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GAS-PRODUCING NONDETONATING COMPOSITION

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2 Claims. (Cl. 52—7)

1

The present invention relates to new or improved gas-producing charges of the kind capable of propagating a self-sustained gas-producing non-detonating decomposition throughout themselves, when they are locally heated by a limited non-detonating igniting element; that is to say, one capable of heating a small portion of the charge to a high temperature and insufficient of itself to effect any substantial general rise in the temperature of the charge.

Depending on the rate at which the gas-producing decomposition is propagated throughout the charge under increasing pressure conditions, the nature of the gases produced, the amount and quality of any solid products of the reaction and the presence or absence of flame, such charges find application for a variety of purposes, including, for instance, the generation of gas pressure for actuating pneumatically operated mechanical devices and blasting operations when a slow heating action is required, as in the winning of lump coal.

This application is a continuation-in-part of applicants' copending application Serial No. 774,693, filed September 17, 1947 now abandoned.

It is known in the art that guanidine nitrate and nitroguanidine may be decomposed when strongly heated, giving a good yield of permanent gases that would be suitable for the aforesaid purposes leaving a certain amount of solid residue.

U. S. Patent No. 2,159,234, discloses a composition which may be used as a non-detonating, gas generating composition capable of undergoing a self-sustaining decomposition without detonation. This composition comprises at least one substance selected from the group consisting of ammonium nitrate, guanidine nitrate, urea nitrate and dicyandiamidine nitrate; a carbonaceous material; and from 1 to 20% of a sensitizing agent comprising at least one member of the group consisting of chromic oxide, alkali metal chromates, ammonium chromate, ammonium dichromate and alkali metal polychromates. If a cooling salt is included in the composition, the composition may be employed for blasting purposes in a pressure operated device having in combination a pressure resistant, pressure responsive container, and deflagrating ignition means. When guanidine nitrate is sensitized by the presence of a suitable proportion of a chromate or bichromate, the decomposition of a charge of the mixture which has not previously been heated, will sustain itself throughout the entire charge once it has been excited by temporary heating of a local portion of the charge as by means of a limited heating element such as an electric powder fuse or a red hot rod even at ordinary pressure.

2

The composition taught in U. S. Patent No. 2,159,234 which could consist of guanidine nitrate, a carbonaceous material, and from 1 to 20% of a chromate or dichromate has the objectionable features that it is hygroscopic on storage under conditions of high humidity and that the gases produced upon ignition of the composition are sometimes not sufficiently hot for certain purposes in which the composition may be employed. Uses for which hotter gases might be required and the requirement that the composition be non-hygroscopic on humid storage have necessitated further research by the applicants. It is the result of this research that has brought the present invention into being.

An object of the present invention, therefore, is the provision of improved charges for gas-pressure-operated devices which charges include compositions capable of undergoing a self-sustained, gas-producing, non-detonating decomposition when ignited with the aid of a local and limited heating element.

A further object of the present invention is to produced a charge of the aforesaid characteristics which is relatively non-hygroscopic on storage and which produces hotter gases than those previously produced by the teaching of the prior art.

Another object of this invention is to produce a composition which is not only relatively non-hygroscopic on storage and which produces hotter gases than heretofore possible but which also, upon decomposition, evolves a high yield of permanent gases at lower pressures than would be possible upon the decomposition of the prior arts' compositions.

Further objects of this invention will become apparent upon consideration of the description of the invention hereinafter.

Applicants have found that chromium compounds, more particularly the chromates and dichromates of the alkali metals, ammonium dichromate and chromium sesquioxide compounds in pulverulent condition can suitably be used as sensitizers for the thermal decomposition of nitroguanidine, thereby enabling the production of new or improved charges suitable for the aforesaid purpose and capable of decomposing with the evolution of a high yield of permanent gases when they are locally heated by a non-

detonating element at lower pressures than would otherwise be possible.

According to the present invention, therefore, a gas-producing charge of the kind suitable for carrying out the objects of this invention comprises a composition having nitroguanidine as its preponderating constituent and in a lesser proportion in admixture with said compound, a pulverulent sensitizer for its thermal decomposition comprising a chromium compound selected from the group consisting of alkali metal chromates, alkali metal dichromates, ammonium dichromates, and chromium sesquioxide. The pulverulent sensitizer utilized in this composition may be used in a range of from 2 to 20% by weight of the composition depending upon the rate at which evolution of the gas is desired and the temperature of the gases desired. It has been found that increase in the amount of the sensitizer increases the rate of evolution of the gases.

Charges made in accordance with this invention decompose smoothly when they are ignited, and in compressed condition, they do not undergo discontinuous volume changes at temperatures at which they are likely to be exposed on storage. It is further possible, according to the invention, to obtain charges that decompose without flame when they are locally heated and which are, accordingly, suitable for blasting in fiery or dusty mines. For blasting purposes, it is frequently possible to confine the mixture in order to enable the pressure to be built up satisfactorily and for this purpose, a blasting assembly comprising a gas producing charge confined in a pressure resisting vessel having the closure adapted to yield at a predetermined pressure may conveniently be employed.

The compositions of this invention have the desired non-hygroscopic storage properties and produce hotter gases than guanidine nitrate, but do not have as good pressing or molding properties as compared with guanidine nitrate. Therefore, it is within the scope of this invention to provide an agent for improving these pressing or molding properties of the mixture. Diphenyl diethyl urea (centralite) has been found to be a desirable agent for such a purpose since it not only improves the pressing properties of the mixture but it also may be used in a sufficiently small quantity in order that none of the other desirable properties of the composition may be effected. Furthermore, if it is desired to have a relatively non-hygroscopic composition without the increased temperature of the gases produced, charcoal may be employed for the purpose of cooling the gases. However, the inclusion of the cooling agent and the pressing agent in these compositions does effect the rate of burning of the composition. Even this lowered rate, however, is still greater than the rate of burning for guanidine nitrate sensitized with ammonium dichromate just as the rate of burning of nitroguanidine sensitized by a chromium compound is greater than guanidine nitrate sensitized by ammonium dichromate.

The invention is illustrated in the following examples in which the parts are parts by weight of the total composition.

Example 1

20 parts of potassium chromate and 80 parts of nitroguanidine are mixed together in a mechanical mortar. 200 grams of this mixture when decomposed in a steel tube blasting device three feet long by 1¼ inches internal diameter burst a disc 5/64 inch thickness. An electric powder fuse containing 30 grams of black powder is used to excite the decomposition.

Example 2

80 parts nitroguanidine, 10 parts ammonium dichromate, 5 parts diphenyl diethyl urea, and 5 parts of charcoal is mixed by milling in a ball mill until an intimate mixture is obtained and it is then pressed in the form of a cylinder. The rate of burning of this pressed charge is found to be 0.07 inch per second at a pressure of about 100 pounds per square inch.

Example 3

For the purpose of comparing the compositions of U. S. Patent 2,159,234 with the present invention, a mixture of guanidine nitrate sensitized by ammonium dichromate was prepared. This mixture consisted of 90 parts of guanidine nitrate and 10 parts of ammonium dichromate made up in the form of Example 2. When ignited by the application of heat, it had a burning rate of only 0.028 inch per second at a pressure of approximately 100 pounds per square inch.

We claim:

1. A gas-producing charge of the type herein defined consisting essentially of a preponderating proportion of nitroguanidine, a pressing agent comprising diphenyl diethyl urea, and a pulverulent chromium compound sensitizer for the nitroguanidine selected from the group consisting of alkali metal chromates, alkali metal dichromates, ammonium dichromate, and chromium sesquioxide.

2. A gas-producing charge of the type herein defined which consists essentially of a preponderating proportion of nitroguanidine, a pressing agent comprising diphenyl diethyl urea, a cooling agent comprising charcoal, and a pulverulent chromium compound sensitizer for the nitroguanidine selected from the group consisting of alkali metal chromates, alkali metal dichromates, ammonium dichromate, and chromium sesquioxide.

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