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EXPLOSIVE

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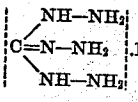
1 Claim. (Cl. 52—5)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to us of any royalty thereon.

The present invention relates to an explosive composition.

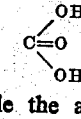
We have discovered that certain salts of triaminoguanidine are explosives possessing highly favorable characteristics which make them of value for military and commercial applications. These explosive compounds are represented by the type formula:



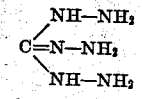
where HX represents any one of a series of inorganic or organic acids which will impart explosives properties to the triaminoguanidine when combined with it.

Triaminoguanidine is structurally related to carbonic acid and may in fact be looked upon as the hydrazine analog of carbonic acid in which the oxygen and hydroxyl groups have been replaced by the isosteric hydrazine groupings, $=N—NH_2$ and $—NH—NH_2$, respectively (see structural Formulas I and II). In a similar manner triaminoguanidine is related structurally to guanidine (see structural Formula III) except that in this instance the amino, $—NH_2$ and imino, $=NH$, groups of guanidine have been replaced by the corresponding isosteric hydrazine groupings.

I
Carbonic acid



II
Triaminoguanidine



III
Guanidine



While the acid derivatives of guanidine have been previously considered for use in explosive mixtures, we have found that they do not possess the favorable properties of the corresponding triaminoguanidine salt and have not been used for military or industrial purposes so far as is known due largely to the extreme insensitivity of the compounds. We have discovered that the sensitivity of the triaminoguanidine salts as well as of diaminoguanidine salts, covered by our copending application, is such that they can be readily brought to complete high order detonation by a priming charge of mercuric fulminate, whereas the corresponding salts of guanidine cannot be so detonated when tested under the same conditions. The complete conversion of the ammonia derivative of carbonic acid, i.e., of guanidine into the corresponding hydrazine derivative triaminoguanidine has a marked effect in increasing the sensitivity of the salts, that is, the ease in which the salts can be made to explode. This is considered an important discovery as no reference to such an effect has yet been encountered in the field of explosives. It is of particular interest that these new more sensitive explosive salts of triaminoguanidine can be used, per se, as high explosives.

In fact, one of these, triaminoguanidine perchlorate is actually capable of being initiated to detonation by the spit of a black powder fuze.

Not only do the triaminoguanidine salts possess favorable sensitivity to initiation, but they have been found to be stable towards storage at temperatures far above those usually met with under conditions of use, and they have been found to exhibit power and brisance comparable to trinitrotoluene and other high explosives which have found extensive use as military explosives.

The more important and significant explosive characteristics of typical inorganic and organic salts of triaminoguanidine, as determined by standard methods are summarized in Table I. While we cite here, for purposes of illustration only the nitrate and picrate of triaminoguanidine, we do not wish to be limited to these salts, for it is indicated that such acids as chloric, hydrazoic, styphnic, dinitrophenol, dinitroresorcinol and the like will combine with the base to give exposive products.

TABLE I

Triaminoguanidine

	Nitrate	Picrate
Melting point, ° C.	216–7	170–2
Sand Test Value, g. sand crushed when initiated with 0.3 g. mercuric fulminate	34.9	44.6
Stability, cc. gas evolved by a 5 g. sample in the 120° vacuum stability test	1.06	1.45
Explosion Temperature, ° C.	260	215

Comparison of the values given in the above table with those for well known explosives will serve to emphasize their favorable properties. Both triaminoguanidine salts are safer to handle in bulk than the important military explosive, pentaerythritol tetranitrate which explodes when subjected to the drop of 2 kg. weight of only 17 cm. The sand test values, generally recognized by those skilled in the art as a measure of the brisance or shattering effect of an explosive place these compounds in the same class with trinitrotoluene. Since these sand test values were obtained under standard test conditions through initiation by 0.3 g. of mercuric fulminate, it is furthermore pertinent from a practical point of view that these explosives can easily be made to detonate at high order and at a high rate with commonly used initial detonating agents. The figures for stability indicate that triaminoguanidine compounds possess excellent stability and would undergo no decomposition under the conditions of storage and use to which military and commercial explosives are now subjected. They are, in fact, more stable than such widely used high explosive compositions as 35/65 trinitrotoluene/trinitrophenylmethylnitramine and 50/50 trinitrotoluene/pentaerythritol tetranitrate both of which fail in this same test.

Particular reference is made to triaminoguanidine perchlorate which is not only a powerful high explosive, crushing 51 g. of sand in the sand test as compared with 22 g. for the same weight of mercuric fulminate, but like the latter may be initiated to detonation by the spit of a black powder fuze. It is furthermore extremely sensitive to impact and will detonate when subjected to the blow of a 2 kg. hammer when dropped from a height of only 7 cm. These characteristics place the perchlorate of triaminoguanidine in the same class with other powerful initiating agents, such as mercury fulminate and lead azide, but it differs from these by virtue of the fact that it possesses an extraordinarily high brisance or shattering effect. Its use as an initiator or as a component of priming and detonating compositions is thereby indicated.

The triaminoguanidine compounds can be shown by calculation to yield relatively low temperature on explo-

sion and would therefore offer advantages over many other high explosives where a "cool" explosive is desired. Triaminoguanidine compounds, in particular the nitrate, can also be used as components of mixed explosives. We have found (*a*) that an explosive mixture consisting of a 50/50 mixture of triaminoguanidine nitrate plus trinitrotoluene possesses greater brisance than the widely used composite of ammonium nitrate and trinitrotoluene and (*b*) that such a mixture in the molten state can be cast loaded into shell, bombs, mines, and other devices used for blasting and demolition purposes.

We claim:

An explosive composition consisting essentially of triaminoguanidine salt of an acidic agent selected from the group consisting of nitric acid, picric acid, perchloric acid, chloric acid, hydrazoic acid, styphnic acid, dinitrophenol, and dinitroresorcinol, and a detonating agent for said salt.

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