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PROPELLANT EXPLOSIVE

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6 Claims. (Cl. 52—7)

This invention relates to improved propellant explosives and methods of producing same, and more particularly to improved smokeless powders and methods of producing the same.

Propellant powders have, in the past, had many varied compositions. Many of such propellant powders contain inorganic salts, e. g., barium nitrate, potassium nitrate, etc., which on combustion leave in the bore of the gun a coating of hygroscopic, inorganic salts, which cause a severe rusting of the bore of the gun if not removed promptly. Even in the case of a smokeless powder which may not contain any inorganic salts, the primer of the cartridge will contain such inorganic salts, and, on firing, these, or their decomposition products, will coat the bore of the gun with a corrosive residue which causes rusting when the gun is left only a short time in a humid atmosphere.

Heretofore, many materials have been added to smokeless powder to prevent metal fouling. For example, metallic tin, tin alloys, lead dust, organo-metallic tin compounds, etc., have been added to smokeless powder for the purpose of forming, with the cupro-nickel metal fouling in the bore, fusible or brittle alloys which would be swept out of the bore by the succeeding projectile, or which could be easily removed by cleaning the bore. Such added substances as the above have no effect whatever on the saline residues left in the bore, which cause rusting of the bore.

Powdered aluminum and magnesium have heretofore been suggested for addition to smokeless powder for the purpose of speeding up the combustion of the smokeless powder. Although not heretofore known aluminum has the action in preventing the formation of rust in the bore, but also has the effect of creating high breech pressures, with the attendant danger of bursting the gun and hence is not suitable for use in the usual smokeless powders.

I have found much to my surprise, that by incorporating into smokeless powder a small proportion of ground glass, calcium silicide, antimony sulfide, metallic antimony powder, antimony oxide, cadmium carbonate, cadmium oxide, metallic cobalt, or manganese dioxide, or mixtures of any of these, I form, on firing such smokeless powder in a gun, a deposit in the bore of the gun which protects the bore against the rusting effects of the saline residue deposited thereon by the combustion of the smokeless powder or the percussion cap, without attendant danger of bursting the gun due to high breech pressures. The exact chemical process involved in such protective action I have been unable to determine. The aluminum heretofore suggested for increasing the combustion temperature of smokeless powder is not within the scope of this invention, since its use results in dangerous increases in the breech pressure in the gun.

These rust-preventing substances may be incorporated in the smokeless powder in widely varying amounts, e. g., from about 0.25% to about 2.00% of the weight of the powder, depending upon the nature of the gun, the nature and grain size of the smokeless powder, the nature of the rust-preventer employed, and the amount of oxidizing salts present in the smokeless powder, but in no event will the amount of rust-preventer added be sufficient to detract seriously by its inert characteristics, from the strength of the smokeless powder. I am, therefore, unable to specify limits of the amounts of rust-preventer to be added to smokeless powders, but I have found that a convenient and effective proportion is about 1% of the weight of the smokeless powder, and that more than 2% offers no appreciable advantage.

As an example of my improved product, I may incorporate by any suitable means during the manufacture of smokeless powder, 1% of antimony sulfide into a powder mix containing 15% nitroglycerin, 0.75% diphenylamine, 1% barium nitrate, and 82.25% nitrocellulose, colloid the mix by the use of suitable nitrocellulose solvents, press through a die, and cut the strings so formed into small grains, dry, and surface coat, if desired, to make the powder progressive-burning.

On firing 50 pounds of the above smokeless powder with non-corrosive primers in a gun and cartridge such as, for example, known as the .22 caliber Hornet, then storing the gun, uncleaned, for 48 hours at 115° F. in an atmosphere of 90% relative humidity, the bore of the gun will remain clean and bright, or at most show small spots of rust which are easily removed and leave no pitting. If the same type of powder and gun be fired without the inclusion of the rust-preventing ingredient, and the gun is stored under the same conditions as before, the bore of the gun will be found completely covered with severe rusting extremely difficult to remove, and after removal of the rust the bore of the gun will be found to be severely pitted. In place of antimony sulfide, I have employed 1% of ground glass, calcium silicide, metallic antimony, antimony oxide, cadmium carbonate, metallic cadmium, cadmium oxide, metallic cobalt, or manga-

nese dioxide, and found the same desirable results are obtained thereby as with the use of antimony sulfide.

The rust-preventing substances incorporated in smokeless powder in accordance with this invention do not increase the speed of combustion of the powder, and have either a slight deterrent action or no effect whatever. As an illustration of the effect of the rust-preventing substances on the speed of combustion of smokeless powder, as reflected by the breech pressures developed by charges of the same weight (10.4 grains) when fired under comparable conditions in a .22 caliber rifle, I may cite the following table:

	Mean pressure	Maximum pressure
	Lbs./sq. in.	*Lbs./sq. in.*
Powder A (no rust-preventer)	44,300	46,400
Powder B (containing antimony oxide)	39,900	43,200
Powder C (containing manganese dioxide)	35,600	40,700
Powder D (containing aluminum)	46,500	51,200

In the above comparison, powders B, C and D are smokeless powders of identical compositions except for containing 1% of powdered antimony oxide, 1% powdered manganese dioxide, and 1% powdered aluminum, respectively. Powder A is a comparable smokeless powder containing no rust-preventing agent. In this table it will be noted that both powders B and C, made in accordance with this invention, gave lower mean pressures and lower maximum pressures than the powder A containing no rust-preventing agent. On the other hand, powder D not made in accordance with this invention, gave both a higher mean pressure and a higher maximum pressure and would tend to be dangerous in use.

Instead of incorporating into the smokeless powder my rust-preventers, I may coat the grains of the smokeless powder therewith. For example, I may mix with a charge of smokeless powder a suitable proportion of rust-preventer, and an amount of an alcohol-acetone mixture sufficient to thoroughly wet the powder mixture, and roll the resulting mixture in a barrel until the alcohol-acetone mixture has slightly softened the surfaces of the powder grains sufficiently to cause the rust-preventer to adhere to the surface of the powder grains, then evaporate the alcohol-acetone mixture from the powder mixture, leaving the powder grains coated with an adherent coating of my rust-preventer.

No particular form of apparatus is necessary for the carrying out of my process of preparing smokeless powder capable of preventing rust formation in the barrel of the gun and it will be understood that my invention is not limited to the above example and description, it being obvious in view of the above description that various adaptations of the invention to various smokeless powders and guns is contemplated as within the scope of this invention.

This application is a division of my application for United States Letters Patent, Serial No. 116,555, filed by me December 18, 1936.

What I claim and desire to protect by Letters Patent is:

1. A smokeless powder including from about 0.25% to about 2% of an inorganic, cadmium-containing substance selected from the group consisting of metallic cadmium, cadmium carbonate and cadmium oxide.

2. A smokeless powder including from about 0.25% to about 2% of cadmium carbonate.

3. A smokeless powder including from about 0.25% to about 2% of cadmium oxide.

4. A smokeless powder having incorporated therein from about 0.25% to about 2% of an inorganic, cadmium-containing substance selected from the group consisting of metallic cadmium, cadmium carbonate and cadmium oxide.

5. A smokeless powder coated with from about 0.25% to about 2% of an inorganic, cadium-containing substance selected from the group consisting of metallic cadmium, cadmium carbonate and cadmium oxide.

6. A smokeless powder including from about 0.25% to about 2% of metallic cadmium.

HENRY N. MARSH.

CERTIFICATE OF CORRECTION.

Patent No. 2,131,352. September 27, 1938.

HENRY N. MARSH.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 36, for the word "pounds" read rounds; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of October, A. D. 1938.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.