Feb. 25, 1958 J. C. LOFTIN ET AL 2,824,515

INCENDIARY

Filed Feb. 12, 1944 2 Sheets-Sheet 1

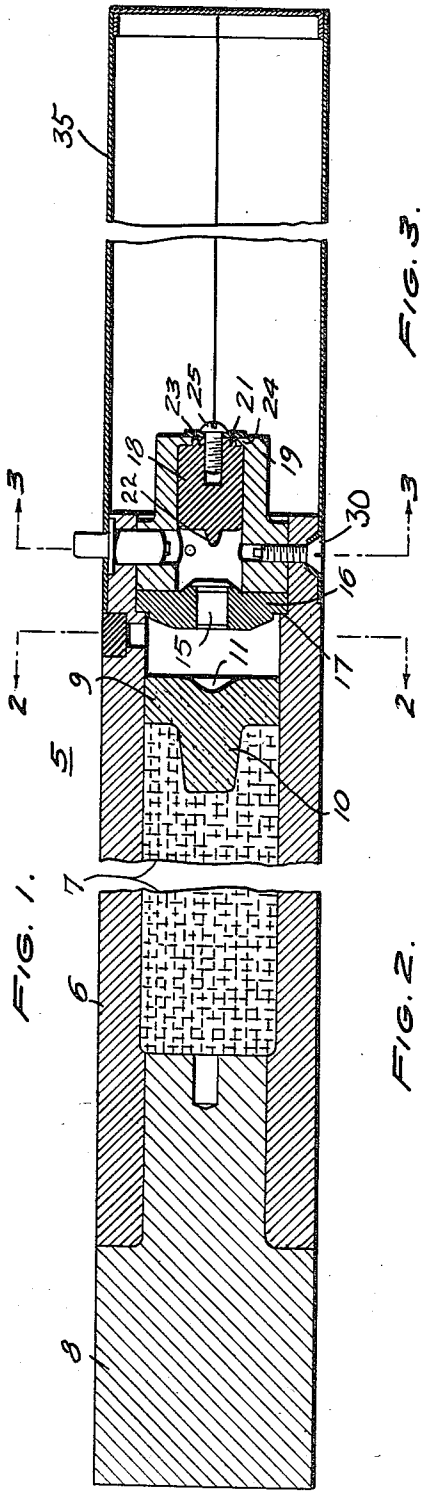


FIG. 1.

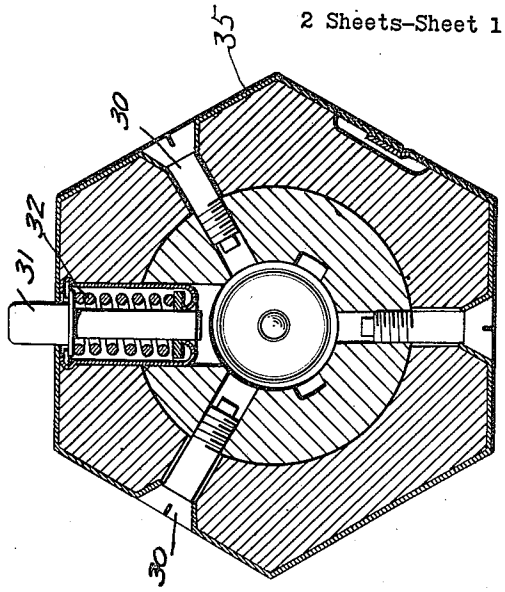


FIG. 3.

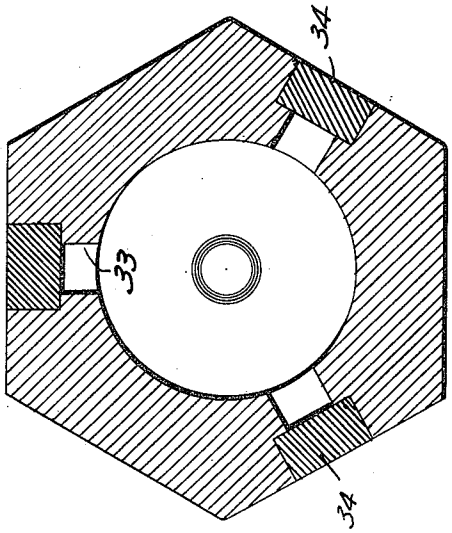


FIG. 2.

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2 Sheets-Sheet 2

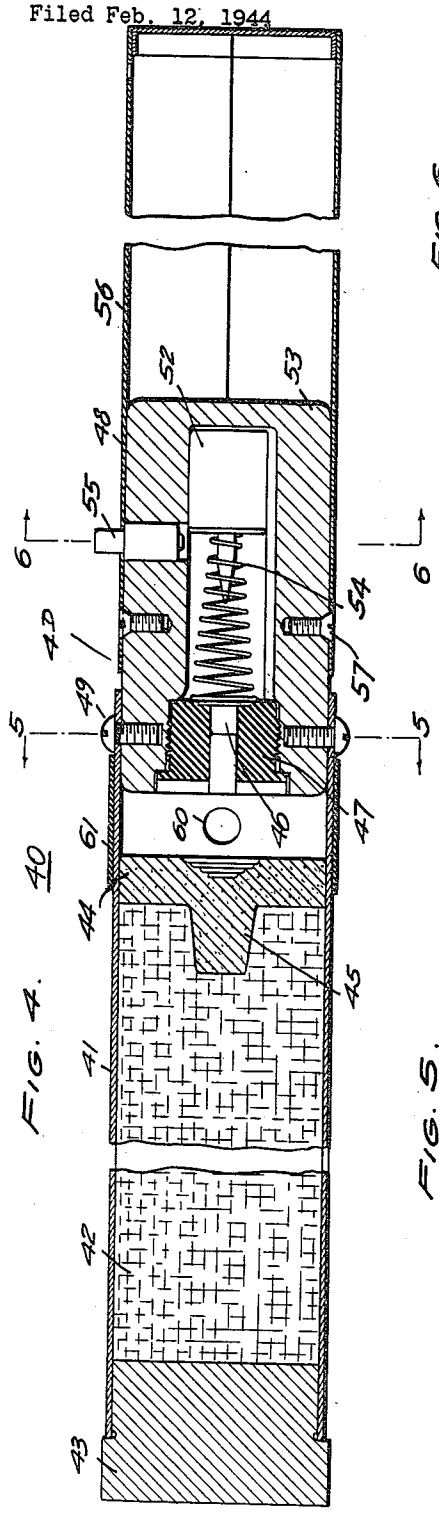


FIG. 4.

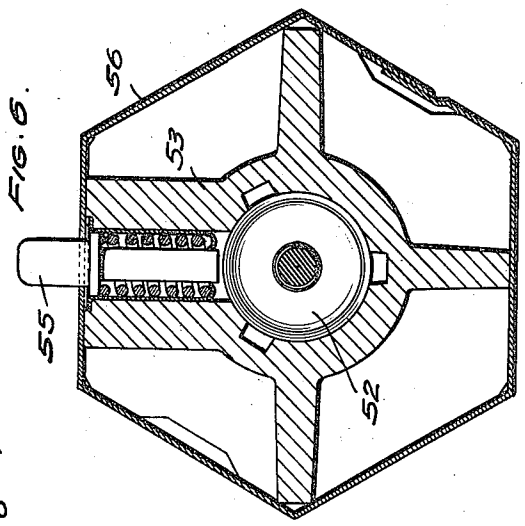


FIG. 6.

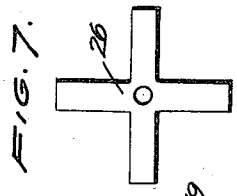


FIG. 7.

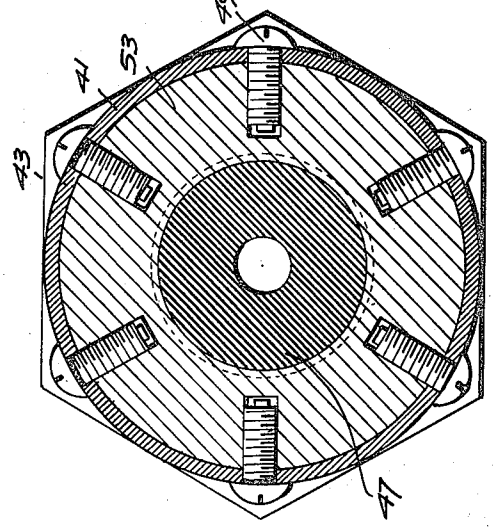


FIG. 5.

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INCENDIARY

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Application February 12, 1944, Serial No. 522,082

3 Claims. (Cl. 102—6)

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

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

This invention relates generally to toxic incendiary munitions, and has particular relation to toxic incendiary bombs adapted to be dropped from aircraft, which give off fumes of cadmium oxide upon burning.

It has been established that fumes of burning cadmium, i. e. cadmium oxide, are exceedingly toxic. Accordingly, the primary object of this invention is the provision of an incendiary munition which upon functioning sets up a toxic cadmium oxide aerosol.

Another object of this invention is the provision of a toxic incendiary bomb adapted to be dropped from aircraft which is both highly toxic and highly incendiary in action.

Other objects of the invention will, in part, be obvious, and will, in part, appear hereinafter.

For a more complete understanding of the nature and scope of this invention, reference may be had to the following detailed description thereof taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of one type of toxic incendiary bomb having a magnesium-cadmium alloy body;

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1;

Figure 3 is a vertical sectional view taken on line 3—3 of Figure 1;

Figure 4 is a longitudinal sectional view of a modified form of toxic incendiary bomb having a steel casing with cadmium-Thermit charge;

Figure 5 is a vertical sectional view taken on line 5—5 of Figure 4;

Figure 6 is a vertical sectional view taken on line 6—6 of Figure 4; and

Figure 7 is an elevational view of a deformable cross-shaped member for retaining the firing pin of the bomb of Figure 1 in position until impact.

Referring particularly to Figure 1 of the drawings, a toxic incendiary bomb is indicated generally at 5 which forms one embodiment of this invention. The bomb 5 comprises a cast magnesium-cadmium alloy hexagonally shaped body 6 which is filled with a Thermit-type charge 7. A cast iron nose 8 is provided at the left hand end of the bomb 5 in Figure 1 which serves to keep the bomb upright when dropped from aircraft.

A first fire charge is loaded against the right hand end of the Thermit charge 7 as shown in Figure 1. The first fire charge 9 is provided with a truncated conical projection 10 adapted to be fitted into a correspondingly shaped recess in the end of the Thermit charge 7. A depression 11 is formed in the center of the exposed surface of the first fire charge 9 which has been found to improve the ignition thereof.

The first fire charge 9 is adapted to be ignited by a primer cap or detonator 15 spaced therefrom and held in a primer cap holder 16 of steel or aluminum which fits against the shoulder 17 formed in the casting 6.

The igniter 15 is adapted to be set off or fired by a firing pin 18 contained in a firing pin holder 19. The firing pin 18 may be made of aluminum or steel and consists of a weight portion 21 with a pin 22. The firing pin has a reduced diameter portion 23 formed on the right hand or upper end thereof which is adapted to fit within an inturned flange 24 of the firing pin holder 19. The firing pin 18 is normally retained in the position shown by means of a screw 25 and a cross-shaped brass member 26 (Figure 7). The cross-shaped member 26 is made of brass or other deformable material so that upon a predetermined impact of the bomb 5, the arms will fold up and permit the firing pin 18 to move downward.

The firing pin assembly is held in place by three screws 30 as shown in Figure 3. A safety pin 31 is provided for preventing the movement of the firing pin 18. The safety pin 31 is provided with a compressed spring 32 fitting there-around which tends to force the safety pin 31 to the released or withdrawn position as shown in Figures 1 and 3. The particular type of bomb 5 shown in Figure 1 is adapted to be loaded into an aircraft in clusters so that a number of bombs, for example, 50 or more, fit against each other so as to hold the safety pins 31 in the safety position.

A hexagonally shaped tail 35 of sheet steel is fitted over the right hand or upper end of the body 6 as shown in Figure 1, and is held in place thereon by the three screws 30 as shown in Figure 3. The tail 35 stabilizes the downward flight of the bomb 5.

As shown in Figures 1 and 2, three vent holes or openings 33 are formed in the casting 6 between the primer cap 15 and the first fire charge 9. The outer ends of the vents 33 are counterbored so as to receive the plugs or stoppers 34 which may be made of rubber, fiber board or metal cups. In order to make the bomb 5 waterproof, the outside surfaces of the plugs 34 are coated with a waterproof cement or laquer. Preferably, the inner counterbored surfaces of the vent holes 33 are also lacquered before the insertion of the plugs 34.

One specific form of the bomb 5 which has been exhaustively tested and standardized for procurement and use has a total weight of about 4 lbs. and an over-all length of about 21 1/32 inches. In this particular bomb, magnesium-cadmium casting 6 has a weight of about 1.4 lbs. and a length of about 11½ inches. For the greater part of its length the casting 6 has a thickness of about 1/32 of an inch. The body 6 may contain as low as 4% cadmium, but preferably it has the following composition:

Aluminum	5.5 to 6.3%.
Cadmium	19.0 to 22.5%.
Zinc	not over 1.5%.
Manganese	0.1 to 1.0%.
Impurities	Less than 0.5%.
Magnesium	Remainder.

One lot of magnesium-cadmium bodies which proved to be very satisfactory had the following composition:

Aluminum	6.3%.
Cadmium	22.5%.
Zinc	Less than 0.1%.
Manganese	0.22%.
Magnesium	71.4%.

A Thermit-type charge 7 which has been found to be very satisfactory has the following composition in percentage by weight:

Aluminum, granular	15.7 to 16.3%.
Iron oxide scale or iron ore	43.5 to 44.5 %.
Aluminum, grained	8.8 to 9.2%.
Barium nitrate	28.6 to 29.4%.
Sulfur	1.9 to 2.1%.

The weight of the Thermit-type charge **7** in a bomb **5** weighing 4 lbs. with a casting **6** weighing 1.4 lbs of the above composition is about 265 grams. The Thermit charge **7** is preferably loaded into the body **6** in four approximately equal increments under a dead load pressure of 6,000 to 7,000 lbs. using a ram shaped to form a truncated conical depression corresponding to the shape of the truncated projection **10** of the first fire charge **9**.

The first fire charge **9** for a 265-gram Thermit charge **7** should weigh from 19 to 21 grams and may be pressed, either loose or in pellet form, on top of the Thermit charge **7** under a dead load of 6,000 to 7,000 lbs. using a ram shaped to form the rounded depression **11**. One type of first fire charge **9** which has been found to be satisfactory comprises 25% magnesium powder and 75% barium chromate.

As indicated above, the toxic incendiary bomb **5** is particularly adapted to be dropped from bombing aircraft. In operation, when a cluster of the bombs **5** is dropped on a target from an aircraft, the bands which hold the bombs **5** in the cluster are broken so as to permit the individual bombs **5** to fall separately in a pattern on the target. As the clustered bombs **5** separate from each other, the safety pins **31** are released to the position shown in Figures 1 and 3 so as to permit the downward fall of the firing pin **18**. Upon impact of the nose **8** of a bomb **5**, the inertia of the firing pin **18** acts to deform the retaining cross-shaped member **26** so as to allow the point **22** of the firing pin **18** to strike the primer cap **15**. The primer cap **15** flashes into the depression **11** of the first fire charge **9** so as to ignite the same. The gaseous products of combustion from the ignition of the first fire charge **9** are sufficient to blow out the vent hole plugs **34** and thus prevent the explosion of the bomb **5**.

The first fire charge **9** burns at a temperature sufficiently high to ignite the Thermit charge **7** which in turn ignites the magnesium-cadmium casting **6**. An intense incendiary action is obtained; and upon burning of the casting **6**, a cadmium oxide smoke or aerosol is formed which is extremely toxic. Thus, in order for the bomb **5** to be safely extinguished, the firefighter must wear a gas mask having a filter which will give protection against the cadmium oxide aerosol.

Referring to Figures 4, 5 and 6 of the drawings, a modified form of toxic incendiary bomb is indicated generally at **40** which comprises a cylindrically shaped iron casing **41** loaded with a cadmium-containing Thermit-type charge **42**. The preferred form of the bomb **40** has a weight of 4 lbs. and an over-all length of $21\frac{11}{32}$ inches, thereby making it of the same weight and dimensions as the preferred form of the bomb **5** of Figure 1. The lower or left hand end of the bomb **40** is provided with a hexagonally shaped cast iron nose **43** so as to maintain the bomb **40** in upright position during flight. The charge **42** may comprise a Thermit composition of the type used for the Thermit charge **7** in the bomb **5**, Figure 1, having mixed uniformly therewith powdered cadmium metal. The cadmium metal may comprise 20% of the weight of the charge **42**.

The charge **42** is loaded into the casing **41** in a manner similar to that described above in connection with the loading of the Thermit charge **7** in the bomb **5** of Figure 1. At the upper or right hand end of the charge **42** a first fire charge **44** is provided having a truncated conical projection **45** fitting into a correspondingly shaped recess in the upper end of the charge **42**. The first fire charge **44** may have the same composition as that of the first fire charge **9** of the bomb **5** of Figure 1. The first fire charge **44** is adapted to be ignited by a primer cap **46** held in a primer cap holder **47** fitting in the lower or left hand end of a firing pin assembly **48**. The firing pin assembly **48** is held in position in the upper or right hand end of the casing **41** by six screws **49** as shown in Figure 5. In order to set off or ignite the primer cap **46**, a firing pin **52** is provided in a firing pin holder **53** preferably formed of aluminum. The firing pin **52** is normally spaced away from the primer cap **46** by means of a compression spring **54**. A safety pin **55** is provided for the firing pin **52** as shown in Figures 4 and 6 which corresponds to the safety pin **31** shown in Figures 1 and 3 for the bomb **5** described in connection therewith. A hexagonally shaped sheet steel tail **56** is fastened over the firing pin assembly **48** by means of screws **57** as shown in Figure 4.

In order to prevent the gaseous products of combustion of the first fire charge **44** and the incendiary charge **42** from exploding the bomb **40** and extinguishing the burning incendiary, a number of vent holes **60** are provided in the casing **41** between the firing pin **46** and the first fire charge **44**, as shown in Figure 4. The holes **60** are closed by waterproof tape **61**.

It will be obvious that the bomb **40** functions in substantially the same manner as the bomb **5** described above. The only important difference is that the iron casing **41** of the bomb **40** does not have the incendiary and toxic properties of the magnesium-cadmium casting **6** of the bomb **5**. However, this is compensated for by the greater weight of the toxic incendiary filling **42**. The cadmium-containing Thermit charge **42** upon burning sets off an intense temperature, and the powered cadmium metal content thereof burns to form a toxic areosol.

In the event that it is desired to convert incendiary bombs on hand of the type shown in Figures 1 and 4, but wherein the body **6** of bomb **5**, Figure 1, does not contain cadmium and the incendiary charge **42** of the bomb **40** of Figure 4 also does not contain cadmium metal, this may be readily done as follows: holes may be drilled into the bombs **5** and **40** and filled with powdered cadmium metal, cadimum wire or solid cadmium castings. In the case of bomb **5**, Figure 1, the cadmium may be inserted entirely in holes drilled in the casting **6** or in holes drilled in the Thermit charge **7**, or in both. Such holes for the cadmium deposit may be drilled either in a longitudinal direction into the bomb **5** or crosswise therethrough. In the case of an incendiary of the type **40** shown in Figure 4, the cadmium will be deposited in holes drilled longitudinally or crosswise into the incendiary filling **42**.

Since certain further changes may be made in the foregoing constructions, and different embodiments of the invention may be made without departing from the scope thereof, it is intended that all matter described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. A toxic incendiary munition comprising, in combination, a body formed of a magnesium-cadmium alloy of the following percent composition:

Aluminum	5.5 to 6.3%.
Cadmium	19.0 to 22.5%.
Zinc	Not over 1.5%.
Manganese	0.1 to 1.0%.
Impurities	Less than 0.5%.
Magnesium	Remainder.

a Thermit-type charge within said body, a first fire charge for igniting said Thermit charge, and firing means for setting off said first fire charge.

2. A toxic incendiary munition comprising, in combination, a body formed of a magnesium-cadmium alloy of the following percent composition:

Aluminum	6.3%.
Cadmium	22.5%.
Zinc	Less than 0.1%.
Manganese	0.22%.
Magnesium	71.4%.

a Thermit-type charge within said body, a first fire charge for igniting said Thermit charge, and firing means for setting off said first fire charge.

3. A toxic incendiary bomb comprising, in combination, a body weighing about 1.4 lbs. formed of a magnesium-cadmium alloy having the following percent composition:

Aluminum	5.5 to 6.3%.
Cadmium	19.0 to 22.5%.
Zinc	Not over 1.5%.
Manganese	0.1 to 1.0%.
Impurities	Less than 0.5%.
Magnesium	Remainder,

a Thermit type charge within said body weighing about 265 grams, a first fire charge for igniting said Thermit charge and weighing from 19 to 21 grams, and firing means for setting off said first fire charge upon impact of said bomb.

References Cited in the file of this patent

UNITED STATES PATENTS

1,316,005	Vautin	Sept. 16, 1919
1,395,769	Ranken	Nov. 1, 1921
1,436,248	Hammond	Nov. 21, 1922
2,124,555	Gann	July 26, 1938
2,318,994	Helmbold	May 11, 1943
2,586,801	Epler et al.	Feb. 26, 1952

FOREIGN PATENTS

490,712	Great Britain	Aug. 19, 1938