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PROPELLANT POWDER.

No Drawing.

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(GRANTED UNDER THE ACT OF MARCH 3, 1883; 22 STAT. L. 625.)

To all whom it may concern:

Be it known that I, CHARLES R. FRANKLIN, a citizen of the United States, and a resident of Dover, county of Morris, and a State of New Jersey, have invented an Improvement in Propellant Powder, of which the following is a specification.

The invention described herein may be used by the Government, or any of its officers or employees in prosecution of work for the Government, or by any other person in the United States, without payment to me of any royalty thereon, in accordance with the act of March 3, 1883.

The subject of the present invention is a propellant powder.

The primary object of my invention is the provision of propellant powder which will meet all ballistic requirements, and which will show a marked reduction in flash.

A further object of my invention is the provision of a powder in which nitroguanidine is substituted for a portion of the nitrocellulose ordinarily used and which is coated with a non-hygroscopic agent.

A further object of my invention is the establishment of a method for making a powder which will be flashless and meet all ballistic requirements.

The powder which constitutes my invention is composed preferably of nitrocellulose and nitroguanidine in proper proportions and a stabilizer such as diphenylamine and is coated with a deterrent and non-hygroscopic agent such as dinitrotoluol. While not necessary I have found it advisable also to use an oxidizing agent such as barium nitrate and to glaze the finished powder with graphite.

Such a powder may be made by treating nitrocellulose of suitable solubility having about 12.6% nitrogen content with a suitable solvent such as, for instance, by displacing the water content of the nitrocellulose with alcohol. Sufficient alcohol is allowed to remain in the nitrocellulose to furnish the required amount for use in mixing the other components of my powder with the nitrocellulose and to form a plastic mass. The alcohol saturated nitrocellulose is disintegrated and transferred to a dough-mixing machine. The mixing machine is operated for a proper period, in practice at

least 10 minutes, and then the proper amount of nitroguanidine is added. After a sufficient interval, in practice at least five minutes, an oxidizing agent such as barium nitrate in the necessary quantity is added to the mixture. The proper amount of ether containing a fixed weight of a suitable stabilizing compound such as a diphenylamine is then added to make a 1 alcohol-2 ether solvent mixture. This mixture also takes the form of a plastic dough-like mass. The plastic mixture is then kneaded for a proper period generally about 30 minutes. The material is then subjected to a pressure of 3,000 pounds, more or less, per square inch, and is then pressed successively through 16 mesh, 24 mesh, and 40 mesh steel screens. This screening operation is repeated until the exterior surface of the mass presents a smooth, compact, and uniform texture. The screened material is then subjected to a pressure of 3,000 pounds per square inch, more or less, until the material presents a hard compact appearance. It is then transferred to another press from which it is extruded through a die preferably by hydraulic pressure, and is then cut into the desired lengths. The grains thus formed are subjected to a heat at 40° C. to 50° C. over a suitable period, which in practice has been found to vary from 5 to 7 days. This heat treatment is carried out in a closed receptacle. The partially dried powder is then completely dried at a temperature of approximately 55° C.

To render the powder non-hygroscopic and at the same time to improve the ballistic qualities the dried grains are then given a superficial coating of dinitrotoluol preferably the 1, 2, 4-derivative or some other suitable material or materials having the same properties. The dinitrotoluol not only protects the powder from deterioration by dampness but also acts as a deterrent. This portion of the manufacture is accomplished by placing the grains in a tumbling barrel to which the coating material or if necessary, materials having the properties outlined above, have previously been added. The temperature during this process is maintained between 30° C. to 40° C. After sufficient material adheres to the grains the powder is preferably screened and glazed with graphite in a tumbling barrel similar to that

used in adding the deterrent or non-hygroscopic agent. It is then blended and screened.

- While it is not intended to adhere strictly to the composition given in the formula below, the same is cited as an illustration of the various organic and inorganic materials that may be utilized by this process of manufacture to form a successful propellant powder. A proper mixture, one which has been used successfully in practice is as follows:

Nitrocellulose.....	85.24%	98%	99.975%
Nitroguanidine.....	9.84%		
Barium nitrate.....	4.48%		
Diphenylamine.....	0.44%		
Dinitrotoluol.....		2%	
Graphite.....			.025%

- In the formula given above any suitable oxidizing agent may be substituted for the barium nitrate in proper proportions; for the diphenylamine, any amino compound such as urea or aniline or any substance having similar qualities may be substituted, while for the dinitrotoluol, trinitrotoluol, trinitrobenzene or any compound having similar properties, or, if desired, any compounds together having similar properties may be substituted.

- A powder made in the manner claimed and composed of compounds such as described has been found to have the proper ballistic qualities and to show a marked reduction in flash and especially fitted for use with .50 caliber machine guns and other small arms, though by no means limited to this use.

- While I have described only one composition it will be understood by those familiar with the art that the proportions of nitrocellulose and nitroguanidine may be widely varied. While I have described simply the use of dinitrotoluol and specifically the 1, 2, 4-derivative it will also be understood that I may use any deterrent material or any compound having non-hygroscopic qualities and having an appreciable solvent action on the nitrocellulose constituent of the powder grain under the prevailing condition, or a plurality of compounds having these qualities. Such deterrent and non-hygroscopic materials are well-known in the art.

- I claim:

1. As a new propellant, nitrocellulose powder containing nitroguanidine, and an oxidizing agent, and having its surfaces impregnated with a deterrent material.

2. As a new propellant, a nitrocellulose powder containing nitroguanidine, and an oxidizing agent and having its surfaces impregnated with a non-hygroscopic material.

3. As a new propellant, a nitrocellulose powder containing nitroguanidine, and an oxidizing agent and having its surfaces impregnated with substantially pure 1, 2, 4-dinitrotoluol.

4. As a new propellant, a nitrocellulose powder containing nitroguanidine, and an oxidizing agent, and having its surfaces impregnated with a nitrohydrocarbon.

5. As a new propellant, a nitrocellulose powder containing nitroguanidine, and a nitrate, and having its surface impregnated with a non-hygroscopic material.

6. As a new propellant, a nitrocellulose powder containing nitroguanidine, and a nitrate and having its surfaces impregnated with a nitrohydrocarbon.

7. As a new propellant, a nitrocellulose powder containing nitroguanidine, and a nitrate and having its surfaces impregnated with substantially pure 1, 2, 4-dinitrotoluol.

8. A propellant powder consisting of a stabilized mixture of nitrocellulose, nitroguanidine and a nitrate and having its surfaces impregnated with a nitrohydrocarbon.

9. A propellant powder consisting of a stabilized mixture of nitrocellulose, nitroguanidine and a nitrate, and having its surfaces impregnated with a non-hygroscopic material.

10. A propellant consisting of a stabilized mixture of nitrocellulose, nitroguanidine and barium nitrate, and having its surfaces impregnated with dinitrotoluol.

11. A propellant powder consisting of a stabilized mixture of nitrocellulose, nitroguanidine and barium nitrate and having its surfaces impregnated with a non-hygroscopic material.

12. As a new propellant, an explosive consisting of a stabilized mixture of about 85 parts of nitrocellulose, about 10 parts of nitroguanidine, and about 5 parts of barium nitrate and having its surfaces impregnated with a nitrohydrocarbon.

CHARLES R. FRANKLIN.