This invention relates to explosives and explosive compositions and more particularly to explosive compositions containing trinitrotoluene which exhibit improved physical properties under variations of temperature and pressure.

Trinitrotoluene is well-known for properties which make it especially useful in making cast explosives. It is relatively insensitive to shocks and blows, highly stable over extended periods of storage and forms no sensitive explosive compounds by reaction with metals. The relatively low melting temperature of trinitrotoluene makes it well adapted for forming cast explosive charges, since fusion may be brought about by the use of hot water or steam.

Although trinitrotoluene, hereinafter referred to as TNT, enjoys the foregoing desirable properties, TNT and explosive compositions containing TNT exhibit three distinct objectionable characteristics which are especially deleterious and evident under storage conditions and in handling and manufacturing. TNT and TNT compound explosives such as tritonal, torpex, Composition B, baratol, and baronex exhibit (1) irreversible dimensional instability, (2) exudation and (3) poor thermal shock resistance.

The objectionable behavior referred to hereinbefore may be typified by cast TNT (grade 1, having a set pint of approximately 80.2° C.). In the course of normal temperature variation under uncontrolled storage conditions or in thermal cycling from approximately 70° F. to 140° F. the cast charge or grains of TNT grow irreversibly each time the temperature undergoes a cycle. Thus, a rise in temperature increases the dimensions of the cast charge but the subsequent decrease in temperature does not produce an equal amount of contraction, so that there is a steady and graduated growth in the dimensions of the cast charge.

TNT also exudes products known to be composed of dinitrotoluene and certain other impurities normally found in commercial TNT. The dinitrotoluene along with these other impurities form eutectic mixtures with TNT which exhibit very low melting points. The presence of these eutectic mixtures in the grain, or charge, makes it possible for the material to liquefy and exude at the more elevated temperatures of storage. The exudation and irreversible growth is frequently sufficiently adverse under military storage conditions as to render the ammunition or explosive unsafe or unsuitable for military use.

Explosive compositions, such as those mentioned hereinbefore which contain TNT as one of the components, exhibit surveillance properties similar to those of TNT; that is, cast charges of these explosives will undergo irreversible dimensional instabilities or to reduce such irreversible growth to an order of magnitude that is no longer found to be deleterious by the utilization of TNT of high purity. For example, when TNT which has been purified by recrystallization from alcohol followed by a second recrystallization from a mixture of ethylene dichloride and carbon tetrachloride and finally water washed and dried to give a set point of 80.7° ±0.1° C., is used for the preparation of a poly component explosive containing a dispersed phase, it is found that the full scale cast charges do not show irreversible changes in volume exceeding 0.9 of one percent. Frequently the growth is of a second order of magnitude, i.e., 0.5 of one percent. Also, due to the absence of impurities and lower order nitrotoluenes in such relatively pure TNT, exudation is avoided. Thus, two of the three objectionable characteristics of TNT and TNT compound explosives may be avoided by the use of sufficiently pure TNT. However, such TNT when in the form of cast explosive charges has especially poor resistance to thermal shock and such charges are accordingly subject to extensive crack failure during thermal cycling or normal stor-
given herein. Such limits range from 0.1 percent to one percent of the TNT present in the explosive mixture.

In addition to those compounds discussed herebefore, it has also been found that the incorporation of trinitro-metaxylene or 1,3,8-trintronaphthalene to TNT or TNT-containing explosives in an amount equal to 0.1 to one percent by weight of the TNT present will eliminate objectionable crack failure without promoting irreversible growth or exudation of the cast explosive. These compounds directly form high melting eutectic mixtures with the TNT of the composition. The use of TNT of high purity, i.e., TNT having a set point of approximately 80.70° C. is essential however to the satisfactory performance of explosives containing either of these two compounds.

Inasmuch as anthracene and the polycyclic aromatics of the class described form equimolecular compounds with lower nitrotoluenes which in turn form high melting eutectic mixtures with the TNT it is possible to vary the process for obtaining the final explosive mixture. Although the process described hereinof of adding the proper amount of anthracene or the selected compound to a molten slurry of the explosive is preferable, it is also possible to first form the equimolecular compound of anthracene and nitrotoluene and add the compound to the TNT or TNT-base explosive to form the eutectic mixture. Thus, the alternative process includes forming an equimolecular compound of anthracene, or one of the polycyclic aromatics described herein, and dinitrotoluene and adding the molecular compound to a molten slurry of high purity TNT explosive composition in an amount within the limits of operability described herein.

While there have been described what are considered to be preferred embodiments of the present invention, it is to be understood that the invention of this application is not limited to the specific examples herein recited but that numerous modifications and variations thereof may be made without departing from the scope of the invention as set forth in the appended claims.

What is claimed is:

1. The process of preparing cast trinitrotoluene and trinitrotoluene-base high explosives resistant to cracking, exudation and irreversible dimensional growth comprising heating the explosive to a molten condition, adding thereto an amount of polycyclic aromatic hydrocarbon of the class consisting of anthracene, naphthalene, dihydroanthracene, acenaphthene, phenanthracene, fluorene, chrysene and pyrene, the amount of said polycyclic aromatic hydrocarbon being from about 0.1 percent to about one percent of the trinitrotoluene present, mixing the explosive and added compound and casting the resulting melt into the desired shape.

2. The process according to claim 1 wherein the polycyclic aromatic hydrocarbon is anthracene.

3. Trinitrotoluene and trinitrotoluene-base explosive comprising from about 0.1 percent to about one percent based on the weight of the trinitrotoluene present of a polycyclic aromatic hydrocarbon of the class consisting of anthracene, naphthalene, dihydroanthracene, acenaphthene, phenanthracene, fluorene, chrysene and pyrene.

4. The trinitrotoluene and trinitrotoluene-base explosive according to claim 3 wherein the polycyclic aromatic hydrocarbon is anthracene.

5. Trinitrotoluene and trinitrotoluene-base explosive comprising trinitrotoluene having a set point of about 80.7° C. ±0.1° C., and anthracene in an amount equal to about 0.5 percent by weight of said trinitrotoluene whereby said explosive is rendered resistant to thermal shock, exudation and irreversible thermal growth.

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