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AMMONIUM NITRATE EXPLOSIVE

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The present invention relates to explosive compositions.

An object of the present invention is the provision of explosive compositions which are sufficiently sensitive to detonate consistently when initiated by a #8 blasting cap but which have a relatively low content of ingredients which are per se sensitive to a #8 blasting cap.

Another object of the invention is the provision of cap sensitive explosive compositions of relatively high density.

A further object of the invention is a provision of cap sensitive explosive compositions of high ammonium nitrate content.

Still another object of the invention is the provision by relatively safe manufacturing procedure of a cap sensitive explosive composition.

Other objects of the invention will be apparent from the following description.

Ammonium nitrate is capable of exerting powerful explosive force and for many years has been used as an ingredient of explosive compositions. However, because ammonium nitrate is exceedingly difficult to detonate by itself many ammonium nitrate explosives which have been prepared heretofore have contained large amounts of highly sensitive ingredients such as nitroglycerine, or have been so insensitive that they have required special boosters to initiate them.

Cap sensitive ammonium nitrate explosives have also been produced by combinations of ammonium nitrate and trinitrotoluene. Such explosives have, however, usually employed relatively large quantities of trinitrotoluene, and have usually employed ammonium nitrate in a pulverized condition of low density. Ammonium nitrate and trinitrotoluene containing compositions have been prepared by heating trinitrotoluene, or mixtures of trinitrotoluene and other nitroaromatic compounds, to melting temperatures and agitating with powdered ammonium nitrate. Or ammonium nitrate and trinitrotoluene have been ground together in wheel mills. Such procedures involving, as they do, heating and attrition have not been as free from hazard as might be desired.

According to the present invention, cap sensitive ammonium nitrate explosives are provided which are of relatively high apparent density but which do not contain a high proportion of highly sensitive ingredients.

The explosives of the present invention are composed of ammonium nitrate of high apparent density as a principal ingredient, a coarse car-

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bonaceous fuel, and a sensitizer made up of a small proportion of mixed trinitrotoluene and oily dinitrotoluene.

Usually, as much as about 90% of the weight of the explosives of the invention may be taken up by ammonium nitrate, but contents of ammonium nitrate as low as about 50% by weight will often be satisfactory.

One of the advantages of the compositions of the present invention is that ammonium nitrate of high apparent density is used.

The apparent density of ammonium nitrate is largely determined by its grain size and shape, and by the distribution of particles of different sizes. Material of larger grain is, in general, denser than small grained material because of the smaller percentage of voids. However, if some finely divided material is added to large grain material so as partially to fill in the larger voids in coarse material, density may be still further increased.

Usually satisfactory cap sensitive explosives may be made in accordance with the present invention with ammonium nitrate having an apparent density as high as 1.05. On the other hand the invention is also applicable to explosives having ammonium nitrate contents of somewhat lower apparent density. In general it may be said that the invention contemplates using ammonium nitrate having an apparent density as low as 0.90.

The values of apparent density stated in this specification are determined by the cold compression method. According to this method, the ammonium nitrate, the density of which is to be determined, at a temperature well below 90° F., is passed through a U. S. S. No. 8 screen to remove any lumps. About 100 milliliters of the ammonium nitrate is then placed in a 300-milliliter cylindrical cup two inches in diameter, and the surface is leveled with a spatula. A plunger 1.81 inches in diameter and actuated by 16 pounds is lowered into the cylinder until it rests on the surface of the ammonium nitrate, and the full weight of 16 pounds is permitted to act for 30 seconds. The plunger is then removed and successively a second and third 100 milliliter portion of ammonium nitrate are added to the cup, and treated in the same manner. The cylinder is then filled to overflowing with ammonium nitrate, and the weight is again applied for 30 seconds. The ammonium nitrate is struck off level with the top of the cylinder, and the contents of the cylinder are weighed. This weight of ammonium nitrate in grams divided by 300,

the volume of the cylinder in milliliters, is taken as the apparent density of the ammonium nitrate.

To obtain adequate sensitivity the ammonium nitrate in the explosive compositions of the invention should be of a grain size such that at least about 75% passes a U. S. S. No. 35 screen, and at least about 15% passes a U. S. S. No. 100 screen. It is, of course, undesirable that the ammonium nitrate be so fine that its apparent density is unduly decreased.

The sensitizer employed in the present explosive compositions is a mixture of oily dinitrotoluene and trinitrotoluene, at least about 50% of the mixture being trinitrotoluene. Usually as much as about 10% of this sensitizer may be used without unduly increasing the amount of sensitive ingredients, and as little sensitizer as is required to include 1% dinitrotoluene in the explosive compositions is generally sufficient.

It is a particular advantage of the present explosives that they do not require the presence of highly sensitive materials such as explosive liquid nitric esters.

Carbonaceous fuel, as for example, ivory meal, apricot pit pulp, coarse saw dust, and particularly coal, should be included in the explosives of the invention.

Weight percentages of carbonaceous fuel in the composition as high as about 12% and as low as about 2% are usually found to give satisfactory results. It has been noted that fine material passing a U. S. S. No. 100 screen in the carbonaceous fuel has an adverse effect on sensitivity. Carbonaceous fuels of a size such that no more passes a U. S. S. No. 100 screen than will provide about 0.1% of the explosive composition are generally sufficiently coarse to obtain adequate sensitivity. While the fuel should not be too fine, it also should not be so coarse that it has insufficient reactivity for proper functioning of the explosive. Usually fuels having a fineness such that at least about 99% passes a U. S. S. No. 10 screen are not too coarse.

The explosive compositions of the invention may contain other customary dynamite ingredients if desired. Metal nitrates of the type of sodium and potassium nitrate, and finely divided combustible metal powders of the type of powdered aluminum or ferrosilicon, may be mentioned as exemplary of additional ingredients.

Ammonium nitrate which is used in dynamite compositions is often coated with waxy materials. Usually it is preferred that ammonium nitrate employed in the present explosives not be coated.

A particular advantage of the explosives of the present invention is that they may be produced by simple mixing at normal room temperatures, that is temperatures between about 65° F. and about 100° F. Also the explosives of the present invention may be prepared in standard dynamite mixing machines, and without the use of pulverizing machines or pulverized ammonium nitrate.

The invention will be further described by the following illustrative examples:

Example 1

85.4 parts by weight of grained ammonium nitrate having an apparent density of about 0.98 and of a grain size such that about 80% was held on a U. S. S. No. 100 screen and 80% passed a U. S. S. No. 35 screen was mixed in a dynamite mixer with 6.1 parts by weight of soft coal, all of which passed a U. S. S. No. 10 screen and all of which was held on a U. S. S. No. 35 screen, and

with 7.0 parts by weight of granular trinitrotoluene. While these ingredients were being mixed, 1.5 parts by weight of oily dinitrotoluene was added and mixing was continued until the ingredients were thoroughly incorporated. The mixing was conducted at room temperature. The resulting explosive had a density of about 1.09 when packed in 1½" by 8" cartridges. It detonated consistently with a No. 6 blasting cap, and displayed a gap sensitivity of ½".

Example 2

85.4 parts by weight of grained ammonium nitrate having an apparent density of about 1.01 and of a grain size such that about 80% passed a U. S. S. No. 35 screen and about 80% was held on a U. S. S. No. 100 screen, 2.5 parts by weight of crystalline trinitrotoluene, which had been mixed with 1.5 parts by weight of oily dinitrotoluene, 6.1 parts by weight of soft coal, all of which passed a U. S. S. No. 10 screen and all of which was held on a U. S. S. No. 35 screen, and 4.5 parts by weight of sodium nitrate, all of which passed a U. S. S. No. 14 screen and was held on a U. S. S. No. 25 screen, were mixed together at room temperature in a dynamite mixer. The resulting explosive had a density of about 1.07 when packed in 1½" by 8" cartridges, and it detonated consistently with a No. 8 blasting cap.

Example 3

88 parts by weight of grained ammonium nitrate having an apparent density of about 1.01 and of a grain size such that 80% passed a U. S. S. No. 35 screen and 75% was held on a U. S. S. No. 100 screen, 2.5 parts by weight of crystalline trinitrotoluene which has been mixed with 2.5 parts of oily dinitrotoluene, 7.0 parts by weight of apricot pit pulp all of which passed a U. S. S. No. 14 screen, and all of which was held on a U. S. S. No. 70 screen, were mixed together at room temperature in a dynamite mixer. The resulting explosive had a density of about 1.10 when packed in 1½" by 8" cartridges, and it detonated consistently with a No. 8 blasting cap.

What is claimed is:

1. An ammonia dynamite explosive capable of detonating when initiated with a number 8 blasting cap and composed of ammonia dynamite ingredients including ammonium nitrate, a sensitizer and a carbonaceous fuel, in which the ammonium nitrate has an apparent density above about 0.90 and a grain size such that at least 75% passes a U. S. S. No. 35 screen and at least about 15% passes a U. S. S. No. 100 screen, said ammonium nitrate being present in an amount between about 50% and about 90%; in which the substantially sole sensitizer is no more than about 10% of a mixture of oily dinitrotoluene and trinitrotoluene; said trinitrotoluene comprising at least about 50% by weight of said mixture and sufficient of said mixture being present that said explosive contains at least 1% of oily dinitrotoluene; and in which the carbonaceous fuel has a grain size such that at least about 99% passes a U. S. S. No. 10 screen and no more passes a U. S. S. No. 100 screen than will provide about 0.1% of said explosive, said carbonaceous fuel being present in an amount between about 2% and about 12%.

2. An explosive according to claim 1 which contains up to about 90% of said ammonium nitrate, and in which said ammonium nitrate has an apparent density not greater than about 1.05.

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3. An explosive according to claim 2 in which the carbonaceous fuel is coal.

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