

UNITED STATES PATENT OFFICE

2,409,201

SMOKE-PRODUCING MIXTURE

Leo Finkelstein, Aberdeen, Md., and Hervey B. Elkins, United States Army

No Drawing. Application November 25, 1943, Serial No. 511,680

5 Claims. (Cl. 252—305)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

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 to a smoke-producing mixture which is useful in munitions for producing a smoke of high obscuring power.

Obscuring smoke has proved to be of important tactical value in warfare, and all nations have been busily engaged in developing superior smoke agents. A well known type of smoke agent is the Berger mixture which was used in the last war and which has since been improved in a number of ways. In this type of agent, finely divided metallic zinc undergoes reaction with an organic chloride. In the reaction the zinc tends to be chlorinated to zinc chloride by the organic chloride which breaks down to liberate free carbon. Unless this type of mixture is modified by added ingredients to oxidize the carbon and modify the reaction, the mixture tends to produce a gray smoke and is somewhat erratic in burning. The modifying agents added to the mixture do not increase the volume of smoke to any substantial extent.

An object of the present invention is to provide a smoke-producing mixture which can be used in all types of munitions in which the Berger mixture type has been used as a filling and which is capable of generating a voluminous cloud of white smoke without the need of a substance to oxidize carbon and without the need of inert modifying agents.

Another object of this invention is to provide a smoke-producing mixture which forms a dense smoke by a highly exothermic reaction that simultaneously can form a very hot slag residue, and accordingly is a valuable adjunct in an incendiary.

The smoke-producing composition of the present invention comprises principally a reactive inorganic or metal chloride mixed with a reactive metal, preferably also with a reactive metal oxide, which react exothermically to produce a smoke-forming compound. Inexpensive and readily available inorganic chlorides may thus be used in the mixture, from which organic chlorides having strategic importance for other uses can be completely omitted.

A very suitable metal chloride for the mixture is iron chloride, which can be used economically. It was found that ferric chloride could be used with finely divided zinc as a smoke-producing mixture but that it is far better to use a reactive metal oxide, such as zinc oxide, and a finely di-

2

vided reactive metal, such as grained aluminum, magnesium or zinc dust, together with the iron chloride. Other reactive metal chlorides, for example, tin tetrachloride, may be used in the same manner; but these substances are more expensive. In general, the reactive elementary metal and the metal constituent of the reactive oxide should be higher in the electromotive series than the metal constituent of the reactive metal chloride, and the elementary metal should be at least as high as the metal constituent of the oxide in the electromotive series. Also, the major proportion of the mixture by weight should be the metal chloride ingredient.

Since the reaction involved is highly exothermic, all that is required to start the reaction is a suitable starting or igniting mixture, for example, such as has been used in smoke and incendiary grenades and bombs.

As an example, the following composition has been found to perform satisfactorily in grenades:

	Per cent
Secondary grained aluminum.....	7.0
Zinc oxide.....	40.0
Iron chloride (FeCl ₃) anhydrous.....	53.0

Experiments show that a harmless zinc chloride smoke results from such a mixture. The mixture is stable prior to ignition and does not require any other type of component. However, it is desirable to have the metal chloride anhydrous for the best performance.

If desired, other ingredients may be added in minor proportions to the composition. Oxidizing salts, like potassium chlorate, sodium chlorate or barium nitrate, may be added. A small amount of more or less inert substances, such as magnesium carbonate and calcium carbonate, may be present in the mixture. Reaction-modifying substances, such as ammonium chloride or sodium bicarbonate, may be employed. The mixture may also contain an organic dye, if it is desired to produce a colored smoke. It may also contain a combustible material, such as powdered sulfur; and it may contain a binder, such as dextrin or an oil. Although no organic chloride is necessary in the mixture, a small proportion of organic chloride, such as hexachlorethane, may be used together with the metal chloride.

In the filling of a smoke candle or smoke pot, a portion of the mixture may be used with modifying agents to delay the reaction. However, when used in conjunction with an incendiary, the mixture can be used satisfactorily without any modifying agent.

3

Furthermore, when the mixture is to be used in a smoke grenade or smoke pot for producing a low-temperature smoke slowly, the metal constituent of the metal oxide may be the same as the finely divided metal which is mixed with the chloride of another metal as, for example, in a mixture of zinc dust and zinc oxide with ferric chloride.

It is to be noted that there are numerous combinations of ingredients which could be selected for use in the mixture and that the quantities of ingredients may be varied, but the compositions are considered as embodying the present invention when they are characterized by the presence of a metal chloride, an oxide of a metal higher in the electromotive series than the metal constituent of the chloride, and a finely divided metal higher in the electromotive series than the metal constituent of the oxide. It is to be understood that various other modifications come within the spirit and scope of the invention.

What is claimed is:

1. A smoke-producing mixture comprising a

4

major proportion by weight of a reactive metal chloride, an oxide of a metal higher in the electromotive series than the metal constituent of the chloride and a finely divided metal higher in the electromotive series than the metal constituent of the oxide, said oxide and said chloride being principal reactants.

2. A smoke-producing mixture comprising a major proportion by weight of reactive iron chloride, grained aluminum and zinc oxide.

3. A smoke-producing mixture comprising a major proportion by weight of reactive ferric chloride, zinc dust and zinc oxide.

4. A smoke-producing mixture comprising a major proportion by weight of reactive anhydrous ferric chloride, grained aluminum and zinc oxide.

5. A smoke-producing mixture comprising about 7% by weight of grained aluminum, about 40% by weight of zinc oxide and about 53% by weight of anhydrous ferric chloride.

LEO FINKELSTEIN.
HERVEY B. ELKINS.