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NITRATE EXPLOSIVES AND METHOD OF MAKING

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This invention relates to blasting explosives of the type designated as dynamites, manufactured with compositions containing mixtures of trimethylolethane trinitrate and nitrostarch.

In the manufacture of dynamites it is customary to employ nitroglycerin with or without the addition of nitropolyglycerin, nitrated sugars, ethyleneglycol dinitrate and similar explosives soluble in nitroglycerin in conjunction with nitrocellulose which is colloidally dispersed by the nitroglycerin and to some extent by the nitropolyglycerin, nitrated sugars, ethyleneglycol dinitrate, etc. It is well known that trimethylolethane trinitrate

$$CH_3.C(CH_2NO_3)_3$$

has no such colloiding action on nitrocellulose at ordinary temperatures, it being necessary to heat mixtures of trimethylolethane trinitrate and nitrocellulose to approximately 80° C. before colloidal dispersion of the nitrocellulose is effected. This renders trimethylolethane trinitrate alone unsuitable for use as a colloiding agent for nitrocellulose in dynamite manufacture.

Nitrostarch is chemically identical with nitrocellulose, the two materials differing physically in that nitrocellulose is fibrous in structure while nitrostarch consists of granules and the molecule of nitrocellulose is of greater size than that of nitrostarch. It would therefore be anticipated that the colloiding action of trimethylolethane trinitrate on nitrostarch would be similar to that of its action on nitrocellulose.

Because nitrostarch is much less expensive than nitrocellulose and has other advantageous characteristics in manufacture and use as compared with nitrocellulose, and because trimethylolethane trinitrate has a lower freezing point than nitroglycerin and is more stable and viscous and less sensitive and volatile than nitroglycerin, the use of these materials together in the manufacture of dynamites would be very desirable.

It has been found that, contrary to expectation, trimethylolethane trinitrate has significant and valuable colloiding action on nitrostarch at ordinary temperatures and that heating of the mixture is not necessary as in the case of mixtures of trimethylolethane trinitrate and nitrocellulose. If five or more parts by weight of nitrostarch containing 13.0 percent nitrogen are mixed at ordinary temperatures with 100 parts by weight of trimethylolethane trinitrate, it is found that the liquid trinitrate dissolves—i. e., colloidally disperses—approximately 1.5 parts by weight of the nitrostarch. Furthermore, it is found that the undissolved granules of nitrostarch have become swollen in size and are soft and jelly-like in consistency. If nitrostarch containing less than 13.0 percent nitrogen is so used, even more of the material is dissolved and the undissolved material is even more swollen in size and softer.

Because of the high viscosity of trimethylolethane trinitrate as compared with nitroglycerin (156 and 35.5 centipoises at 20° C. respectively), such a colloidal dispersion of nitrostarch in trimethylolethane trinitrate is extremely sticky or adhesive and therefore serves as a superior coating and sensitizing agent for insensitive inorganic salts such as the ammonium nitrate and sodium nitrate commonly used in dynamite compositions. Because of the practical insolubility of trimethylolethane trinitrate in water (less than 0.01 gram per 100 grams of water at 25° C. as compared with 0.14 gram for nitroglycerin), a coating of such a colloidal dispersion of nitrostarch in trimethylolethane trinitrate is highly effective in water-proofing such water-soluble inorganic salts as ammonium nitrate and sodium nitrate. If there is present in the mixture more nitrostarch than the trimethylolethane trinitrate can dissolve, the swollen, undissolved granules of nitrostarch serve to enhance the adhesive and moisture-proofing effects of the solution of nitrostarch in TMETN.

The particular mixture of trimethylolethane trinitrate and nitrostarch that I may use in a dynamite composition depends upon the other ingredients to be used, the explosive power and sensitivity desired and the requirement with respect to water resistance. The dynamite compositions manufactured with these two ingredients may contain 5 to 49 percent trimethylolethane trinitrate and 0.5 to 30 percent nitrostarch.

As examples of preferred compositions containing trimethylolethane trinitrate and nitrostarch, the following are mentioned:

	1	2	3	4	5	6	7
Ammonium nitrate, percent	84.5	72	75	54.5			
Sodium nitrate, percent		3.5		13	47.5	53.5	54.5
Trimethylolethane trinitrate, percent	5	20	5	30	30	40	10
Nitrostarch, percent	5	1	17	0.5	20	1	30
Carbonaceous matter, percent	5	3	2.5	1.5	2	5	5
Chalk, percent	0.5	0.5	0.5	0.5	0.5	0.5	0.5

In these compositions I may use as preferred such antacids as calcium carbonate, zinc oxide, magnesium oxide or mixtures of two or more of these. It is to be noted that my claim of invention is not restricted to compositions containing only the ingredients shown in the above examples, as I may use substitutes for these ingredients other than trimethylolethane trinitrate and nitrostarch and add ingredients such as TNT, liquid nitrotoluenes, sodium chloride, ammonium chloride, alum, ammonium sulphate or gypsum.

Although I do not wish to limit myself to the use of any particular inorganic nitrate, or mixture of inorganic nitrates or to the use of such inorganic nitrates in particles of any specific size, the inorganic nitrates that I prefer to use are the nitrates of ammonia, sodium and potassium, and the particle size which I prefer is material all of which will pass through a sieve having ten meshes to the linear inch, and of which less than 50% will pass through a sieve having 120 meshes to the linear inch. This represents the particle size of the inorganic nitrates most generally used in the formulation of dynamites of the customary type containing nitroglycerin as the sensitizing ingredient.

It is to be understood that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of the illustration which do not constitute departures from the spirit and scope of the invention.

I claim:

1. A detonatable explosive composition consisting essentially of granules of an inorganic nitrate selected from the group consisting of ammonium, sodium and potassium nitrates and mixtures thereof, trimethylolethane

trinitrate and nitrostarch, the nitrostarch being at least in part in the form of a colloidal solution in the said trinitrate, the said solution coating the granules of the inorganic nitrate and providing sensitizing and waterproofing therefor, and the proportions by weight being about 47.5–84.5 parts of the inorganic nitrate, 5–40 of the said trinitrate and 0.5–30 of the nitrostarch.

2. The explosive of claim 1 in which some at least of the nitrostarch is suspended in non-colloidal form in said colloidal solution.

3. In making a detonatable explosive, the process which comprises stirring 47.5–84.5 parts by weight of granules of an inorganic nitrate selected from the group consisting of ammonium, sodium and potassium nitrates and mixtures thereof with a viscous mixture of 0.5–30 parts of nitrostarch and 5–40 parts of trimethylolethane

trinitrate in which some at least of the nitrostarch is in the form of a colloidal solution in the said trinitrate, the said solution being in proportion to coat the inorganic nitrate granules, and continuing the stirring until the coating of the granules is effected.

References Cited in the file of this patent

UNITED STATES PATENTS

1,728,307	Rupp	Sep. 17, 1929
1,883,044	Spaeth	Oct. 18, 1932
1,932,050	Spaeth	Oct. 24, 1933
2,171,379	Wahl	Aug. 29, 1939

FOREIGN PATENTS

442,850	Great Britain	Nov. 14, 1934