Jan. 12, 1960 A. S. BERLIN ET AL 2,920,561

EXPLOSIVE GAS BOMB SUITABLE FOR CLUSTERING

Filed April 18, 1956 2 Sheets-Sheet 1

Fig. 1.

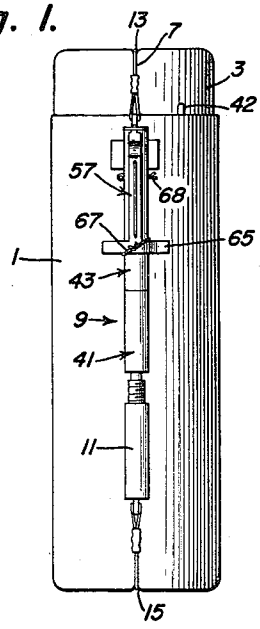


Fig. 2.

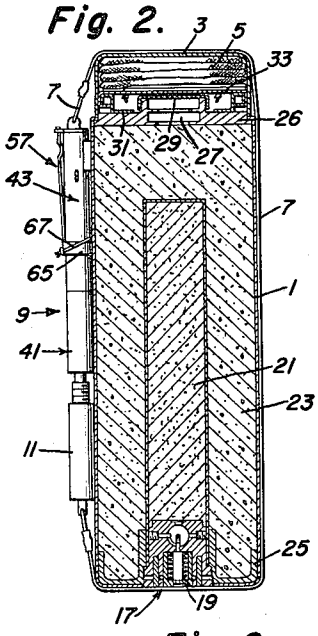


Fig. 3.

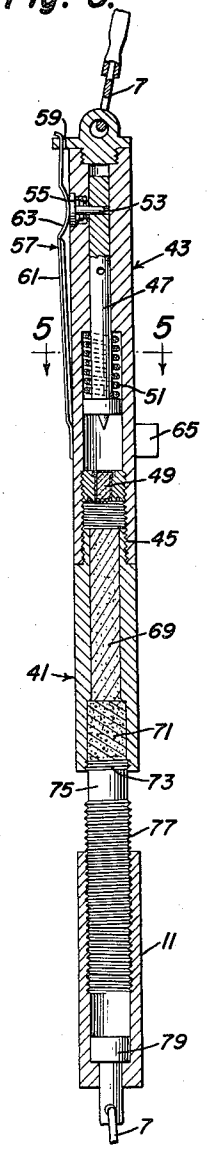


Fig. 4.

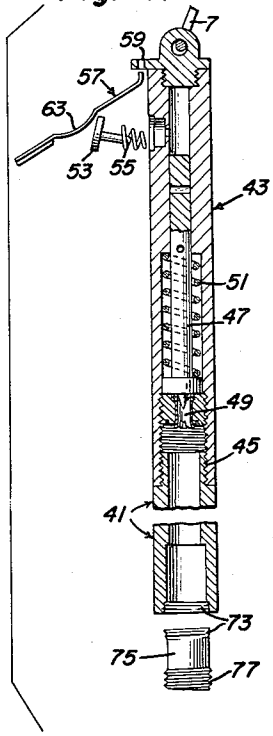


Fig. 5.

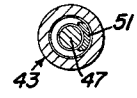


Fig. 6.

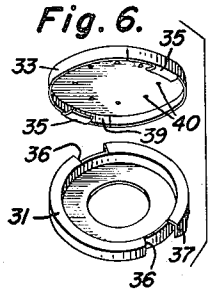
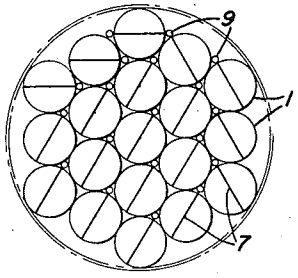


Fig. 7.



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Jan. 12, 1960 A. S. BERLIN ET AL 2,920,561

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Filed April 18, 1956 2 Sheets-Sheet 2

Fig. 8.

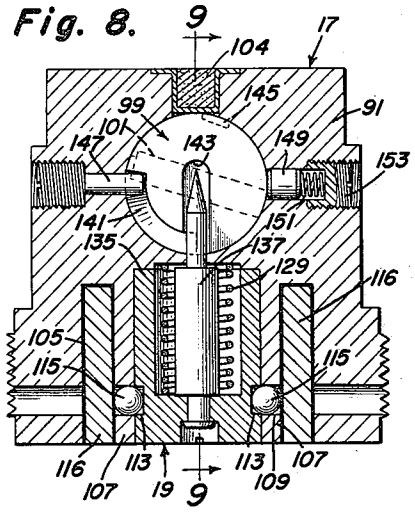


Fig. 10.

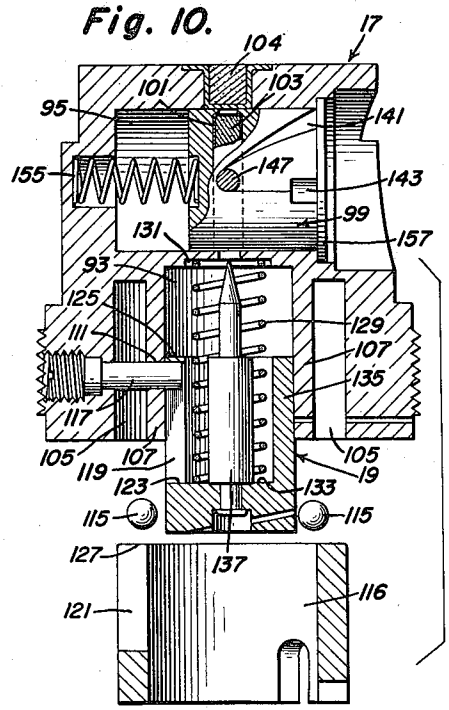


Fig. 9.

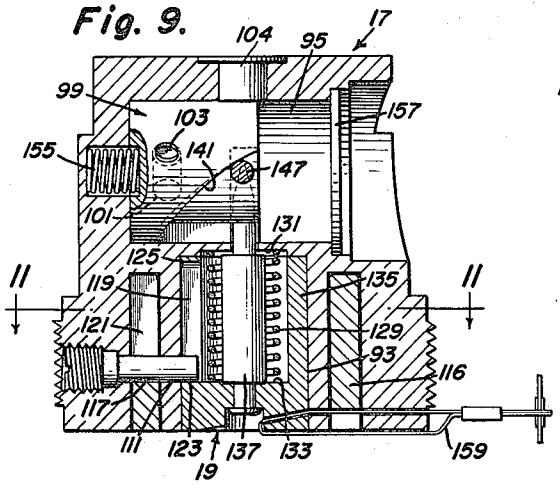


Fig. 12.

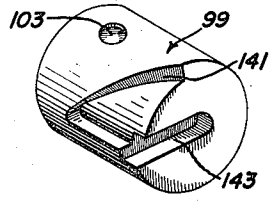
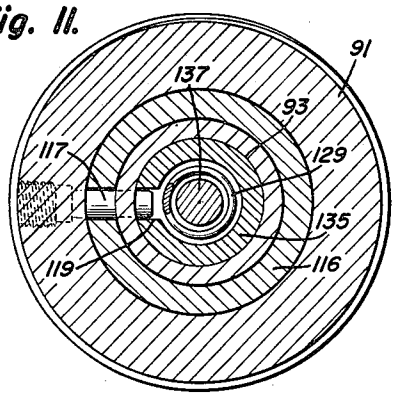


Fig. 11.



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United States Patent Office 2,920,561 Patented Jan. 12, 1960

2,920,561

EXPLOSIVE GAS BOMB SUITABLE FOR CLUSTERING

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Application April 18, 1956, Serial No. 579,122

5 Claims. (Cl. 102—7.2)

(Granted under Title 35, U.S. Code (1952), sec. 266)

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

This invention relates to an explosive gab bomb suitable for clustering.

An object of the invention is to provide a bomb which will efficiently disseminate toxic material over an area commensurate with the properties of the agent, serve as a fragmentation bomb, and be safe to handle.

The bomb is, in general, a cylinder having a small parachute housed in a cup at the tail end. The cup is held in place by a retainer wire which is connected at its ends to a pyrotechnic delay mechanism. The delay mechanism includes a lever type arming bar which is held in the unarmed position by the adjacent bombs of the cluster. Upon break up of the cluster the arming bar is released, setting the delay mechanism in action. After the proper time interval the delay mechanism causes the release of the retaining wire, liberating the parachute.

The nose end of the bomb is provided with an inertia-armed impact-sensitive fuze. The deceleration caused by the opening of the parachute arms the fuze, causing it to become impact-sensitive. When the bomb strikes the ground or other surface, the fuze detonates a central burster charge, fragmenting the casing and dispersing the chemical filling.

In the drawing, Fig. 1 is a side elevation of a bomb in accordance with our invention.

Fig. 2 is a longitudinal cross section of the bomb.

Fig. 3 is a longitudinal cross section of the delay in its unarmed condition.

Fig. 4 is a longitudinal cross section of the delay just after detonation of the ejecting charge.

Fig. 5 is a cross section on the line 5—5, Fig. 3.

Fig. 6 is an exploded perspective view of the means for attaching the parachute to the bomb.

Fig. 7 is an end view of a plurality of the bombs arranged in a cluster.

Fig. 8 is a longitudinal section through the fuze.

Fig. 9 is a section on line 9—9, Fig. 8, but showing the rotor in elevation.

Fig. 10 is a section on the same plane as Fig. 9, showing the fuze, at the moment of arming.

Fig. 11 is a section taken on line 11—11, Fig. 9.

Fig. 12 is a perspective view of the rotor.

Referring to the drawing, the bomb comprises a cylindrical steel casing 1 having a cup 3 mounted at one end within which is folded a parachute 5 which is connected to the bomb. A retaining wire 7 which is preferably a stranded wire, encircles the casing and cup and is joined at its ends to a delay 9. Means are provided to tighten the wire so as to hold the parts securely together. We have shown a turnbuckle 11 but other means may be employed, such as a spring or the crimped tube disclosed in application Serial No. 476,094, filed December 17, 1954, now

Patent No. 2,868,125, by Bernard Rogge. In order to prevent slippage of the wire the ends of the cup and casing are provided with diametral grooves 13 and 15 respectively.

The nose end of the bomb is provided with an inertia-armed impact-sensitive fuze 17 having a firing pin 19, which protrudes from the nose of the bomb when the fuze is armed. The fuze 17 communicates with a burster 21. This burster is ordinarily cylindrical, as shown. However, it may be of other forms and may be a shaped charge designed to give a desired type of dispersion. A chemical charge 23 fills the casing 1. This chemical charge may be either solid or liquid. The bomb is however particularly intended to disseminate a liquid non-persistent highly toxic agent.

The bombs are assembled in a cluster as shown in Fig. 7, with the delays 9 lying in the voids between casings 1. Any suitable type of cluster adapter may be employed, for example, that shown in application Serial Number 321,064, filed November 17, 1952, now Patent No. 2,796,021, by A. S. Berlin et al. or that shown in application Serial Number 324,162, filed December 4, 1952, now Patent No. 2,809,583, by R. L. Ortynsky et al.

Upon breakup of the cluster, the delay 9 is set into operation and after a fixed time releases the retaining wire 7. The cup 3 then drops off releasing parachute 5. The deceleration caused by the opening of the parachute arms the fuze 17, so that the firing pin 19 protrudes from the nose of the bomb. On impact, the firing pin is driven inwardly. The fuze detonates the burster charge 21 which bursts the casing 1, scattering fragments and dispersing the chemical filling 23.

The various components of the bomb will now be described in more detail.

The casing 1 is reinforced at the nose end of the bomb by annular channel 25 which supports burster 21 and fuze 17. The tail end is closed by plate 26, which is provided with a filling opening 27, closed by cap 29.

In order to secure the parachute to the casing an annular flange member 31 (see Figs. 2 and 6) is mounted on plate 26 and the parachute comprises a cap 33 having inwardly projecting prongs 35. These prongs, together with notches 36 in flange 31 and stops 37 form a bayonet connection. In assembling the bomb, cap 33 is placed over flange 31 and rotated until prongs 35 contact stops 37. Locking tab 39 is then bent inwardly into notch 36, preventing rotation and locking the cap 33 in place. This is done by means of a screwdriver or similar tool, which is inserted through opening 42. Cup 3 is provided with an opening 42. The parachute cords are secured to cap 33, which is provided with holes 40.

In combination with the other features of this bomb, the parachute performs several functions. First, it controls the ballistic characteristics of the bomb. It produces a low and controllable terminal velocity. By selecting the size of the parachute the terminal velocity and the dispersion of the bombs may be controlled within wide limits. It orients the bomb so as to cause it to strike nose first, which is important in the case of a chemical or fragmentation bomb since the distribution of the contents and/or fragments varies with the position of the bomb at the time of explosion. Finally in cooperation with the particular fuze employed, and the delay mechanism, the parachute serves to arm the fuze after the bomb has left the cluster.

The delay 9 comprises an elongated casing formed by charge holder 41 and firing pin holder 43. The two holders are joined by screw connection 45.

Within the firing pin holder is a firing pin 47 which is urged toward primer 49 by firing pin spring 51. The firing pin 47 is normally held in the position shown in Fig. 3 by lock pin 53 which is urged outwardly by lock

pin spring 55. The lock pin 53 is held in place against spring 55 by arming bar which is pivoted to holder 43 at 59. Arming bar 57 comprises a longitudinal portion 61 provided with a depressed portion 63 which contacts the pin 53. It also comprises an arched portion 65 which embraces holder 43 and contacts the bomb casing 1. Before clustering arming bar 57 is held in place by safety wire 67 and firing pin 47 is held by cotter key 68. During the clustering operation the wire and key are removed.

The charge holder 41 contains a delay charge 69 and an ejection charge 71. A breakable screw connection 73 joins charge holder 41 to connector 75. Connector 75 may be of various forms, depending on the particular tightening mechanism employed, so long as it closes the end of charge holder 41 and is provided with means for connecting it to wire 7. We have shown it as joined to turnbuckle 11 by threads 77. The turnbuckle 11 receives connector pin 79 which is attached in any suitable manner to retaining wire 7. The other end of wire 7 is secured in any suitable manner to firing pin holder 43.

The operation of the delay is as follows. When the bombs are clustered the arming bar 57 is held in the position shown in Fig. 3 by adjacent bombs. Upon cluster breakup the arming bar is released and is free to drop off, as shown in Fig. 4. Lock pin 53 is ejected by spring 55, releasing firing pin 47, which is driven by spring 51 into primer 49. Explosion of the primer ignites delay charge 69 which after a predetermined period explodes ejection charge 71, the explosion strips threads 73 thus separating holders 41 and 43 from connector 75 and releasing retaining wire 7.

The fuze 17 comprises a fuze body 91 having a longitudinal bore 93 and a transverse bore 95. The axes of bores 93 and 95 intersect. Firing pin 19 is slidably mounted in longitudinal bore 93 while a rotor 99 is slidably and rotatably mounted in transverse bore 95. The rotor 99 is pierced by a bore 101 which is aligned with longitudinal bore 93 when the fuze is armed, but out of alignment when the fuze is unarmed. A detonator 103 is mounted in bore 101.

In the nose of the fuze, surrounding bore 93, is a deep annular channel 105 of uniform width separated from longitudinal bore 93 by annular wall 107. Wall 107 is pierced at several points by openings 109 and 111. Firing pin 19 is provided with sockets 113. A ball 115 is positioned in each opening 109 and extends into a socket 113. The diameter of opening 109 is somewhat larger than the thickness of annular wall 107 and the diameter of balls 113 is substantially the same as that of openings 109, but enough smaller to permit rolling within the opening.

The balls 115 are held in place by arming ring 116 which is mounted in annular channel 105. The dimensions of the arming ring 115 and channel 105 are such that the ring is held in place by frictional engagement. The tightness of fit is rather critical and will be further discussed later.

Firing pin retainer 117 is threaded into fuze body 91 and passes through opening 111. Firing pin 19 and arming ring 116 are provided with longitudinal slots 119 and 121, respectively, to receive firing pin retainer 117. Slot 119 terminates at shoulders 123 and 125 which engage retainer 117 to limit movement of the firing pin 19 in either direction. Slot 121, however, is open at its inner end 127 permitting arming ring 116 to slide out of channel 105. Firing pin spring 129 engages shoulders 131 and 133 on fuze body 91 and firing pin 19 respectively. Spring 129 urges firing pin 19 outwardly, but when arming ring 116 and balls 115 are in place the firing pin is locked against such movement.

The firing pin 19 comprises an annular body member 135 and a central striker 137. Spring 129 is located between these two members of the firing pin.

The rotor 99 is cylindrical and shorter than bore 95. In addition to bore 101, it is provided with a cam groove having a helical cam surface 141, a striker socket 143 and lock pin socket 145. A guide pin 147 is mounted in the fuze body 91 and engages cam surface 141. A lock pin 149 is also mounted in fuze body 91 and is urged toward the rotor by lock pin spring 151, which in turn is held in place by lock screw 153. Rotor spring 155 urges the rotor toward the right in Figs. 9 and 10. The end of bore 95 opposite to spring 155 is closed by plug 157. In the unarmed position, striker 137 of the firing pin engages striker socket 143 and prevents movement of the rotor 99.

In the armed position shown in Fig. 10 the striker 137 is withdrawn from socket 143, the detonator 103 is aligned with striker 137 and lock pin 151 is in engagement with socket 145, holding the rotor fixed in this position. Firing pin 19 projects from the nose of the bomb. When the bomb strikes the ground, striker 137 is driven into detonator 103. Explosion of the detonator actuates the burster charge 21.

A safety wire 159 holds arming ring 116 in place.

The operation of the fuze is as follows. When the bomb is clustered, safety wire 159 is removed and arming ring 116 is thereafter held in place by friction, by wire 7 and by virtue of the bombs being positioned end to end in the cluster. The tightness of fit of the ring 116 in channel 105 is such that even upon breakup of the cluster the ring remains in place and firing pin 19 is locked in place by the engagement of balls 115 and sockets 113. When delay 9 releases wire 7 and the parachute opens, however, the jolt caused by the deceleration is sufficient to throw out arming ring 116, as shown in Fig. 10. The balls 115 then fall out, unlocking firing pin 19 which is then pushed outwardly by spring 129 until retainer 117 engages shoulder 125. The firing pin then projects from the end of the bomb.

By this outward movement of firing pin 19, striker 137 is withdrawn from socket 143. Spring 155 then moves rotor 145 to the right in Fig. 10. During this longitudinal movement, engagement of guide pin 147 with cam surface 141 causes the rotor to rotate. Movement of the rotor is arrested by engagement of lock pin 149 in socket 145. The fuze is then armed, as described above.

In summary we have provided a gas bomb which has many desirable characteristics. It combines the antipersonnel effects of a chemical bomb and a small high explosive fragmentation bomb. Its ballistic characteristics are desirable for a low penetration chemical bomb and are controllable. Finally, the combination of the delay, the parachute, and the inertia-armed impact-sensitive fuze provide a very safe structure. The series of events necessary to explode the bomb are such as to make it most unlikely that they would ever occur accidentally. This makes it practicable to employ chemical warfare agents of the highest toxicity.

While we have described our bomb and its components in detail it will be obvious that various changes are possible. We therefore desire our invention to be limited solely by the scope of the appended claims.

We claim:

1. A cluster bomb comprising a casing having a tail end and nose end, a cup on said tail end, a parachute housed within said cup and connected to said casing, a retaining wire longitudinally encircling said casing and said cup and retaining said cup on said casing, a pyrotechnic delay mechanism connecting the ends of said wire, said delay including an arming bar adapted to lie against said casing in its unarmed position and to swing outwardly from said casing to arm said delay, said delay being constructed and arranged to release said wire a predetermined time after being armed, an inertia-armed fuze in said casing, said fuze comprising arming means responsive to the deceleration upon the opening of said parachute while said bomb is falling and percussion means effective

to ignite a detonating mechanism upon impact when thus armed by deceleration, and a burster charge within said casing arranged so as to be detonated by said detonating mechanism when said fuze strikes an obstruction.

2. A bomb as defined in claim 1 and further comprising a charge of a highly toxic chemical warfare agent surrounding said burster charge.

3. A bomb as defined in claim 1 wherein said delay comprises connectors at each end of said casing joined to said retaining wire, frangible joining means uniting at least one of said connectors to said elongated casing, an explosive ejection charge within said elongated casing adjacent said frangible joining means, a pyrotechnic delay charge adjacent said ejection charge, a primer adjacent said delay charge, a firing pin mounted for movement longitudinally of said elongated casing and positioned so as to strike said primer, a firing pin spring urging said firing pin toward said primer, an arming bar pivotally mounted on said elongated casing and extending longitudinally thereof, locking means in engagement with said firing pin and holding said firing pin away from said primer against the action of said firing pin spring, and an arming spring urging said locking means of our engagement with said firing pin, said parts being so constructed and arranged that when said arming bar is held against said elongated casing, said locking means is held in engagement with said firing pin, while when said arming bar moves away from said elongated casing, said firing pin is released and is driven by said firing pin spring against said primer.

4. A bomb as defined in claim 1 said fuze comprising a fuze body mounted in the nose end of said casing, a channel in said fuze body, an arming member frictionally held in said channel, said retaining wire engaging said arming member in such a manner as to hold it in said channel the tightness of fit of said arming member in said channel being such that said arming member is normally retained therein in the absence of said retaining wire but is ejected therefrom by the shock of the deceleration occurring upon opening of the parachute while said bomb is falling, and means for arming said fuze in response to ejection of said arming member and causing said fuze to thereupon become impact-sensitive.

5. A bomb as defined in claim 1 wherein said inertia armed fuze comprises a fuze body mounted in the nose

end of said bomb and having a longitudinal axis extending longitudinally of said bomb, a longitudinal bore extending throughout the length of said fuze body and a transverse bore intersecting said longitudinal bore, a firing pin mounted in said longitudinal bore and a rotor mounted in said transverse bore, a striker carried by said firing pin, a detonator mounted on said rotor said striker engaging said rotor in such a manner as to hold said rotor in a fixed position, said detonator and striker being held out of alignment, a spring urging said firing pin outwardly, an annular channel surrounding said longitudinal bore, an arming ring frictionally held in said channel, locking means held in place by said arming ring and engaging said firing pin in such a manner as to prevent outward movement thereof, means for moving and guiding said rotor so constructed and arranged that when said firing pin moves outwardly said rotor is moved into a position wherein said striker is in alignment with said detonator, said retaining wire passing across said arming ring, and holding said ring in position the tightness of fit of said arming ring in said channel being such that the ring is normally held in position in the absence of said retaining wire but is ejected by the shock of the deceleration occurring upon opening of the parachute while said bomb is falling releasing said locking means and permitting outward movement of said firing pin by said spring, whereby said fuze is armed and whereby said bomb will be detonated when said firing pin strikes an obstruction.

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