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[54] **COOL BURNING GUN PROPELLANTS CONTAINING TRIAMINOGUANIDINE NITRATE AND CYCLOTETRAMETHYLENE TETRANITRAMINE WITH ETHYL CELLULOSE BINDER**

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[52] **U.S. Cl.** **149/19.7;** 149/92

[51] **Int. Cl.²** **C06B 25/06**

[58] **Field of Search** 149/91, 92, 19.7, 19.8

[56] **References Cited**

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[57] **ABSTRACT**

A family of gun propellants formulated with triaminoguanidine nitrate and cyclotetramethylene tetranitramine with a binder of ethyl cellulose to reduce the isochoric flame temperature while providing high mass impetus.

7 Claims, No Drawings

COOL BURNING GUN PROPELLANTS CONTAINING TRIAMINOGUANIDINE NITRATE AND CYCLOTETRAMETHYLENE TETRANITRAMINE WITH ETHYL CELLULOSE BINDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to gun propellants and is particularly directed to gun propellant formulations employing triaminoguanidine nitrate and cyclotetramethylene tetranitramine to provide low isochoric flame temperatures and high mass impetus.

2. Prior Art

For several hundred years, investigators have been seeking to improve firearms and the propellants used in them. Many significant improvements have been made. However, as long as there is a demand for such weapons, the search for improvements will continue. In recent years, automatic guns have been developed which are capable of firing several thousand rounds of ammunition per minute. However, the gun propellants available heretofore have had isochoric flame temperatures in the range of 2400°K to 3300°K. As a result, the barrels of the automatic guns have tended to overheat and become warped quite rapidly. Consequently, it has been necessary to replace the gun barrels frequently, which reduces the effectiveness of such guns and adds considerably to the expense of operating such guns. While some prior art gun propellants are known which have lower flame temperatures, these cool-burning propellants generally also have significantly lower mass impetus.

BRIEF SUMMARY AND OBJECTS OF INVENTION

These disadvantages of the prior art are overcome with the present invention and a family of gun propellants is proposed which provides isochoric flame temperatures 20 to 30 percent lower than those of conventional military propellants, while yielding comparable or higher mass impetus.

The advantages of the present invention are preferably attained by providing gun propellant formulations employing triaminoguanidine nitrate and cyclotetramethylene tetranitramine.

Accordingly, it is an object of the present invention to provide improved gun propellants.

Another object of the present invention is to provide gun propellants having flame temperatures which are significantly lower than those of conventional military propellants while yielding comparable or greater mass impetus.

A specific object of the present invention is to provide gun propellant formulations employing triaminoguanidine nitrate and cyclotetramethylene tetranitramine.

These and other objects and features of the present invention will be apparent from the following detailed description.

DETAILED DESCRIPTION OF THE INVENTION

In that form of the present invention chosen for purposes of illustration, a family of gun propellants is formulated, employing triaminoguanidine nitrate and cyclotetramethylene tetranitramine to provide flame temperatures which are significantly lower than those of

conventional military propellants, while yielding comparable or greater mass impetus.

The theoretical performances of standard military propellants, as described in U.S. Army Propellant Manual No. AMCP-706-150, published February 1965, are shown in Table I.

TABLE I

Propellant	Mass Impetus ft.-lb./lb.	Flame Temperature	Molecular Weight
M-1	305,000	2417°K	22.06
M-2	360,000	3319°K	25.64
M-10	339,000	3000°K	24,58
IMR	325,000	2827°K	24.17

In contrast, propellants formulated with triaminoguanidine nitrate and cyclotetramethylene tetranitramine have yielded specific impulses in the range of 304,000 to 335,000, with flame temperatures in the range of 1900°K to 2200°K.

EXAMPLE I

In accordance with the present invention, a gun propellant was formulated consisting of 25% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 20% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate. This propellant yielded a specific impulse of 305,200 ft.lbs./lb., and an isochoric flame temperature of 2035°K, with a molecular weight of 18.55.

EXAMPLE II

A gun propellant was formulated consisting of 55% by weight of triaminoguanidine nitrate; 25% by weight of cyclotetramethylene tetranitramine; 15% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate. This propellant yielded a specific impulse of 304,800 ft.lbs./lb., and an isochoric flame temperature of 1978°K, with a molecular weight of 18.06.

EXAMPLE III

A gun propellant was formulated consisting of 30% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 15% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate. This propellant yielded a specific impulse of 327,800 ft.lbs./lb., and an isochoric flame temperature of 2154°K, with a molecular weight of 18.27.

EXAMPLE IV

A gun propellant was formulated consisting of 55% by weight of triaminoguanidine nitrate; 25% by weight of cyclotetramethylene tetranitramine; 17.5% by weight of ethyl cellulose; and 2.5% by weight of isodecyl pelargonate. This propellant yielded a specific impulse of 308,500 ft.lbs./lb., and an isochoric flame temperature of 2001°K, with a molecular weight of 18.05.

EXAMPLE V

A gun propellant was formulated consisting of 30% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 17.5% by weight of ethyl cellulose; and 2.5% by weight of isodecyl pelargonate. This propellant yielded a specific impulse of 332,700 ft.lbs./lb., and an isochoric flame

temperature of 2193°K, with a molecular weight of 18.34.

The gun propellants of the present invention yielded impact sensitivities of 35–45 inch-pounds and a Taliani test showed no gas evolution at 93°C after 1 hour.

Obviously, numerous other variations and modifications may be made without departing from the present invention. Accordingly, it should be clearly understood that the forms of the present invention described above are illustrative only and are not intended to limit the scope of the present invention.

What is claimed is:

1. A gun propellant containing triaminoguanidine nitrate and cyclotetramethylene tetranitramine with a binder of ethyl cellulose.

2. A gun propellant consisting of 20% - 60% by weight of triaminoguanidine nitrate; 20%–60% by weight of cyclotetramethylene tetranitramine; 10%–25% by weight of ethyl cellulose; and 2.5%–10% by weight of isodecyl pelargonate.

3. A gun propellant consisting of 25% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 20% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate.

4. A gun propellant consisting of 55% by weight of triaminoguanidine nitrate; 25% by weight of cyclotetramethylene tetranitramine; 15% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate.

5. A gun propellant consisting of 30% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 15% by weight of ethyl cellulose; and 5% by weight of isodecyl pelargonate.

6. A gun propellant consisting of 55% by weight of triaminoguanidine nitrate; 25% by weight of cyclotetramethylene tetranitramine; 17.5% by weight of ethyl cellulose; and 2.5% by weight of isodecyl pelargonate.

7. A gun propellant consisting of 30% by weight of triaminoguanidine nitrate; 50% by weight of cyclotetramethylene tetranitramine; 17.5% by weight of ethyl cellulose; and 2.5% by weight of isodecyl pelargonate.

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