

UNITED STATES PATENT OFFICE

2,484,023

MANUFACTURE OF PROPELLANTS

Charles P. Fenimore, Baltimore, and Lester P. Kuhn and Joseph H. Frazer, Havre de Grace, Md.

No Drawing. Application June 20, 1945,
Serial No. 600,635

1 Claim. (Cl. 52—20)

(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 manufacture of a propellant comprising nitrocellulose and to a nitrocellulose containing composition.

Among the objects of the invention is to provide a nitrocellulose containing propellant for projectiles in which the nitrocellulose component thereof gives a greater quantity of heat upon explosion at low densities of loading and under low pressure than nitrocellulose in the form it is obtained as a final product of the nitration of cellulose.

A further object of this invention is to provide a nitrocellulose or a propellant made therefrom which burns more smoothly and more completely at low pressures than ordinary nitrocellulose which has not been treated according to the invention.

Throughout the description of this invention and in the claims, the terms "nitrocellulose" and "nitrocellulose of gun cotton grade" mean nitrocellulose of the type used in making propellants or explosives and usually containing not less than 11.05 per cent and not more than 14.12 per cent nitrogen. The nitrocellulose of gun cotton grade which is used as a starting material for the present invention is in the fluffy fibrous condition it assumes in manufacture before it is colloidized and worked up into grains of powder.

We have discovered that compounds of certain metals when adsorbed by fibres of fluffy fibrous nitrocellulose of gun cotton grade have the property of increasing the quantity of heat liberated upon exploding the nitrocellulose at pressures ranging from atmospheric pressure to pressures of the order of magnitude of 500 p. s. i. This increased liberation of heat is manifested in the case when the fibrous nitrocellulose containing the adsorbed compounds is exploded or burned in its fibrous form and also in the case when it is colloidized and mixed with other ingredients in the manufacture of propellant powders. In addition, the burning or explosion of the fibrous nitrocellulose or nitrocellulose powder made therefrom is smoother than the burning or explosion of fibrous nitrocellulose of gun cotton grade or powders made therefrom which do not contain the

2

said compounds within them in a highly dispersed condition. Among the metals whose compounds give the above described effects may be mentioned nickel, cobalt, iron, copper, tin, lead, cadmium, and cerium. It is preferred to use an organic acid salt of the metals mentioned, and these salts should be soluble in non-aqueous solvents which are not solvents for nitrocellulose.

The said metal compounds bring about the results stated even when present in very small proportion compared with the weight of the fibrous nitrocellulose of gun cotton grade. The action of the compounds of the metals is catalytic and their presence in the highly dispersed form obtained according to the present invention appears to cause gaseous reaction products (such as nitric oxide, aldehydes, ketones, etc.), which would otherwise escape burning, to enter into the burning or explosion reaction, thereby increasing the quantity of heat liberated. The compounds of the metals absorbed may be present in such an amount as to provide 2% or less of metal in the form of metal compound in the fluffy fibres of the nitrocellulose. As low as 0.70% of the catalytic metal have been found to give the improved burning characteristics referred to above.

In practicing the invention an organic acid salt of one of the above named metals is dissolved in a non-aqueous solvent for it which is not a solvent for nitrocellulose. Then this solution is brought into intimate contact with dry or water free, fibres of fluffy fibrous nitrocellulose. For example, the fibres of nitrocellulose may be suspended in the solution and stirred therein until the adsorption of the metal compound has occurred. The concentration of the metal compound in solution and the quantity of solution used in treating the fibres of the fluffy fibrous nitrocellulose permit the amount of metal compound adsorbed by the said fibres to be regulated. After the adsorption of the salt or compound, the fibrous nitrocellulose is removed by filtration from the suspension, washed with fresh portions of the solvent, and then dried, or treated with some other solvent to displace the solvent used in washing. This displacing solvent may be one chosen with regard to the further steps that are used in working up the treated fibrous nitrocellulose into powder grain. The treated fibrous nitrocellulose is then mixed with suitable solvents, colloidizing agents,

3

plasticizers, stabilizers, etc., as usually done in the manufacture of powder grain, and then formed into powder grains in any suitable manner.

While the generic character of the invention is clearly set forth above, the following specific example is given by way of illustration of details of practicing the invention.

Example

25 grams of substantially pure cobaltous rosinate is dissolved in 1000 cc. of carbon tetrachloride and then diluted with 2500 cc. of petroleum ether. To this solution 500 grams of dry, or water free, fibrous nitrocellulose are added and the mixture stirred to form a suspension. The stirring is continued for fifteen minutes after the nitrocellulose has been added. The treated nitrocellulose is then filtered off, dried, and thereafter incorporated in a mix or mixture for making powder grains. The filtrate resulting from the filtration step is substantially colorless, indicating practically complete adsorption of the cobalt rosinate by the fibres of the fluffy fibrous nitrocellulose.

We claim:

The process for preparing propellants which comprises contacting fluffy fibrous nitrocellulose substantially free of water with a solution of cobaltous rosinate in a mixture of carbon tetrachloride and petroleum ether, to effect adsorption of cobaltous rosinate from said solution by said

4

fibrous nitrocellulose, separating said fibrous nitrocellulose from said solution after the said adsorption of cobaltous rosinate therefrom, drying the said separated fibrous nitrocellulose, and thereafter incorporating in a propellant mix the fibrous nitrocellulose containing the adsorbed cobaltous rosinate.

CHARLES P. FENIMORE.

LESTER P. KUHN.

JOSEPH H. FRAZER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
610,455	Stevens	Sept. 13, 1898
647,420	Luck	Apr. 10, 1900
1,838,346	Woodbridge	Dec. 29, 1931
1,963,116	Burns et al.	June 19, 1934
1,963,975	Ellis	June 26, 1934
2,038,700	Woodbridge	Apr. 28, 1936
2,131,352	Marsh	Sept. 27, 1938

FOREIGN PATENTS

Number	Country	Date
174	Great Britain	1877
2,832	Great Britain	1877
6,289	Great Britain	1895