United States Patent [19]

Hyer

[11] 3,769,106

[45] Oct. 30, 1973

[54] **IGNITER COMPOSITION**

[75] Inventor: **Harry J. Hyer**, Los Gatos, Calif.

[73] Assignee: **United Aircraft Corporation**, Hartford, Conn.

[22] Filed: **Sept. 17, 1971**

[21] Appl. No.: **181,641**

[52] U.S. Cl. **149/18**, 149/37, 149/42, 149/44, 149/85

[51] **Int. Cl.** **C06c 9/00**

[58] **Field of Search** 149/18, 37, 42, 44, 149/85

[56] **References Cited**

UNITED STATES PATENTS

2,545,076	3/1951	Ellenbogen	149/85 X
3,046,728	7/1962	Fitzpatrick	149/37 X
3,160,537	12/1964	Trafton	149/37
3,259,972	7/1966	Long	149/37 X
3,338,763	8/1967	Kristal	149/85 X

FOREIGN PATENTS OR APPLICATIONS

20,494	10/1910	Great Britain	149/85

Primary Examiner—Carl D. Quarforth
Assistant Examiner—E. A. Miller
Attorney—Steven F. Stone

[57] **ABSTRACT**

An exothermic pyrotechnic composition suitable for the ignition of gas generating candles to be used for the generation of gases in a confined volume is disclosed. The incorporation of borax into a conventional iron-chlorate type igniter composition substantially reduces the propagation rate and causes the formation of a highly adherent slag. Taken together, these features reduce the likelihood of the igniter compound exploding from the surface of the material to be ignited and of the generation of gases from the ignited composition at a rate sufficient to overpressurize the volume.

6 Claims, No Drawings

IGNITER COMPOSITION

BACKGROUND OF THE INVENTION

In various gas generating systems known to the prior art, an exothermic gas generating composition is provided with a more readily ignitable composition which, in conjunction with an ordinary fuse or electric match, provides the ignition train for the ignition of the main body of gas generating material. See for example, U.S. Pat. Nos. 2,981,616, M. H. Boyer, for Gas Generator Grain, Apr. 25, 1961, 3,293,187, M. M. Markowitz, Oxygen Generating Products, Dec. 20, 1966 or R. M. Bovard et al., 3,516,797 for Chemical Oxygen Generator, June 23, 1970. Satisfactory ignition of these types of pyrotechnic mixtures as well as of the thermite type compositions require that an igniter material of high caloric output be held in intimate contact with the mass of pyrotechnic material to be ignited for a period of time sufficient to permit the initiation of self-sustaining exothermic reaction in the body of the pyrotechnic material. The igniter obviously must be more readily ignited than the main mass of pyrotechnic material and ignition mixtures of finely powdered metals such as iron, boron, titainium, zirconium, or magnesium together with a suitable oxidizing agent such as a chlorate or perchlorate, with or without inert ash forming.

DESCRIPTION OF THE INVENTION

The incorporation of borax into an iron-chlorate igniter composition substantially reduces the propagation rate of the composition and produces an ash which is highly adherent both to itself and to the composition upon which it is deposited. This invention is usable in the iron-chlorate igniter compositions which consist of a mixture of iron and a chlorate typically an alkali or alkaline earth metal chlorate. The actual composition of the igniter mixture can be varied widely to obtain variation in characteristics such as ignitability, for example, as is known to the art; but to function as an igniter, the ratio of iron to the chlorate should be on the fuel-rich side of stoichiometric. If the composition contains other oxidizable compounds such as a binder of dextrin, for example, sufficient chlorate should be provided to fully oxidize the oxidizable species while still maintaining an overall fuel-rich mixture of iron to chlorate. As a general rule, the more fuel-rich the composition, the easier it is to ignite. In addition to the iron, chlorate and an organic binder, various amounts of ash forming and/or reinforcing materials such as aluminum oxide, asbestos and chopped glass fibers, for example, may be added as is known to the art. Typically, these materials are compounded in the form of a paste with water and then either applied to the surface to be ignited or compacted into the proper shape and then applied to the surface to be ignited and dried thereon. Since the igniter is normally compounded with water, the borax can be added as such or can be formed in situ from any of the incompletely hydrated forms of $Na_2B_4O_7$. The amount of borax to be used depends upon the degree of suppression of the propagation rate that it is desired to obtain. Thus, for example, small amounts of borax will produce some effect and 5 percent of borax has been found to produce over 50 percent reduction in the propagation rate of a comparable material without the borax. Higher amounts of borax could also be used but, in most cases, it is not necessary to reduce the rate below that obtained with about 5 percent borax. The effect of borax on typical igniter compositions is readily apparent from the inspection of Table I which contains results of two runs for each composition.

TABLE I
(Percent by weight)

	I	II	III	IV	V	VI	VII	VIII	IX	X
Fe	30	35	30	30	30	30	30	30	60	57
$NaClO_3$	32	32	37	32	32	32	32	32	32	35.15
Al_2O_3	27	27	27	32	27	27	27	27	2	1.9
Dextrin	5	5	5	5	5	5	5	5	1	0.95
Asbestos	1	1	1	1	1	1	1	1		
$Na_2B_4O_7 \cdot 10H_2O$	5									5
H_3BO_3					5					
$Na_3PO_4 \cdot 10H_2O$						5				
$CaCl_2 \cdot 2H_2O$							5			
$MgSO_4 \cdot 7H_2O$								5		
Rate (in/min), run 1	3.0	6.5	4.3	5.9	4.3	4.9	6.9	4.7	3.7	1.6
Rate (in/min), run 2	2.9	6.1	4.7	5.9	4.4	4.4	6.5	4.8	3.8	1.7

As can be seen, Formulation I containing 5 percent borax had a substantially lower propagation rate than any of the comparable Formulation II, III or IV which contained, instead of the borax, an additional 5 percent or iron, chlorate, or aluminum oxide, respectively. Similar results were obtained with the borax containing composition X when compared with the comparable non-borax containing composition IX. In addition, borax produced a greater reduction in propagation rate than any other additive tested (Formulations V–VIII) which include both boron containing and highly hydrated compounds. Further, the effect of borax appears to be unique to iron-chlorate compositions since tests have shown it not to function with the iron-perchlorate equivalent or with any of the conventional nitrate-sugar-charcoal, thermite, $BKNO_3$ or aluminum-perchlorate-vegetable oil (Alclo)igniter systems.

While this invention has been described with respect to various embodiments thereof, it should not be construed as being limited thereto. Various modifications can be made by workers skilled in the art without departing from the scope of the invention which is limited only by the following claims wherein:

I claim:

1. In an iron-chlorate igniter composition comprising a fuel-rich mixture of iron and metal chlorates, the improvement wherein said composition contains a burning rate retarding amount of borax.

2. The composition of claim **1** wherein said metal chlorate is selected from the group consisting of alkali and alkaline earth metal chlorates.

3. The composition of claim **2** wherein said iron-chlorate igniter composition further comprises an organic binder.

4. The composition of claim **3** wherein said iron-chlorate igniter composition further comprises inert structural reinforcement.

5. The composition of claim 3 wherein said iron-chlorate igniter composition further comprises inert ash forming agents.

6. The composition of claim 4 wherein said iron-chlorate igniter composition further comprises inert ash forming agents.

* * * * *