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2,951,752.

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[54] **INCENDIARY COMPOSITION CONTAINING A**
METAL, METAL ALLOY, OXIDIZER SALT, AND
NITRATED ORGANIC COMPOUND
3 Claims, No Drawings

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114

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ABSTRACT: In an incendiary composition consisting essentially of about 50 percent by weight of metal powder from the class consisting of zirconium, titanium, and uranium in a particle size of 20 to 60 mesh, about 22½ percent by weight of 50–50 alloy of magnesium and aluminum, and about 22½ percent by weight of an oxidizer from the class consisting of barium nitrate and potassium perchlorate, the combination therewith of the improvement enabling said composition to retain impact sensitivity under elevated temperature storage for a longer period of time, and to process a longer duration of burning, said improvement consisting essentially of about 5 percent by weight of an explosive from the class consisting of trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), and cyclotrimethylene trinitramine (RDX), whereby such composition is adapted for embodiment in small caliber projectiles containing no fuze to retain its impact sensitivity against a thin aluminum sheet.

INCENDIARY COMPOSITION CONTAINING A METAL, METAL ALLOY, OXIDIZER SALT, AND NITRATED ORGANIC COMPOUND

This invention relates to a metal powder incendiary composition of the type disclosed in the prior application of Thomas Stevenson, Ser. No. 736,932, filed May 21, 1958 for "Incendiary Composition" now U.S. Pat. No. 2,951,752 of which the present application is a continuation-in-part, and has for an object to provide an incendiary composition which is better adapted to retain its impact sensitivity during storage under elevated temperatures in the desert, ships, and tropics. Another object is to provide such a material having a longer burst duration than did that mentioned above.

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

A long sought-after goal for incendiary compositions has been duration of burst or length of burning time for the composition. The present invention has been found to give about a 15 percent longer burning time than did that disclosed in the aforesaid prior application.

The incendiary material in said prior application marked a substantial advance in the incendiary art due largely to the lengthened burst duration. One disadvantage was discovered to reside in reduced impact sensitivity on impingement of a projectile upon an aluminum sheet such as are used on aircraft, after having been in storage under temperatures above normal room temperature. The exact cause of the reduction in impact sensitivity is not known with certainty but according to one theory may be due to the presence of an oxide film of perhaps only molecular thickness forming on some or all of the metal particles.

The exact manner in which the present improved composition acts to lengthen duration of burst is not sure and neither is it known how and why such composition is effective in retaining the impact sensitivity of the incendiary.

A preferred embodiment of the improved incendiary material of this invention includes about:

a. fifty percent by weight of zirconium particles of a size from 20 to 60 mesh, 22.5 percent by weight of potassium perchlorate in its usual powdered form, 22.5 percent by weight of a 50-50 alloy of magnesium and aluminum in its ordinary powdered form as has been used in previous incendiary compositions, and 5 percent by weight of an explosive such as trinitrotoluene, familiarly known as TNT.

Instead of zirconium, titanium or uranium have given substantially equivalent results for some purposes when in the 20 to 60 mesh size mentioned, although zirconium has been found to give slightly better results. The larger the percentage of such metal fuel used in this particle size the longer will be the burst duration. Perhaps 75 percent by weight may be an upper limit for the zirconium, titanium, and uranium in the 20 to 60 mesh size. No lower limit has been mentioned for these burning metals because the lower the percentage used the smaller is the expected burst duration, something not usually desired. In one view a preferred composition may be regarded as a compromise between burst duration and the advantages of the other materials listed.

Instead of potassium perchlorate as an oxidizer, barium nitrate has been found useful in the same percentage. Why these two oxidation materials are suitable is not known. As the quantity of zirconium or its equivalent is increased the quantity of the other materials must be reduced while maintaining about the same weight of oxidizer as magnesium-aluminum alloy and about the same ratio of explosive to the oxidizer and alloy maintained.

The alloy of magnesium and aluminum is used in the same powdered form in which it has previously been used with potassium perchlorate as an incendiary. Its function in the present invention is the same as it was in the prior Stevenson invention and application mentioned hereinafter and of which this application is a continuation-in-part. It is believed to function as an igniter and impact sensitive starter to assist in ignit-

ing the zirconium, titanium, or uranium in the 20 to 60 mesh particle size. This larger particle size then had been customary in much of the prior art, had not been used prior to said Stevenson invention referred to above and was found to be difficult to ignite, which is why the magnesium-aluminum alloy powder is used.

Other explosives than the TNT mentioned above may be used. Among such may be mentioned PETN (pentaerythritol tetranitrate) or RDX (cyclotrimethylene trinitramine), all of which are well known explosives. The exact action of the explosive in making possible longer burst duration and retention of impact sensitivity by the composition is not known but it is believed to act as an overall sensitizer to impact.

The present invention is intended principally for small caliber projectiles carrying no fuze. The need solved by this invention does not arise with larger caliber projectiles because they are usually equipped with a fuze and therefore need not be sensitive to impact when dependent on a fuze to ignite the incendiary material. However the excellent incendiary bursts described for small arms projectiles could be obtained more easily with fused projectiles. In practice it would be found necessary to optimize the proportion of ingredients in the basic formula for best results in other calibers.

Other examples of compositions include about the following percentages by weight:

b. zirconium, titanium or uranium of 20 to 60 mesh size of particles 75 percent, potassium perchlorate or barium nitrate 10 percent, magnesium-aluminum alloy powder 10 percent, TNT, PETN, or RDX, 5 percent,

c. zirconium, titanium, or uranium, 50 percent, potassium perchlorate or barium nitrate 20.5 percent, magnesium-aluminum alloy 20.5 percent, TNT, PETN, or RDX 9 percent,

d. zirconium, titanium or uranium, 50 percent, potassium perchlorate or barium nitrate, 23.5 percent, magnesium-aluminum alloy, 23.5 percent, TNT, PETN, or RDX 3 percent,

e. fifty percent metallic fuel such as zirconium, titanium or uranium, 19.5 percent potassium perchlorate or barium nitrate, 19.5 percent of the 50-50 magnesium and aluminum alloy, and 11 percent explosive such as TNT, PETN, or RDX.

Of these five examples, that mentioned first containing about 5 percent of the explosive mix and 50 percent of the metallic fuel for nonfused projectiles seemed to be the best. In each example the metal fuel including zirconium, titanium or uranium, is always in the 20 to 60 mesh particle size.

This invention should be distinguished from the prior use of much more finely divided zirconium in a primer composition when the zirconium is quick burning and unsuitable for the long burning incendiary of this invention. The present inventor was the first to use the present large particle size for zirconium and in order to do so he had to make and have made such metal in the desired size of particles because none was on the market when he made this invention. The present invention should also be distinguished from the finely divided particles of amorphous black zirconium when made slow burning for use in a powder train by means of tightly packing it or by means of a relatively poor or slowly active oxidizer such as barium chromate or strontium chromate.

This invention would be unnecessary for sensitivity improvement were it certain that the projectiles would always strike a heavier structural member of an aircraft than a thin aluminum sheet.

I claim:

1. In an incendiary composition consisting essentially of about 50 percent by weight of metal powder from the class consisting of zirconium, titanium, and uranium in a particle size of 20 to 60 mesh, about 22½ percent by weight of 50-50 alloy of magnesium and aluminum, and about 22½ percent by weight of an oxidizer from the class consisting of barium nitrate and potassium perchlorate, the combination therewith of the improvement enabling said composition to retain impact sensitivity under elevated temperature storage for a longer period of time, and to process a longer duration of burning, said improvement consisting essentially of about 5

percent by weight of an explosive from the class consisting of trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), and cyclotrimethylene trinitramine (RDX), whereby such composition is adapted for embodiment in small caliber projectiles containing no fuze to retain its impact sensitivity against a thin aluminum sheet.

2. An incendiary composition yielding prolonged burst duration and improved sensitivity after storage over prolonged periods of time at elevated temperatures, consisting essentially of about 50 percent by weight of zirconium having a particle size of about 20 to 60 mesh, about 22.5 percent by weight of potassium perchlorate as an oxidizing agent, about 22.5 percent by weight of a 50—50 alloy of magnesium-aluminum as a preliminary fuel, and about 5 percent by weight of trinitrotoluene, whereby the mixture retains impact sensitivity at elevated temperatures for long periods of time.

3. An incendiary composition consisting essentially of about 50 percent to 75 percent by weight of a metallic fuel having a particle size of 20 to 60 mesh from the class consisting of zirconium, titanium, and uranium, about 19.5 percent to 23.5 percent by weight of oxidizing material from the class consisting of potassium perchlorate and barium nitrate, about 19.5 percent to 23.5 percent by weight of a powdered 50—50 alloy of magnesium and aluminum, and about 3 percent to 11 percent of an explosive from the class consisting of trinitrotoluene, pentaerythritol tetranitrate, and cyclotrimethylene trinitramine" whereby a longer burst duration is possible and there is improved retention of impact sensitivity under storage under higher than normal room temperatures.

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