILED MAR. 21, 1917.

1,340,546. Patented May 18, 1920.

2 SHEETS—SHEET 1.

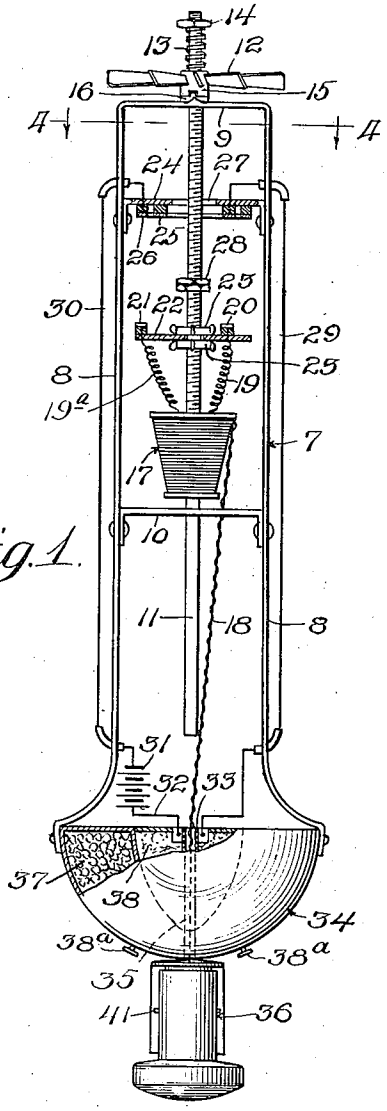


Fig. 1.

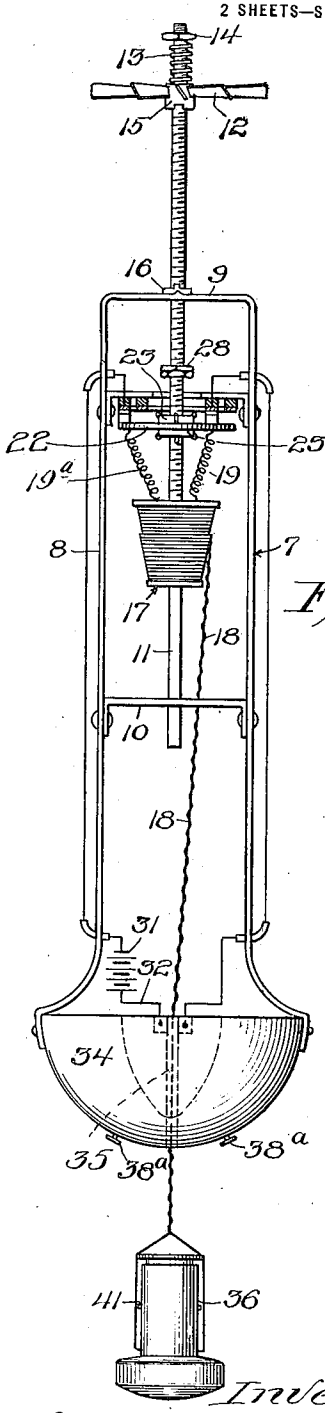


Fig. 2.

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2 SHEETS—SHEET 2.

Fig. 3.

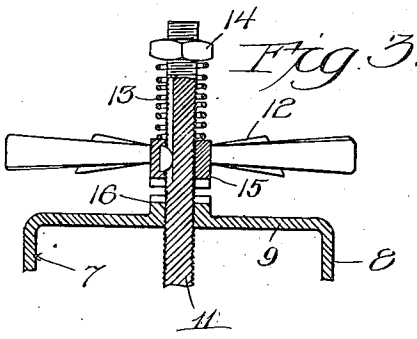



Fig. 4

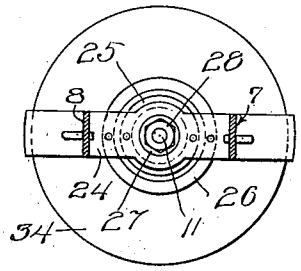



Fig. 5

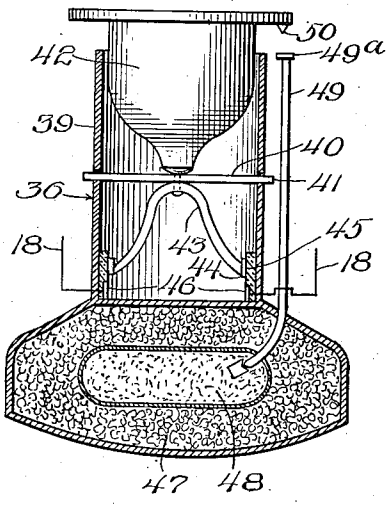
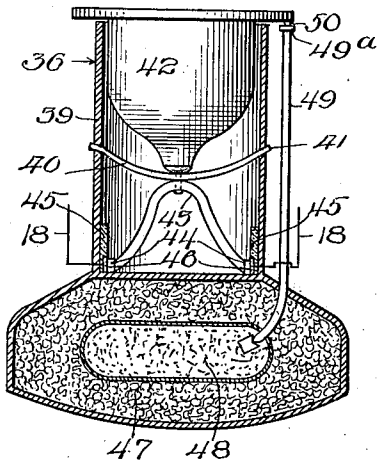



Fig. 6.




Witness:

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# UNITED STATES PATENT OFFICE.

CHARLES R. KEERAN, OF CHICAGO, ILLINOIS.

## BOMB.

1,340,546. Specification of Letters Patent. Patented May 18, 1920.

Application filed March 21, 1917. Serial No. 156,409.

*To all whom it may concern:*

Be it known that I, CHARLES R. KEERAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Bombs, of which the following is a specification.

This invention relates to an explosive device in the nature of a bomb, adapted, when dropped from a height, to be exploded at a predetermined elevation above the ground.

The present bomb, which is intended to be operated by dropping, is equipped with means readily adjustable for placing, rather than timing, the explosion. For this purpose it is provided with an antenna, which may include in its construction an auxiliary bomb, the antenna being arranged to precede the bomb in its descent, and upon contact with the ground to cause the main bomb to explode while still in the air. In the present bomb construction I have sought to provide means for accomplishing the above ends; also other means for preventing accidental explosion of the bomb prior to its intended operation; means for insuring the explosion of the bomb at a predetermined elevation above the ground; and adjusting means for regulating the place of the explosion relative to the surface of the earth.

Special advantages attach to the use of two distinct bombs, the main bomb to be exploded in the air, and the other to be exploded upon contact with the earth. It is well recognized by those skilled in the art that a bomb which explodes in the air is comparatively useless against fortifications or entrenchments, while on the other hand a bomb which explodes in the ground is comparatively useless against troops, except those in the immediate vicinity of the point of explosion. It is also well recognized that in dropping a bomb from an airship, the aim is necessarily uncertain. The aviator cannot tell with certainty where his bomb is going to hit. Therefore, my improved device, consisting of what may be termed a double bomb, one portion of which explodes at a predetermined distance above the ground, and the other portion exploding when in contact with the earth, affords a greater probability of accomplishing effective damage to an enemy than a bomb which explodes only in the air, or a bomb which explodes only when in contact with the ground.

My invention consists also in numerous other features of construction and combinations of parts, as will more fully hereinafter appear.

In the drawings:

Figure 1 shows in elevation parts being in section, a bomb which embodies the present invention, the device being adjusted for dropping from an air craft;

Fig. 2 is a similar view showing the relation of the parts during the descent of the bomb;

Fig. 3 is an enlarged detail showing the propeller device which retards the descent of the bomb;

Fig. 4 is a transverse section taken on line 4—4 of Fig. 1;

Fig. 5 is a longitudinal section through the contact device attached to the antenna; and

Fig. 6 is a view similar to Fig. 5, showing the position of the parts after the device has made contact with the ground.

In the present exemplification of my invention I utilize a frame 7 including side rails 8, a cross head 9, and a cross brace 10. Extending centrally and longitudinally of the frame is a screw shaft 11, threaded for a considerable portion of its length and having a threaded engagement with the cross head 9. A propeller 12 is slidingly mounted on the upper end of the shaft, but is prevented, by any suitable means, from rotating relative thereto. Immediately above the propeller is a coiled spring 13, held under tension by means of a nut 14 secured to the extremity of the shaft. The under side of the propeller is formed with a hub 15 adapted normally to engage with a member 16 positioned on the upper side of the cross head, this engagement of the hub and member serving to lock the shaft 11 against rotation within the frame. When the propeller is moved upon the shaft against the tension of the spring 13, the hub 15 is disengaged from the member 16 so as to permit the shaft 11 to revolve.

Near the cross brace 10 the shaft carries a reel or spool 17, upon which are wound suitably insulated electric wires 18. These wires are in double formation and may be twisted or otherwise secured together so as to unwind from the reel in unison. The inner ends of the wires 18 extend in coiled formation from the reel as at 19 and 19ª, to connect, respectively, with terminals 20 and 21

which are mounted upon a disk 22. This disk is slidably secured to the shaft 11, but is normally held fixedly thereon by means of lock nuts 23 secured to the shaft on opposite sides of the disk. Mounted on the frame above the disk is a plate 24, which carries inner and outer contact rings 25 and 26, respectively, arranged to be contacted by the terminals 20 and 21 when the disk 22 has been advanced sufficiently by longitudinal movement of the shaft 11 within the frame. The plate 24 is formed with a central opening 27, through which may pass a locking member 28 secured upon the shaft. Extending from the contact rings 25 and 26 are electrical connections 29 and 30, the latter of which connects with one pole of a battery 31. The other battery pole is connected by a wire 32 with an electrically igniting device 33, to which the wire 29 is also connected. When the terminals 20 and 21 contact with the rings 25 and 26, the wiring connections described form a complete circuit, except at the ends of the wires 18 which are unwound from the reel.

Carried by the frame 7, at its lower end, is a bomb shell 34, arranged to be exploded by the electrically operated igniting device 33. A passage 35 is provided centrally of the bomb shell, through which the wires 18 pass to connect with a contact device 36. As the present bomb is intended to explode at a distance above the ground, it is desirable that its energy be expended effectively over as wide an area as possible, and for this purpose I prefer to form the bomb shell somewhat as illustrated. The bomb shell may comprise an outer compartment 37 for shrapnel balls or other metal fragments, and an inner compartment 38 containing a suitable explosive capable of being fired by the igniting device 33. In cross section the compartments 37 and 38 are larger toward the sides and upper portions and smaller at the bottom. As the bomb is intended for explosion above the surface of the earth, I prefer this construction, as the missiles and explosive charge are thereby so disposed relative to each other and to their intended target as to distribute most uniformly the metal fragments over the entire area in which the bomb is effective. If desired, one or more impact devices $38^a$ may be arranged on the bottom side of the bomb casing and be operatively connected with the explosive charge. The purpose of these devices is to explode the bomb upon contact with the earth should all other means for causing the explosion fail.

The contact device 36 may be formed in any one of a number of different ways, the one shown in Figs. 5 and 6 being especially effective. This device consists of a shell or casing 39 through which is extended, in a transverse direction, a bar 40 which may be conveniently formed of soft iron. The ends 41 of the bar project through the casing a slight distance on either side. Secured to the bar 40 is a plug 42 which occupies a position in the upper end of the casing. To this same bar is also connected a yoke member 43 having extremities 44 normally held by spring tension against a block 45 of insulated material on the inner side of the casing. Contacts 46, connected with the wires 18, are mounted in the block 45 and are arranged to be engaged by the extremities 44 of the yoke member when the plug is driven into the casing. The connection between the plug 42, the bar 40, and the member 43 may, if desired, hold these three elements against rotary movement with respect to each other so as to insure a proper alinement of the extremities 44 with the contacts 46.

The contact device may also, if desired, be formed in conjunction with an auxiliary bomb, and for this purpose I have shown a construction providing compartments 47 and 48, in which are contained missiles and an explosive charge, respectively. A delayed-action fuse 49, arranged to ignite the charge, is operatively connected at one end with the explosive charge, and at the other end with a primer $49^a$ located in proximity to a striker 50 which is attached to the plug 42. Manifestly, the same movement of the plug relative to the casing, which causes the yoke member to establish a circuit between the two contacts 46 will result in the striker igniting the fuse to bring about an explosion of the charge 48.

Prior to use, the disk 22 is adjusted lengthwise of the shaft, so that the contacts 20 and 21 will be brought into engagement with the rings 25 and 26 when a predetermined quantity of wire 18 has been unwound from the reel. If it is desired that the bomb should be exploded at a distance, say 25 feet above the earth, then the disk 22 will be so adjusted as to unwind from the reel a sufficient length of wire 18 for this purpose before the contacts 20 and 21 will engage with the rings 25 and 26 to stop the shaft and reel from further turning movement. The particular height at which the bomb should be exploded is to be determined by such factors as its velocity at the moment of explosion and the character of its intended target. It is obvious that as the velocity of the bomb increases, the area in which its missiles are effective decreases, assuming a single elevation of explosion. The velocity of the bomb will be governed by the distance of its drop. The operator, however, may determine the area over which the bomb will take effect by setting the device to explode at a given height or distance away from the intended target, and by properly adjusting the disk 22, relative to the

height of the drop, the bomb may be made to operate to the best advantage.

At the time the bomb is constructed, the stop member 28, which may consist of two nuts locked upon the shaft, is so set as to prevent accidental movement of the disk 22 upon the shaft to a point where the circuit is closed, when the parts are in their normal position, as shown in Fig. 1. The stop member, however, does not interfere with the normal operation of the device, as it is free to pass through the central opening 27 in the plate 24. In practice, the distance between the cross head 9 and the stop member 28 should be slightly less than the distance between the plate 24 and the disk 22, when in its lowermost position.

The relation of the parts in the mechanism and in the contact device can be ascertained readily at any time. The propeller 12, when in normal position, is closed up against the cross head 9, thus giving the operator a visual indication of its position, so that he will not attempt to set the disk 22 when the propeller 12 is in any position other than that shown in Fig. 1. When in this position the stop member 28 acts as a safety to prevent the contacts 20 and 21 from being brought into contact with the rings 25 and 26 by any method other than rotation of the shaft 11. It is also possible to tell whether the circuit is closed in the auxiliary bomb 36 by noting the position of the ends 41 of the bar 40, which are arranged normally to project through the casing walls, as shown in Fig. 5. If the ends of the bar are drawn in, as in Fig. 6, the operator will be warned that the circuit is closed within the bomb 36, and will govern his actions accordingly.

After the parts have been adjusted for explosion at a predetermined height, the bomb is ready to be released for action. Upon being dropped, the blades of the propeller will offer a certain resistance to the air, such as to retard to a slight extent the velocity of the bomb. As soon as sufficient velocity has been attained, the increasing air resistance on the propeller blades will overcome the tension of the spring 13, so that the propeller will slide longitudinally upon the shaft to a point where the hub 15 will clear the member 16. When this occurs, the air acting on the propeller blades will cause the propeller to rotate, and with it the shaft 11, thus unwinding the wires 18 from the reel 17.

The antenna, with the contact device at its extremity, is enabled to drop in advance of the bomb, owing to the retarding influence exerted by the propeller. As the shaft 11 is revolved, it is screwed upwardly relative to the frame until the contacts 20 and 21 are seated against the rings 25 and 26, at which point it will cease to turn further. The circuit which is connected with the igniting device of the bomb is then closed at all points except in the auxiliary bomb 36, which will be the first part of the bomb device to reach the ground. The impact of the auxiliary bomb with the earth will cause the plug 42 to be forced downwardly into the casing 39, so that the extremities of the yoke member 43 are brought into contact with the contacts 46 to close the last gap in the electrical circuit. This movement of the plug 42 relative to the casing will necessitate the bending of the bar 40, which will yield for the purpose, but which will not permit of a rebound to open the circuit; thus the electrical igniting device 33, operatively arranged within the bomb, is energized to instantaneously explode the bomb 34 while still in the air. It is obvious that the elevation of the bomb explosion may be predetermined by regulating the distance that the antenna shall precede the bomb during descent.

The auxiliary bomb shown and described is arranged to explode upon contact with the earth. Connected with this bomb is a delayed-action fuse 49, whose action may be sufficiently slow to allow an appreciable element of time to elapse between the time of its ignition and the time of the explosion of the charge 48. This brief interval of time would suffice for the establishment of the electrical circuit necessary for the explosion of the main bomb 34, following immediately behind it. If the electrical igniting device should fail of operation, the main bomb will, upon striking the earth, be exploded through the medium of the impact devices 38a. In the event that these impact devices should not operate, then the main bomb may be exploded by the concussion resulting from the explosion of the auxiliary bomb, which is preferably timed to go off after a sufficient time has gone by to allow the main bomb to reach the earth. It is thus apparent that the explosion of the present bomb may be brought about (1) by the electrical igniting apparatus; (2) by the impact devices connected therewith; or (3) by the concussion resulting from the explosion of the auxiliary bomb.

I claim:

1. In combination, a main bomb, an auxiliary bomb, an electric circuit connecting the two said bombs, means brought into action during the flight of the main bomb to separate the auxiliary bomb a predetermined distance from the main bomb, and means contained in the auxiliary bomb to explode both bombs upon the contact of the auxiliary bomb with the earth, substantially as described.

2. In combination, a main bomb, an auxiliary bomb, electric contacts in said main bomb and auxiliary bomb, an electric circuit

connecting the two bombs, means set in operation during the flight of the main bomb to close the electric circuit contained therein, and other means set into action by the contact of the auxiliary bomb with the earth, to close the circuit in said auxiliary bomb, whereby the auxiliary bomb explodes upon contact with the earth, and the main bomb explodes at a predetermined distance above the earth, substantially as described.

3. In a bomb, the combination of an explosive charge, an igniting device therefor, a propeller rotatably connected with the bomb, a contact device in advance of the bomb operatively connected with the igniting device, and means connected with the propeller for releasing the contact device a predetermined distance ahead of the bomb, whereby the bomb explosion is set to occur at a fixed distance from its target, substantially as described.

4. In a bomb, the combination of an explosive charge, an electrical igniting device therefor, means for retarding the speed of the bomb during its travel consisting of a propeller, a threaded shaft to which the propeller is secured, and a frame upon which the shaft is mounted, a contact device in advance of the bomb and operatively connected with the electrical igniting device, and means carried by the bomb operable during travel thereof for releasing the contact device a predetermined distance ahead of the bomb consisting of a reel mounted on the shaft, current wires connected with the igniting and contact devices adapted to be unwound from the reel when the propeller is revolved, and means for arresting the revolving movement of the propeller and shaft when a given length of wires has been unwound, substantially as described.

5. In a gravity bomb, the combination of a shell having inner and outer compartments therein for an explosive charge and missiles respectively, the outer compartment being extended across the bottom and around the sides of the shell and increasing in size toward the sides of the shell, and the inner compartment being of increased size in the regions immediately adjacent the larger portions of the outer compartments, substantially as described.

CHARLES R. KEERAN.