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EXPLOSIVE COMPOSITION

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This invention relates to an explosive composition and more particularly to an explosive of the "Pentolite" type.

As is well known, an explosive consisting essentially of one part of pentaerythritol tetranitrate to one part of trinitrotoluene and existing in the form of granular particles or agglomerated granules in which each granule is expected to consist of essentially one part pentaerythritol tetranitrate to one part trinitrotoluene, is now being used in warfare under the name of "Pentolite."

In order to convey a clearer picture of what "Pentolite" is, the following outline of a process for preparing it is given:

About 950 parts, by weight, of water are placed in a vessel provided with a suitable stirrer and 235 parts, by weight, of pentaerythritol tetranitrate in the form of crystals of the desired screen test are added, with constant stirring. Then, 235 parts, by weight, of trinitrotoluene (grade A) are dissolved in about 250 parts, by weight, of warm acetone and this clear solution added in a fine stream, with stirring, to the suspension of the pentaerythritol tetranitrate in water.

The result of this process is the granular product mentioned above and called "Pentolite." The latter, upon drying, is ready for use in loading operations and is usually used in this granular condition or heated in a suitable kettle to a temperature between 80° and 115° C. to provide a semi-liquid mixture suitable for pouring into the desired containers in which it is allowed to cool and solidify.

The process outlined above is not a part of the present invention. It is given for purposes of clarity and to show how my explosive composition may be prepared and handled.

It is also well known that even though two lots of "Pentolite" have about the same chemical composition and screen test and have been prepared in the same manner, they may vary considerably in viscosity at the temperatures used in commercial practice and this viscosity may seriously interfere with charging the mixture into the desired containers.

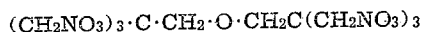
No satisfactory solution of this problem has been discovered to date.

I have discovered that the use of a minor amount of dipentaerythritol hexanitrate in conjunction with the pentaerythritol tetranitrate and trinitrotoluene produces a mixture which no longer possesses the objectionable viscosity characteristics mentioned above and still has the

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chemical and explosive properties required of a "Pentolite."

The chemical formula of pentaerythritol tetranitrate is $C(CH_2NO_3)_4$ and of dipentaerythritol hexanitrate is



showing that, in so far as the explosive-energy properties are concerned these two explosives are almost alike. However, from other standpoints as physical properties, solubility characteristics, sensitivity toward shock etc., dipentaerythritol hexanitrate is distinctly different than pentaerythritol tetranitrate.

As indicated above, the cause of poor flowage or improper viscosity of "Pentolite" at temperatures which are practicable in loading operations is not known. Numerous experiments have been made in this country and abroad and so far as I am aware, no uniformly successful process has yet been devised, even though the delays in production caused by batches of poor viscosity are often of serious proportions.

I have discovered that it is possible to obtain uniformly successful results if a relatively minor proportion of dipentaerythritol hexanitrate is added to a mixture of pentaerythritol tetranitrate and trinitrotoluene having a certain limited composition. Thus I have found that ternary mixtures consisting of

	Per cent
Dipentaerythritol hexanitrate	2½-7½
Trinitrotoluene	47½-42½
Pentaerythritol tetranitrate	46-52

are uniformly operative at the temperatures usable in plant operations.

If smaller amounts of dipentaerythritol hexanitrate than those mentioned above are used, the viscosity is not uniformly satisfactory at the temperatures usable in practice; if too large amounts are used the tendency of the undissolved pentaerythritol tetranitrate crystals to settle out is so greatly increased that it becomes difficult to obtain a product of uniform composition upon cooling and casting.

While the critical limits for the dipentaerythritol hexanitrate content of the ternary mixture of pentaerythritol tetranitrate, trinitrotoluene and dipentaerythritol hexanitrate are primarily based upon the requirements of viscosity of the mixture at operable temperatures, it will readily be apparent that, if the resulting ternary mixture, of satisfactory viscosity, does not have a satisfactory insensitiveness toward shock that the

use of dipentaerythritol hexanitrate would be impracticable. I have found that dipentaerythritol hexanitrate, in the proportions shown, is an excellent agent in conjunction with the trinitrotoluene to impart the proper degree of insensitiveness to the mixture. Also, dipentaerythritol hexanitrate does not reduce the heat stability of the ternary mixture as is so often the case when a nitrate and a nitro explosive are melted together. This is of especial significance for a military, naval, or aeronautical explosive. Also, dipentaerythritol hexanitrate has a very favorable density in the molten condition in relation to trinitrotoluene and pentaerythritol tetranitrate and this partially accounts for the slow rate of settling of the pentaerythritol tetranitrate crystals which remain suspended in the partially melted ternary mixture as the latter is poured into shells, etc.

It should be noted that my invention comprehends a composition of matter and that I may use many processes to prepare this composition in various physical forms. In the process given above I may prepare my composition in a semi-molten condition (in which condition it is of particular usefulness for certain shell loadings and the like in which a cast explosive of uniform composition is desired), and in a granular condition (in which it is of particular usefulness in pressure loading). Also, in so far as the granular condition is concerned, I may prepare two types, in one of these each granule is composed of a crystal or crystals of pentaerythritol tetranitrate surrounded or coated by trinitrotoluene and dipentaerythritol hexanitrate to form a porous granule; in the other type, which is made by dissolving the proper amounts of pentaerythritol tetranitrate, dipentaerythritol hexanitrate and trinitrotoluene in acetone to a single, concentrated solution and then pouring this solution in the form of a thin stream into a large excess of

hot water, with stirring, to precipitate the ternary mixture of trinitrotoluene, pentaerythritol tetranitrate and dipentaerythritol hexanitrate as a globular product and then cooling to completely solidify each particle, the individual granules thus produced are compact and substantially non-porous. The latter type is particularly useful when certain other requirements as to packing density, screen test, etc., are desired.

I claim:

1. A composition of matter comprising essentially 46-52% of pentaerythritol tetranitrate, 42.5-47.5% trinitrotoluene and 2.5 to 7.5% dipentaerythritol hexanitrate.

2. A composition of matter comprising essentially 46-52% of pentaerythritol tetranitrate, 42.5-47.5% trinitrotoluene and 2.5 to 7.5% dipentaerythritol hexanitrate, said product being in the form of granular particles of substantially uniform composition.

3. A composition of matter comprising essentially 46-52% of pentaerythritol tetranitrate, 42.5-47.5% trinitrotoluene and 2.5 to 7.5% dipentaerythritol hexanitrate, said product being in the form of porous, granular particles of substantially uniform composition.

4. A composition of matter comprising essentially 46-52% of pentaerythritol tetranitrate, 42.5-47.5% trinitrotoluene and 2.5 to 7.5% dipentaerythritol hexanitrate, said product being in the form of granular particles of substantially uniform composition, in which the pentaerythritol tetranitrate exists mainly as crystals imbedded in a mixture of trinitrotoluene and dipentaerythritol hexanitrate.

5. A cast composition of matter comprising essentially 46-52% of pentaerythritol tetranitrate, 42.5-47.5% trinitrotoluene and 2.5-7.5% dipentaerythritol hexanitrate and being of substantially uniform composition throughout.

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