

United States Patent

Voigt, Jr. et al.

[15] 3,706,609

[45] Dec. 19, 1972

[54] TNT COMPOSITION CONTAINING A CELLULOSIC RESIN WHICH IS FREE FROM OILY EXUDATION UPON STORAGE

[72] Inventors: H. William Voigt, Jr., Stanhope, N.J.; Lawrence W. Pell, West Orange, N.J.; Jean P. Picard, Morristown, N.J.

[73] Assignee: The United States of America as represented by the Secretary of the Army

[22] Filed: Dec. 29, 1970

[21] Appl. No.: 102,541

[52] U.S. Cl. 149/18, 149/105, 149/107, 149/99

[51] Int. Cl. C06b 9/04

[58] Field of Search.....149/11, 18, 19, 94, 99, 105, 149/108, 109, 107

[56] References Cited

UNITED STATES PATENTS

2,809,120 10/1957 Sloan et al. 106/182 X

2,814,570	11/1957	Sloan et al.	106/170 X
2,966,405	12/1960	Sloan et al.	149/60 X
3,290,190	12/1966	Godfrey et al.	149/18
3,403,061	9/1968	McDonald.....	149/18 X
3,523,841	8/1970	Knight.....	149/94 X

Primary Examiner—Carl D. Quarforth
Assistant Examiner—P. A. Nelson
Attorney—Harry M. Saragovitz, Edward J. Kelly and Herbert Berl

[57] ABSTRACT

A castable high explosive composition of the 2, 4, 6-trinitrotoluene (TNT) variety containing a cellulosic resin having a thermoplastic nature.

A method of incorporating a thermoplastic resin of the cellulosic variety into a castable high explosive composition containing TNT by initially coating such cellulosic resin on the surface of a finely divided solid explosive and then uniformly dispersing the latter throughout the castable composition.

7 Claims, No Drawings

TNT COMPOSITION CONTAINING A CELLULOSIC RESIN WHICH IS FREE FROM OILY EXUDATION UPON STORAGE

The invention described herein may be manufactured, used and licensed by or for the Government for Governmental purposes without the payment to us of any royalties thereon.

This invention relates to an improved castable high explosive of the TNT variety.

More particularly, this invention relates to a castable high explosive composition containing TNT which has been modified with a thermoplastic resin of the cellulosic variety.

As is well known, castable high explosives are not only required in the manufacture of large caliber shells, bombs and land mines but are also preferred in the manufacture of other type shells due to simplicity in handling, safety achieved in loading and overall cost in manufacture.

In the past, characteristics such as exudation, voids, brittleness and irreversible expansion were noted in the preparation of a castable high explosive such as TNT. In the case of exudation, the low melting oils usually appear when the cast is stored around 71° C. but may appear even at room temperature. This leads to loose charges and possible premature explosions in the gun barrel. Also, the physical nature of the cast is usually brittle, particularly at the low temperatures required by military use, and cracking occurs where the cast is cycled from differing zones of temperature. The latter condition ultimately affects the impact sensitivity of the cast, and can reduce the penetration of armor plate by shaped charges. Furthermore, the coefficient of thermal expansion of this type castable explosive is high, and irreversible expansion of the cast occurs when heated. This facilitates the formation of voids which also adversely influences the impact sensitivity of the final cast.

In the past, additives of the silica variety having a finely divided particulate nature were utilized as absorbents of the low melting oils which usually make up the bulk of the exudation of the explosive cast. However, as is well known, undesirable cracks with their inherent hazardous characteristics usually develop in the solidified explosive cast when such additives are added to the initial composition containing TNT. Another difficulty encountered in the use of this system lies in the fact that silica usually possesses some degree of absorbed water which also interferes with the final characteristics of the solidified explosive cast. For instance, calcium silicate, a commonly used additive which is alkaline, reacts with the TNT to produce a dark brown explosive cast having a relatively higher sensitivity to impact. It may be further stated that the use of this additive system disadvantageously affects the cast explosive with respect to brittleness, and cracking during temperature cycling.

In a recent innovation in the art, a thermosetting elastomer was added to the initial explosive composition utilized to produce a cast explosive in order to overcome the difficulties of the aforesaid system. However, as described in patent application titled "Improved Castable Explosive," Ser. No. 610,697 dated Jan. 20, 1967, this thermosetting modification of the cast binds the TNT in such a manner during curing that the scrap resulting from the conventional loading

operation cannot be remelted uniformly or readily reused. This scrap is the portion of the explosive cast above the main portion when the cast is cooled to solidify the fluid composition after loading into a shell.

However, this difficulty is quite important because the individual classes of weapons utilizing various cast explosive compositions based on TNT number in the hundreds. These requirements are of a continuing nature by the military and are especially acute during periods of national emergency. Therefore, if the scrap which represents about 10 percent of the volume of explosive utilized in a single casting operation were available for effective reuse, tremendous savings would result coupled with a more efficient manufacturing process to offset the effect of acute shortages of the prime ingredients of the explosive cast during such times of national emergency.

What is needed is a castable explosive of the TNT variety whose explosive cast is amenable to processing with enhanced efficiency as a result of the ability of the cast to be effectively and totally utilized on a repetitive basis. In addition, such explosive cast should be free of voids, cavities and exuding oils and should possess, from a military point of view, an improved degree of sensitivity to impact shock besides other characteristics which advantageously affect brittleness and the further ability of the cast to be recycled from differing zones of temperature.

The subject invention answers the needs of the art with the elimination of the aforesaid disadvantages in the manufacture of explosives of the TNT variety with special emphasis on an explosive charge of a remeltable nature, whose solidified cast is homogeneous with improved sensitivity to impact and freedom from such troublesome characteristics such as exudation, cracks and brittleness.

It is therefore an object of this invention to provide an improved castable high explosive of the TNT variety having characteristics which make it amenable to reprocessing on a repetitive basis for the production of an optimum number of casts from a single batch possessing an acceptable level of quality within controlled limits.

Another object is to provide a castable high explosive of the aforesaid type possessing, in addition, freedom from voids, cracks, and exudation and having an acceptable level of sensitivity to thermal cycling and impact.

A further object of this invention is to provide a castable high explosive of the TNT variety modified with an additive system containing a thermoplastic resin which may be effectively and totally utilized in the loading operation.

A further object is to prepare a castable high explosive from a crude grade of TNT rather than from the refined grade of TNT conventionally employed, thereby eliminating the costly treatments and pollution problems attending such purification of TNT.

A still further object of this invention is to provide a method enabling the advantageous addition of selected thermoplastic resins to such high explosives to achieve the aforesaid characteristic in a simple, easy and efficient manner amenable to the use of conventional techniques of manufacture.

Other objects and many of the attendant advantages of this invention will become better understood upon a reading of the following detailed description, wherein:

Broadly, the composition of this invention encompasses a castable high explosive of the TNT variety modified with a thermoplastic resin of the cellulosic variety, preferably having explosive characteristics.

More specifically, in the preferred embodiment, this invention relates to the modification of a castable composition of TNT with a high molecular weight cellulose nitrate, also known as nitrocellulose. The selected cellulose nitrate is a very durable, heat-resistant material having a nitrogen content of about 12 percent and a viscosity of 600 to 1,000 RS seconds. In this manner, the heat stability of the basic explosive composition can be maintained without compromise.

The composition of this invention is based on the concept that the high molecular weight nitrocellulose has the propensity to accept the low melting impurities of the composition, such as dinitrotoluene and mononitrotoluene, as well as, unsymmetrical isomers of trinitrotoluene, all of which contribute to the exudation of the cast. As a result of such substantially high uptake in this regard, relatively small amounts of the nitrocellulose are necessary to prevent exudation of the cast. Thus, the viscosity of the melt is not appreciably altered by the addition of such cellulosic additive and the pourability of the composition is maintained. It has also been found that by such addition of the cellulosic material, an explosive cast is achieved having greater mechanical strength and enhanced heat resistance.

There are other cellulosic type of thermoplastic resins which may be used to advantage in the present composition and these include cellulose acetate, cellulose acetate butyrate, ethyl cellulose, modified cellulose nitrate, e.g., cellulose acetate nitrate, cellulose propionate and cellulose nitrates of viscosities other than that specified for the preferred embodiment.

In general, the castable explosive composition must possess a relatively low viscosity in order to be effectively poured or cast into a shell with an acceptable efficiency of operation. However, the incorporation of the selected high molecular weight nitrocellulose does not noticeably increase the viscosity of the melt and the resulting solidified cast explosive is extremely homogeneous in nature. We have found that the cellulosic additive may be uniformly incorporated into the castable explosive composition in an amount between about 0.1 and 2.0 percent by weight based on the weight of the TNT present in the composition without encountering any of the aforesaid difficulties of the art. However, highly satisfactory results have been achieved when as little as about 0.6 percent of the preferred cellulosic material was added to the composition. In fact, the latter modified composition containing cellulose nitrate was so stable with regard to heat that substantially no liberation of gas occurred when a 5 gram sample of such modified composition was tested for 40 hours in the standard 120° C. vacuum stability test.

In a preferred embodiment of this invention the thermoplastic cellulosic resin additive is employed together with an organic plasticizer therefor. It has been found that the use of an organic plasticizer-cellulosic additive system is more effective for physically binding and tak-

ing up the liquid impurities present in TNT and thereby reduces exudation more effectively than use of the cellulosic additive alone. Organic plasticizers for thermoplastic cellulosic resins used as additives in this invention are well known. Illustrative organic plasticizers which may be used include esters of organic and inorganic acids, such as acetylated castor oil, diethyl phthalate, dibutylphthalate, octyl decylphthalate, dioctyl succinate, dibutyl sebacate, dihexyl sebacate, dihexyladipate, and tris (dichloropropyl) phosphate.

Advantageously, the selected nitrocellulose may be uniformly incorporated into the TNT composition by precoating — which term in this invention includes intimately mixing — a finely divided solid, preferably an explosive compound, with such selected cellulosic material, and then dispersing the coated finely divided solid throughout the TNT melt prior to the pouring and solidification of the resulting composition in a shell. The finely divided solids which may be utilized for this purpose include pentaerythritol tetranitrate, cyclotrimethylene trinitramine, cyclotetramethylene tetranitramine, ammonium nitrate, crystalline TNT, aluminum powder and finely divided organic resins. If desired, to improve the heat stability, of the nitrocellulose, a plasticizer for the nitrocellulose of the epoxy variety may also be coated on the finely divided solid along with the nitrocellulose or added directly to the TNT melt. In addition, the use of such particulate solids with the nitrocellulose also contributes to the degree of heat stability of the selected nitrocellulose. It has been found that substantially uniform distribution of the selected cellulosic material throughout the entire melt is achieved by this simple method.

Precoating in said manner may be omitted in certain instances as in the case of commercial TNT compositions which contain substantial amounts of another particulate explosive such as HMX. In such case when the nitrocellulose additive in powdered form is sprinkled into the agitated, molten TNT, the particulate explosive already present functions as a carrier to disperse the nitrocellulose additive in the molten TNT. This permits the nitrocellulose to colloid or gel rapidly and uniformly throughout the molten mass and thus minimize its tendency to separate and rise to the surface as a separate layer or blobs.

The following is a procedure which has proved itself to be highly satisfactory in the coating of the finely divided explosive with the cellulosic material of a thermoplastic nature, prior to the addition of such coated explosive to the melt containing trinitrotoluene.

PROCEDURE

A colloidal nitrocellulose lacquer was added to a slurry of the crystalline explosive and the resultant mass was agitated by mixing for about 20 minutes. The lacquer contained 11.2 lbs. of a solvent such as methyl ethyl ketone in which was distributed 0.6 lbs. of nitrocellulose plasticized by 0.6 lbs. of an epoxy plasticizer. The specific nitrocellulose utilized was initially wet with ethanol and possessed a viscosity of about RS 890 seconds and contained about 11.81 percent nitrogen. The epoxy plasticizer was of the epoxidized soy bean oil variety but satisfactory results were also achieved with pentaerythritol tetraepoxystearate. The slurry of the crystalline explosive contained 18.8

lbs. of fine beta cyclotetramethylene tetranitramine having a particle size of about 5 to 15 microns distributed in 8 lbs. of water containing 0.01 grams of polyvinyl pyrrolidone.

After the resultant mass was thoroughly mixed, the supernatant liquid was removed by filtering or decantation. At this point, 40 lbs. of cold water was added and agitation was continued for about 2 minutes after which the suspension was filtered and the filter cake was washed at least twice with individual portions of about 25 lbs. of cold water. The resulting suspension was then filtered and the precipitate was dried at 70° C. to a moisture content of about 0.1 percent.

The product of this procedure was found to produce an negligible amount of gas in the Standard Vacuum Stability test at 120° C. for 40 hours.

After the crystalline explosive is coated with the cellulosic material, the resulting product is distributed throughout the melt of trinitrotoluene prior to loading in order to furnish a nitrocellulose content of about 0.6 percent uniformly throughout the melt. For example, only about 20 parts of the product of said procedure need be added to about 80 parts of the melt to insure the required amount of nitrocellulose. However, since it is common to incorporate 1 part of the basic melt into approximately 3 parts of filler of the crystalline explosive variety, only about 0.2 parts of the product of said procedure is necessary to prevent exudation and cracking of the final cast through the action of the nitrocellulose.

As an alternate to the above procedure, a finely divided coprecipitate could be prepared containing approximately 30 percent by weight of nitrocellulose to 70 percent of a crystalline explosive such as cyclotrimethylene trinitramine and cyclotetramethylene tetranitramine. Only 2 parts of such product added to 98 parts of TNT are required to provide a content of 0.6 percent by weight of nitrocellulose in the melt.

Thus, it is possible to produce an explosive melt of the trinitrotoluene variety having the desired low viscosity or pourability necessary in casting, in addition to producing the desired mechanical and physical characteristics in the resultant solidified cast. This is achieved because very small amounts of the high

molecular weight nitrocellulose are required to combine with the liquid plasticizers present in the melt to produce a tough, impact resistant, elastomeric film having explosive characteristics. In fact, such preferred nitrocellulose has been found to combine physically with the plasticizers in an amount of up to 500 percent by weight based on the weight of the nitrocellulose, the latter absorbing plasticizers of the epoxy variety plus the low melting liquid impurities of the explosive cast such as dinitrotoluene and mononitrotoluene as well as the unsymmetrical isomers of the melt itself.

In a further embodiment, conventional uncoated finely divided explosives may also be suspended in the melt and the resulting cast. However, to insure complete suspension of such crystalline explosive, hydrophobic silica of the precipitated variety having a microfine particle size is added to the melt. Usually, the use of silica imparts cracking to the cast. However, we have found that if 1 to 2 percent of hydrabietyl alcohol is added along with the silica, cracking will be prevented and the bonding of the crystalline explosive to the basic explosive cast will be enhanced. However, if it is de-sired to eliminate the silica in such addition of crystalline explosive, it has been found highly desirable to vibrate the melt containing the crystalline explosive to purposely cause such crystalline explosive to settle throughout the melt. In such a case, a higher crystalline explosive content is achieved than is possible with ordinary techniques.

In any case, our concept functions according to the amount of TNT present in a given cast explosive composition and therefore, it is only necessary to add that quantity of our thermoplastic additive to the melt required and based on the actual trinitrotoluene present in the melt. The amount and nature of the finely divided solid explosive filler may be essentially disregarded, since the trinitrotoluene which furnishes the characteristics of pourability and castability to the melt also is the ingredient possessing the properties of brittleness and the tendencies to crack and exude, the latter properties this invention is designed to correct.

Table I, which follows, illustrates a preferred series of formulas for the composition of this invention and the inherent advantages of this system may be readily appreciated by comparing its properties to that of a control which is also shown.

TABLE I

Ingredients ¹	Melts				
	A	B	C	D	E
1. HMX or RDX filler.....	72.35.....	72.35.....	72.35.....	72.35.....	75.....
2. TNT.....	24.55.....	24.55.....	25.55.....	92.80.....	25.....
3. High molecular weight NC.....	0.15.....	0.30.....	0.30.....	0.57.....	.....
4. Epoxy plasticizer.....	0.75.....	0.75.....	0.75.....	2.85.....	.....
5. Hydroabietyl alcohol.....	2.00.....	1.85.....	1.00.....	3.78.....	.....
6. Hydrophobic silica.....	0.20.....	0.20.....	0.15.....	.....	.....
Characteristics:					
120° C. vacuum stability, 40 hrs. 5 gm. ml. gas.....	0.70.....	Negligible.....	Negligible.....	Negligible.....	Negligible.....
P.A. impact sensitivity, 2 kg. wt., ht., inches.....	17.....	17.....	17.....	17.....	14.....
Friction pendulum sensitivity test.....	Unaffected.....	Unaffected.....	Unaffected.....	Unaffected.....	Unaffected.....
Pourability of melt.....	Very good.....	Satisfactory.....	Very good.....	Satisfactory.....	Satisfactory.....
Hardness of cast, Shore Durometer:					
20° C.....	.....	.....	D57, non-brittle	.....	D45, brittle.
71° C.....	.....	.....	D50, no exuding	.....	Exudes.
-40° C.....	.....	.....	D60, no cracking	.....	Cracks, brittle.
Suspension of HMX or RDX filler.....	Complete.....	Complete.....	Complete.....	Obtained by vibrating.....	Segregation and settling of RDX or HMX.
Temperature cycling, -50° C to +71° C.....	Unaffected.....	Unaffected.....	Unaffected.....	Unaffected.....	Brittleness, exudation, and irreversible growth accompanied by cracks in cast.
Uniformity of distribution of TNT impurities.....	Complete.....	Complete.....	Complete.....	Complete.....	Incomplete; exuding of impurities.
71° C. storage.....	No effect.....	No effect.....	No effect.....	No effect.....	Exuding.
Overall effective thermoplastic plasticization of TNT content, percent.....	10.....	10.....	6.9.....	7.2.....	None.
Overall NC content relative to TNT, percent.....	0.61.....	1.2.....	0.59.....	0.57.....	Do.

¹ Percent by weight based on weight of total composition

1. HMX — cyclotetramethylene tetranitramine
RDX — cyclotrimethylene trinitramine
2. TNT — 2, 4, 6 - trinitrotoluene
3. High molecular weight nitrocellulose: RS 600-1,000 seconds of approximately 12 percent nitrogen content. RS is a viscosity measurement in seconds by the Hercules standard method which uses a 16 ounce solution or 12.2 percent solution of nitrocellulose in a 3.1 butyl acetate: ethanol solvent mixture.
4. Epoxy plasticizer: an epoxidized plasticizer which may be selected from the following group:
 - a. Pentaerythritol tetraepoxystearate having a pour point of -20°F, oxirane oxygen content of 5.4 percent and iodine number of 1.1.
 - b. Triglyceride of stearic acid containing epoxy and acetoxy groups.
 - c. Epoxidized soy bean oil having a pour point of 15°F, oxirane oxygen of 6.8, and iodine number of 2.0.
5. Hydroabietyl alcohol, technical grade: a high molecular weight, of approximately 274, monohydric alcohol, which may have various degrees of hydrogenation such as dehydro-, di- and tetra-, which is made from rosin acid or abietic acid by reduction of the carboxyl group to an alcohol. This material is a viscous liquid at room temperature, having a hydroxyl value of approximately 5 percent, acid number about 0.3, and is miscible in TNT.
6. Hydrophobic silica: a microfine, precipitated silica powder prepared in manufacture whereby approximately 10 percent of silicone oil (hydrogen methyl siloxane) is cured at 300° C. for 16 hours with fine silica to form a silicone-bonded silica of negligible internal porosity, of approximately 15 millimicron ultimate particle size, which coated product is a thermal and hydrolytic-stable material used to suspend materials without unduly increasing viscosity of the system.

In an another embodiment of this invention, enhanced heat resistance in long term storage of the cast may be achieved when a powdered thermoplastic resin such as cellulose propionate is utilized as the additive plus a specified plasticizer such as acetylated castor oil, di-n-hexyl azelate or dibutyl sebacate, each of which functions to decrease or prevent the brittleness of the cast at temperatures as low as 40° C. The addition of an epoxy resinous liquid such as the bisphenol type acts as a heat stabilizer for the cellulose propionate.

A preferred example of cellulose propionate as an additive for use in the present composition follows.

EXAMPLE

	Ingredients	grams
1)	TNT	68
2)	1 part TNT to 3 parts RDX	126
3)	Silicone antifoam liquid	0.0133
4)	Epoxy resin	0.133
5)	Cellulose propionate powder	0.800
6)	Fibrous rovings of Polyethylene terphthalate	0.267
7)	Di-n-hexyl azelate	0.267

A cast produced from the above composition contained about 2.1 percent of the thermoplastic additive based on the weight of the trinitrotoluene present in the system and was found to be highly effective for use in long burster tubes with the attendant advantages

heretofore enumerated.

Other examples of the use of cellulose propionate as the thermoplastic additive of this invention are set forth below.

EXAMPLE

	Ingredients	Parts by Weight	I	II
1)	TNT, melt	100		100
2)	Silicone antifoam	0.01		0.01
3)	Diglycidyl ether of the bisphenol type having an epoxy equivalent of 180-200 and a viscosity of 10-16000 cps at 25°C.	0.10		0.10
4)	Cellulose propionate (powder)*	0.60		0.60
5)	Dibutyl sebacate	0.20		
6)	Acetylated castor oil			0.25
7)	Epoxy plasticizer			0.25

*A powdered cellulose ester resin having about 65.5% combined acid as propionic acid and having a falling ball viscosity (ASTM D871-56) of about 10 seconds. The average mols per glucose unit are 2.35 propionate, 0.40 acetate and 0.25 hydroxyl.

Note: 0.10 parts of Dacron fibrous rovings of 0.5 denier (¼ inch length) may be added to the above to increase strength and lower thermal expansion of the cast.

The thermoplastic cellulose resins and plasticizers may be included in the composition up to a total of about 15 percent by weight based on the weight of the trinitrotoluene. It has been found that as the content of the cellulosic material is increased relative to the content of the trinitrotoluene and as the content of the specified liquid additives is decreased, the pour viscosity of the melt increases. In general, a low viscosity melt is desirable to achieve a practical pourability before solidification of the cast.

As is evident from the foregoing, this invention produces a castable explosive of the modified TNT variety whose solidified cast is homogeneous and remeltable for reuse in addition to being free of exuding oils or cracks, less brittle and with the ability to withstand temperatures ranging from -50° C. to 71° C. Included is a method of incorporating a thermoplastic resin in the explosive composition to accomplish these advantageous results as well as a means of suspending particulate explosives throughout the basic explosive cast. This invention obviates the disadvantages of the art while also improving the mechanical strength and toughness of the basic cast explosive by imparting a somewhat elastomeric property to the cast in order to decrease brittleness particularly at temperatures as low as -50° C. while preventing undesirable exudation from the cast at temperatures as high as 71° C.

This invention is of an unexpected nature because when ordinary linters or fibers of nitrocellulose are added to the melt, they will not readily distribute but will rather clump or rise to the surface. Furthermore, the means of incorporating such thermoplastic resins of the cellulosic variety into the cast provides a way of making optimum use of the scrap from ordinary loading.

This invention is also advantageous from an economic point of view. The scrap from the ordinary loading may now be remelted and reused within control levels as to quality because they will not deviate in chemical analysis from any other portion of the solidified cast. This is because the low-boiling, less fully nitrated fractional impurities of the cast are uniformly distributed because they have plasticized the thermoplastic resinous additive. This is in contrast to the ordinary cast of trinitrotoluene where the scrap materi-

al is not uniform in composition making for a less perfect explosive cast if ever reused.

Also, the end product of this invention consisting of the present composition is of a pourable nature. This is further unexpected because if a low viscosity, less heat stable nitrocellulose were added to the melt to achieve any of the aforesaid advantages, it would require an excessive amount of additive resulting in an excessively viscous melt.

Another important advantage of the invention is that it reduces pollution of environment by utilizing low-grade TNT in place of conventional purified TNT. This obviates the final stage of TNT manufacture, viz. treatment with aqueous sodium sulfite before washing and drying, and eliminates the burning of nitrous oxides in the atmosphere and discharge of red-colored aqueous effluents into streams.

What is claimed is:

1. A castable explosive composition which is free from oily exudation during storage comprising 2,4,6-trinitrotoluene and 0.1-2.0 percent based on the weight of said 2,4,6-trinitrotoluene of a thermoplastic cellulosic resin solidified therein.
2. The castable explosive of claim 1 wherein an organic plasticizer for said cellulose resin is also incorporated.
3. The castable explosive of claim 1 wherein said cellulosic resin is selected from the group consisting of cellulose nitrate, cellulose acetate, cellulose acetate butyrate, cellulose propionate,

ethyl cellulose.

4. The castable explosive of claim 3 wherein said cellulosic resin is present in an amount between about 0.1 and 2.0 percent by weight based on the weight of said 2,4,6-trinitrotoluene.

5. The castable explosive of claim 3, wherein said cellulosic resin is cellulose nitrate.

6. In a castable explosive containing 2,4,6-trinitrotoluene possessing oily impurities which cause oily exudation in the solidified cast on storage, the improvement consisting in the incorporation therein of about 0.6 per cent by weight based on the weight of said 2,4,6-trinitrotoluene of a thermoplastic cellulosic resin selected from the group consisting of

cellulose propionate

cellulose acetate

cellulose acetate butyrate

ethyl cellulose

cellulose nitrate of high molecular weight and having a nitrogen content of about 12 percent and a viscosity between about 600 and 1,000 RS seconds.

7. The castable explosive of claim 6 wherein the cellulosic resin is cellulose propionate and a plasticizer selected from the group consisting of di-n-hexyl-azelate, dibutyl sebacate and acetylated castor oil is added to prevent brittleness in said explosive due to cellulose propionate, and an epoxy resinous liquid of the bisphenol type is added as a heat stabilizer and acid scavenger.

* * * * *

35

40

45

50

55

60

65