

UNITED STATES PATENT OFFICE.

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SMOKELESS PROPELLANT POWDER.

No Drawing.

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To all whom it may concern:

Be it known that I, TENNEY L. DAVIS, a citizen of the United States, and a resident of Somerville, county of Middlesex, and State of Massachusetts, have invented an Improvement in Smokeless Propellant Powder, of which the following is a specification.

The subject of this invention is smokeless propellant powder.

The main objects of the invention are the production of a powder having the ballistic advantages of colloided nitrocellulose powders while at the same time possessing perfect stability and which may be prepared without the use of volatile and hygroscopic solvents thereby rendering the powder non-hygroscopic and constant in its ballistic properties and which may be so combined that the rate and temperature of combustion may be regulated to any desired degree.

Pentaerythrite tetranitrate or "tetranitropentaerythrite," as it is commonly but incorrectly called, is an excellent explosive which has found considerable use in detonators, detonating fuses, etc. It is a very powerful explosive, being somewhat more powerful than nitroglycerine. It is very hot and for this reason perhaps, has found little application for use in fire arms. Like nitroglycerine it contains more oxygen than is needed for its own combustion, and like nitroglycerine it can submit to being mixed with other substances, either explosive or non-explosive, which contain an insufficient amount of oxygen, for the preparation of mixtures which are suitable for use either as shattering explosives or as propellant powders.

Pentaerythrite tetranitrate exists in the form of white crystals which while sensitive to shock and friction, are nevertheless perfectly stable in themselves and do not decompose spontaneously, as do nitrocellulose and nitroglycerine with the evolution of acid producing oxides of nitrogen. The great stability of the substance renders it especially suitable for the preparation of perfectly stable smokeless powder. The high temperature and rapid rate of combustion of pentaerythrite tetranitrate make it desirable that this substance should not be used alone as a propellant powder but should be incorporated or mixed with some other substances which will diminish the rapidity of its burning and lower its temperature of combustion. Such propellant mixtures

might conceivably be prepared by the intimate mixing of the ingredients and their subsequent compression and breaking up into granules as happens in the manufacture of black powder, but these powder granules at best would be somewhat coarse and their time of burning and the consequent ballistic properties could not be regulated as precisely as can now be done with colloided nitrocellulose powder. The best material for the purpose will be one which forms with pentaerythrite a uniform homogenous mass sufficiently plastic to be molded or squeezed into perfectly solid and non-porous powder grains.

Since pentaerythrite is a tetrabasic alcohol it forms in addition to the tetranitrate, a whole series of other derivatives, esters and ethers, similar to those which are formed by any of the alcohols. It forms crystalline derivatives with the aromatic aldehydes. Being a tetrabasic alcohol it forms derivatives in which one, two, three or four of the hydroxyl groups are substituted in the same or different ways.

I have discovered that certain derivatives of pentaerythrite form with pentaerythrite tetranitrate homogenous mixtures which, sometimes in the presence of solvents and sometimes not, are plastic and can conveniently be molded. I have found, for instance, that pentaerythrite tetrabenzoate is suitable, under certain conditions, while under others the mono- di- and tri-benzoates or mixtures of these are to be preferred.

Having described my invention what I claim as new and desire to secure by Letters Patent is:—

1. A propellant powder, comprising pentaerythrite tetranitrate and a derivative of pentaerythrite.

2. A propellant powder, comprising pentaerythrite tetranitrate and an ester of pentaerythrite.

3. A propellant powder, comprising a plasticised pentaerythrite.

4. A propellant powder, comprising pentaerythrite tetranitrate and a benzoate of pentaerythrite.

5. A propellant powder comprising pentaerythrite tetranitrate and pentaerythrite tetra-benzoate.

6. A propellant powder, comprising a plasticised pentaerythrite derivative.

7. The process of producing a smokeless propellant powder comprising mixing pen-

taerythrite derivatives, at least one of which possesses explosive properties to form a plastic mass and then dividing said plastic mass into grains of the desired shape and size.

5 8. The process of producing a smokeless propellant powder, comprising mixing pen-

taerythrite derivatives, at least one of which possesses explosive properties, in the presence of a solvent to form a plastic mass, and then dividing the plastic mass into grains of the desired shape and size. 10

TENNEY L. DAVIS.