June 7, 1966 G. C. MacDONALD 3,254,996

METHOD OF PREPARING A SINTERED INCENDIARY BOMBLET

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FIG. 1

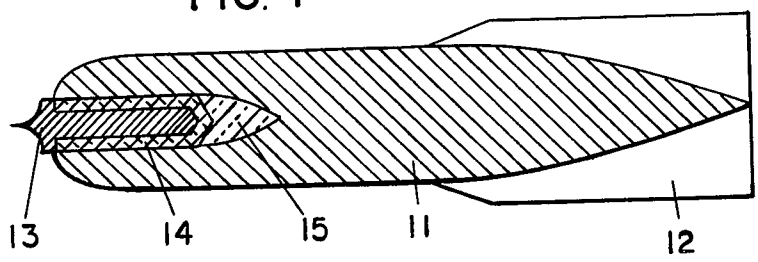
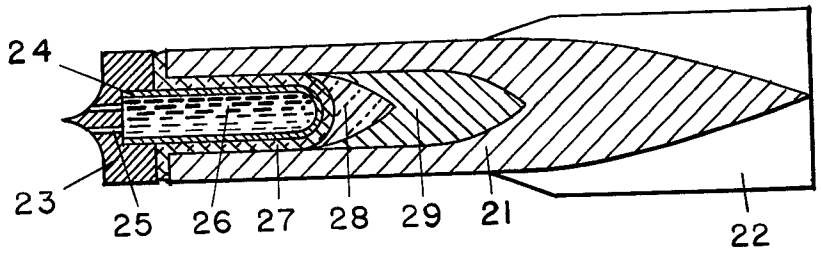


FIG. 2



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METHOD OF PREPARING A SINTERED INCENDIARY BOMBLET

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4 Claims. (Cl. 75—206)

This invention relates to a novel Thermite incendiary and anti-personnel bomblet, which, in addition provides a capability to induce catastrophic intergranular corrosion in certain aircraft and missile structures. This bomblet is intended for use against relatively "soft" and flammable targets such as troop bivouac areas, houses, vehicle parking areas, oil and gasoline depots, crop and forest areas that require only modest penetrating power and the touch of a match to accomplish their purpose. It is also intended for use against parked aircraft and unprotected missile sites. If hits on these have been attained, careful damage assessment and/or repair will be required lest structural failure occur when the airplane is flown or the missile is launched. Many modern aircraft have the entire top or bottom load-bearing section of the wing made of a single exotically-machined slab, and a hit in this area may well require replacement of the entire wing with attendant delay in returning the airplane to a combat-ready status.

A factor favoring initiation of catastrophic intergranular corrosion is the fact that the upper surface of an airplane wing, when not in flight, is under a considerable tensile stress, and this greatly aids in the introduction of this type of corrosion. Further factors implementing this corrosion damage are the stress and deformation incident to impact of the bomblet, together with the additional stresses and increased rate of chemical reaction due to the incendiary action of the Thermite. An additional major factor favorably influencing initiation of catastrophic intergranular corrosion is that a preferred corroding agent, mercury, with or without additives to improve penetration, can be delivered to the highly-stressed and heated bomblet impact area either as a liquid, a vapor, or a mixture of both to give the most effective penetration. Obviously, too, the presence of mercury in the bomblet makes it highly poisonous to man.

It is thus seen that this novel incendiary provides an antimaterial bomblet of high lethality which factor will effectively limit firefighting activities during the actual bomb raid, further adding to the military effectiveness of this invention.

In some designs of incendiary bomb it may be desirable to include magnesium or beryllium instead of using Thermite as the primary heating agent. This is for the very practical reason that Thermite carries its own oxygen for combustion, and consequently delivers only 800 calories of heat per gram, whereas magnesium, getting oxygen from the air, delivers 6,000 calories per gram, and beryllium gives 15,000 calories per gram.

A still further feature of this invention, in the event that a portion of the incendiary is to be made of magnesium or beryllium is that a more efficient igniting means is provided, whereby a minimum of first fire composition is required to ignite the Thermite, and a minimum of Thermite is required to ignite the magnesium or beryllium if used.

Since the materials for the Thermite-type reactions have to be powdered or granulated for the reactions to take place, press-forming the bomblet in a mold with subsequent sintering to add strength provides a number of manufacturing advantages such as simplicity and adaptability to automatic machine processes, etc., in addition to giving good efficiency due to the absence of inert materials in the bomblet. Another reason favoring sintered Thermite for this type of weapon is that a great deal of industrial capacity is presently available.

While the metallic aluminum in the Thermite powder gives good strength when sintered, there are many other effective oxygen-bearing incendiary formulations. For example, a 50/50 mixture of Fe_3O_4 and $CaSi_2$ burns more slowly and with a higher reaction temperature than does Thermite, is 70% more dense, and delivers ⅔ as many calories per gram. Substitution of $CaSi_2$ for some of the aluminum slows down the Thermite reaction, and gives a sticky slag that may improve the effectiveness of this type of bomb for some applications.

By adjusting the relative percentages of first fire composition and Thermite powder in the transition zone between these two, ignition of the Thermite can be most efficiently accomplished. Similarly, if a portion of the bomb is to be magnesium or beryllium, ignition can best be accomplished if the Thermite powder is blended with the magnesium or beryllium powder at the interface prior to sintering. This can be easily accomplished by rolling or agitating the loose, powdered contents of the mold, after filling and prior to pressing to consolidate.

There are many first fire compositions, and I do not wish to be restricted to any particular formulation, but a mixture of 25% magnesium powder and 75% barium chromate has been found to be satisfactory.

Many compositions exist which will serve as a frictional or percussive igniter means. One such composition is as follows:

	Parts
Mercury fulminate	37
Barium nitrate	32
Antimony sulfide	28
Ground glass	5
Trinitro toluol	5

Additives such as polysulfide rubber may be required to retain the striker in place, seal the assembly, and provide a level of sensitivity that will permit handling, etc., without premature initiation.

A Thermite-type composition used to ignite the magnesium main body of one type of incendiary bomb is approximately as follows:

	Percent by weight
Aluminum, granular	16
Aluminum, grained	9
Iron oxide scale or iron ore	44
Barium nitrate	29
Sulfur	2

Test samples of sintered Thermite were made in the form of rectangular briquettes, and were prepared as follows: A mixture consisting of one part aluminium powder and three parts red oxide of iron (Fe_2O_3) was pressed in a mold at 50 tons per square inch pressure. No lubricants or binders were used, and the briquette as removed from the mold showed sufficient "green strength" to permit handling. It was then sintered for 15 minutes at 600° C. in an atmosphere of molecular hydrogen. On removal, it was given a protective coating of sodium silicate and dried for a few minutes at 110° C. This treatment produced sufficient strength for the proposed bomblet usage. In effect, these test samples consisted of a mixture of Fe_3O_4 and aluminium in Thermite proportions, the higher oxide of iron having been reduced to the lower oxide required for the best Thermite reaction. This heat treatment also reduced the external layer of iron oxide to a thin pure iron coating which also added protection and increased strength. Much latitude exists for the development of higher physical properties if desired, since the sintering temperature can be carried up to about 1400° C. if necessary.

If used for ground-launched short range sabotage rather than direct bombing attack, it should be possible to

lob these bomblets accurately from a silent electric mortar, or from a spring-powered catapult.

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 section view of one form of toxic and corrosive incendiary bomblet wherein the toxic and incendiary agent is contained in the incendiary composition.

FIGURE 2 is a longitudinal section view of a similar bomblet, and depicts a configuration wherein the toxic and corrosive agent is separately encapsulated.

Reference is made to FIGURE 1 of the drawings which depicts one embodiment of this invention. The bomblet body **11**, and stabilizing fins **12** are press-formed from a powdered Thermite-type material to form the bomblet in more or less complete form with a minimum of manufacturing processes. Subsequent sintering at an elevated temperature provides adequate physical strength. Striker **13** preferably hardened and pointed, is displaced rearward on impact, the shear and compression initiating the igniter composition **14**, which propagates to the first fire composition **15** and to the Thermite body **11** in the usual manner.

A second embodiment of this invention is depicted in FIGURE 2, wherein body **21** and fins **22** are impact-forged from magnesium. Striker **23** and vial **24** complete the striker assembly, and encapsulate corrosive agent **26**. This corrosive agent, for example mercury, may be dispensed through small holes **25** in the striker, **23**, or through the pores of the metal in the event that sintered tungsten carbide or similar material is used for the striker. Combustion of the incendiary material will shortly raise the encapsulated mercury to a boil (357° C.) and the vapor pressure will expel it. Additives can be used to expel the mercury at a lower temperature if desired. On impact, the striker assembly is displaced rearward, the resulting compression and shear initiating igniter composition **27**, first fire composition **28** and Thermite charge **29** as is known in the art.

For some applications, and in view of the problems incident to making the initiating system adequately safe, especially in bomblets that may be as small as ten to the pound, it may be desirable to design the external configuration so that the fins on one bomblet protect the striker of the next as they are racked nose to tail in the shipping container or in a dispenser for air-dropping.

From the foregoing it will be apparent to those skilled in the art that there is herein disclosed a new and useful incendiary bomblet as well as a method for making it. While specific examples have been given, applicant claims the benefit of a full range of equivalents within the scope of the appended claims.

I claim:

1. The process of manufacturing an incendiary bomblet having a streamlined main incendiary portion with integral extending fins at the rear section and first fire composition portion in the forward section of said bomblet which comprises:

(a) providing a Thermite-type powdered mixture of a solid metal oxide powder and a powdered metal,

(b) providing a mold having a mold cavity corresponding to the shape of the desired bomblet,

(c) filling a portion of said mold with powdered mixture,

(d) providing a powdered first fire composition which will ignite by percussion to burn with a temperature sufficiently high to ignite said Thermite-type powdered mixture,

(e) adding a quantity of said first fire composition to said mold,

(f) pressing the contents of said mold in the mold with sufficient pressure to form said contents into a composite shape capable of being removed from the mold and handled without disintegration,

(g) removing the resulting composite shape from said mold, and

(h) heating the composite shape at an elevated temperature below the ignition temperature of the composite shape up to 1400° C. to produce a sintering of the compressed powdered mixtures forming said composite shape.

2. A process as claimed in claim **1** wherein the contents of the mold are agitated sufficiently prior to said pressing step (f) to produce a blending of the Thermite-type mixture and the first fire composition where they adjoin one another.

3. A process of manufacturing an antimateriel bomblet having a main body portion in the shape of a streamlined ellipsoid with integral extending fins and an encapsulated corrosive agent in the forward section of said bomblet which comprises:

(a) forming from incendiary metal selected from the group consisting of magnesium and beryllium, a bomblet having a streamlined ellipsoidal body portion, integral extending fins at the rear section and a hollow container in the forward section of said bomblet,

(b) compressing a Thermite-type mixture of finely divided metal oxide powder and finely divided metal into said hollow container to fill only a portion thereof,

(c) compressing into said hollow container adjacent to said Thermite-type mixture a first fire composition which on ignition will burn with a temperature sufficiently high to ignite said Thermite-type mixture,

(d) compressing over the top of said first fire composition an igniter composition which will ignite by percussion, the amounts of said first fire composition and said igniter composition being insufficient to fill said hollow container, and

(e) inserting in the unfilled portion of said hollow container a vial containing a metal corrosive agent, the top of said vial being covered with a striker head for the bomblet, said striker head having small apertures therein through which said corrosive agent will be dispensed when the said Thermite-type mixture is ignited upon impact of said bomblet after being dropped from a substantial height.

4. A process as claimed in claim **3** wherein said metal corrosive agent is mercury metal.

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