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METHOD OF PREPARING CAST EXPLOSIVE CHARGES

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This invention relates to cast explosive charges and more particularly to a more advantageous method for the preparation of blends of trinitrotoluene and pentaerythritol tetranitrate.

In the preparation of these blends, it has been the practice of the art to employ carefully dried pentaerythritol tetranitrate. There have been attendant difficulties in that lumps are formed on addition to molten TNT.

This application is a continuation in part of our copending application, Serial No. 415,635, filed October 18, 1941.

An object of the present invention is a high-density cast explosive charge of outstanding properties. A further object is an improved method for preparing explosive charges containing trinitrotoluene and pentaerythritol tetranitrate. A still further object is such a method in which increased efficiency in handling the ingredients results, and in which safety in operation is promoted. Additional objects will be disclosed as the invention is described more in detail hereinafter.

We have found that the foregoing objects are accomplished when we utilize pentaerythritol tetranitrate wet with water and bring it into mixture with trinitrotoluene. The latter in molten condition is contacted with the pentaerythritol tetranitrate, and the water present in this latter material will rise to the surface. It can then be decanted, drawn or skimmed off, or removed in any desired manner.

Two procedures may be followed in obtaining the mixture of PETN with molten TNT. For example, we may bring the TNT into molten form and introduce the wet PETN thereinto. We may, on the other hand, blend the solid TNT with the wet PETN and then raise the temperature above the fusion point of the lower melting compound. If desired, both explosive materials may be introduced into water and the temperature of said water be raised above the fusion point of the TNT, for example, by the passage of steam. Whatever the procedure, when the wet PETN becomes blended with molten TNT, the water present rises to the surface and may be removed therefrom.

The pentaerythritol tetranitrate available for commercial use is ordinarily in wet form. The regulations require that this explosive for shipping shall have a water content of at least 40% and material in storage in large amounts should have no less water content. Consequently, the material available for use will ordinarily be in very wet form. The drying of wet pentaerythri-

tol tetranitrate is time-consuming and is accomplished with considerable hazard. The discovery therefore that wet pentaerythritol tetranitrate can be satisfactorily introduced into the melt is a very important advance.

In preparing cast blends of TNT and PETN, the mixture of the two is prepared and the TNT maintained in molten condition at a temperature between its melting point and 100° C. The PETN is desirably in relatively finely divided condition and thoroughly mixed with the TNT by agitation. A water layer forms almost immediately on top of the melt and this water can be drawn off readily, leaving normally less than 5% of water in the molten blend. The melt can be formed and handled satisfactorily in steam-jacketed metal containers. Under such conditions, the greater part of the residual water in the melt will be removed by evaporation in a relatively short time. We find it desirable, however, to hasten the removal of the water by passage of air through the melt. It is desirable to dry the material to a moisture content not greater than 0.1%.

Various compositions of such blends of trinitrotoluene with pentaerythritol tetranitrate can be prepared having desirable explosive properties. We find a 50-50 composition to give satisfactory results and, generally speaking, prefer to maintain the composition within the range of 35-75% pentaerythritol tetranitrate and 65-25% trinitrotoluene. It will be understood that in such blends the trinitrotoluene is the continuous phase, with pentaerythritol tetranitrate dissolved in the molten compound to an amount equal to approximately a tenth of the trinitrotoluene by weight, with the remainder dispersed therein.

The following specific embodiments will serve as examples of methods employed to prepare blends in accordance with the foregoing description.

Example I

Two 5000-gram batches (about 11 lbs. each) were prepared by adding to molten trinitrotoluene heated to 98° C. pentaerythritol tetranitrate having a water content of 40%, the two compounds being used in a 50-50 relationship. The melts were made in a jacketed sheet-iron pot, 9" in diameter by 6½" in depth, heated with steam at 0-lbs. pressure. All the trinitrotoluene was first brought into molten form and unheated pentaerythritol tetranitrate was added in 200-300 gram lots at such a rate that the melt temperature remained between 75-80° C.

As soon as all the pentaerythritol tetranitrate had been added, removal of supernatant water was begun by means of a dipper. The molten blend was stirred at intervals and was allowed to stand with continued heating from the steam jacket. The water content in each case amounted to less than 0.1% after the elapse of about 87 minutes. The removal of water was evidenced by the change of color from whitish opacity to clear amber.

Example II

Two 4000-gram batches (8.8 lbs. each) were prepared of 50-50 blends in a manner similar to that of Example I, except that in this case, the pentaerythritol tetranitrate added had a water content of 18%. After the water had been removed from the top of the melt, the material contained 4-5% water, as was found to be the case regardless of the original water content. The removal of the residual water was hastened by bubbling air through the melt. In this case, the moisture content amounted to less than 0.1% after about 54 minutes of operation.

Example III

A 5000-gram lot was prepared by mixing 2500 grams of TNT with 3500 grams of wet PETN, having a water content of approximately 40%. The mixture was in a jacketed kettle and was heated to a temperature above the melting point of TNT. After fusion was complete and thorough mixture had been obtained, the water was removed from the surface by dipping. The mixture was then allowed to stand at a temperature above the fusion point until the clearness of the melt showed the elimination of substantially all the water.

Example IV

Similar amounts of TNT and wet PETN were brought into a jacketed sheet-iron pot containing water. Steam was run into the mixture to agitate the same and to raise the temperature above the melting point of the TNT. After thorough mixture, the supernatant water was removed from the surface. Air was caused to pass through the fused mixture while it was maintained at an elevated temperature, and a dry mixture was thereby obtained.

The advantages of the process according to our invention can be readily appreciated. As has already been stated, the use of wet pentaerythritol tetranitrate avoids the loss of time consumed in drying the material. At the same time, it reduces the hazards of the operations by elimination of the drying process as well as by making it possible to handle wet pentaerythritol tetranitrate, rather than the sensitive dry material. There is the further advantage that the wet material is considerably more suitable than the dry for the prepara-

tion of melts, since it does not form lumps on addition to molten trinitrotoluene. Such lumps are formed with dry pentaerythritol tetranitrate, which becomes encased in layers of crystallized trinitrotoluene when the former cools the trinitrotoluene below its freezing point. The use of material containing 40% of water, as a matter of fact, is decidedly advantageous over that containing 18%, for example, and allows more rapid addition of the material to molten trinitrotoluene.

Our invention has been described fully in the foregoing. It will be understood, however, that many details in compositions and methods of procedure can be introduced without departure from the scope of the invention. We intend to be limited therefore only by the following patent claims.

We claim:

1. The method of preparing cast explosive charges, which comprises blending trinitrotoluene and wet pentaerythritol tetranitrate, raising the temperature of the mixture to a point where the trinitrotoluene becomes molten, removing the separated water from the surface of the blended charge and further reducing the water content by evaporation at an elevated temperature.

2. The method of preparing cast explosive charges, which comprises preparing a blend of 35-75% pentaerythritol tetranitrate and 65-25% trinitrotoluene by mixing trinitrotoluene and pentaerythritol tetranitrate having a water content greater than 10%, heating to form a melt, removing the separated water from the surface of the blended charge, and bringing about further drying by passage of air through the melt.

3. The method of preparing cast explosive charges, which comprises adding to molten trinitrotoluene pentaerythritol tetranitrate wet with more than 10% of water, removing the separated water from the surface of the blended charge and further reducing the water content by evaporation at an elevated temperature.

4. The method of preparing cast explosive charges, which comprises preparing a blend of 35-75% pentaerythritol tetranitrate and 65-25% trinitrotoluene by adding to the trinitrotoluene in molten condition pentaerythritol tetranitrate having a water content in excess of 10%, removing the separated water from the surface of the blended charge and bringing about further drying by passage of air through the melt.

5. The method of preparing cast explosive charges, which comprises adding to molten trinitrotoluene pentaerythritol tetranitrate wet with more than 10% of water, removing the separated water from the surface of the blended charge and further reducing the water content by evaporation.

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