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3,129,126

BLASTING COMPOSITION

Harold G. Carlevato, Hagerstown, Md., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware
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This invention relates to an improved blasting explosive composition. More particularly, this invention relates to an explosive composition characterized by unusually high bulk strength.

In all quarry and stripping operations of substantial size, large quantities of explosives are used to free the rock or ore from its bed and to fragment the material so that it can be removed and further processed. The cost of the explosive and of the operations required to effect a blast constitute a substantial proportion of the cost of the materials thus obtained.

Many explosive formulations utilizing relatively cheap ingredients have been evaluated as a means of reducing the cost of blasting. Various properties such as handling characteristics, sensitivity, storability, and reliability must be considered in the selection of a blasting agent. A relatively recent blasting agent which has achieved commercial acceptance is described in U.S. Patent 2,930,685, and comprises an aqueous slurry of trinitrotoluene and ammonium nitrate to which gelling agents and metal nitrates can be added.

This invention provides a greatly improved slurry-type blasting composition, which in addition to having an excellent combination of properties such as those mentioned hereinbefore, is inexpensive and has greatly improved bulk strength and, consequently, greatly improved strength per unit volume of explosive. Because of its greater strength per unit volume, as compared to known slurry-type blasting agents such as those described above, the composition of this invention can achieve equivalent blasting effects with fewer or smaller diameter boreholes, or both, thereby substantially reducing the cost of preparing the blasting site.

The blasting composition of this invention, and preferably each 100 parts by weight thereof, consists essentially of:

- (a) About from 20 to 30, and preferably 25 to 28 parts by weight of ammonium nitrate,
- (b) About from 10 to 25, and preferably 14 to 16 parts by weight of sodium nitrate,
- (c) About from 20 to 30, and preferably 26 to 28 parts by weight of trinitrotoluene,
- (d) About from 10 to 30, and preferably 18 to 22 parts by weight of ferrophosphorus, and
- (e) About from 8 to 20, and preferably 10 to 12 parts by weight of water.

The ferrophosphorus employed in the compositions of this invention is conveniently obtained as a by-product from the manufacture of elemental phosphorus. Usually, the ferrophosphorus contains about from 10 to 75%, and preferably about from 20 to 60% by weight of phosphorus. The ferrophosphorus employed herein is finely divided; ferrophosphorus having a particle size such that it will pass through a 50, and preferably a 100 mesh screen (U.S. standard series) is particularly preferred. The particle size of the TNT, ammonium nitrate and sodium nitrate are not particularly critical. Usually, TNT having 3-mesh (U.S. standard series) or smaller particle size is employed, while ammonium nitrate and sodium nitrate having a particle size of 20 mesh or smaller are usually used.

To minimize segregation of the components of the compositions of this invention on storage, and particularly when the compositions of this invention are to be used

in the presence of free water in a borehole, the compositions preferably contain up to 10, and usually 0.5 to 1.5% by weight of gelling agent based on the weight of composition. Examples of gelling agents are guar gum flour and other galactomannans such as locust bean flour; wheat flour; cereal products; pregelatinized starch products and mixtures thereof. Other known additives for blasting agents such as, for example, RDX, PETN, DNT and fuel oils also can be added in small proportions.

The compositions of this invention can be prepared by merely mixing the various ingredients thereof to form a homogeneous slurry. For optimum blasting efficiency, the water present in the compositions of this invention contains a high proportion of ammonium nitrate, and preferably is substantially saturated therewith. For this reason and in order to obtain a product of optimum uniformity, the water is usually first premixed with ammonium nitrate to form a concentrated, and preferably substantially saturated solution, then the requisite proportions of the remaining ingredients are added to the solution. The resulting slurry blasting agents can be stored in a container such as a bag of polyethylene or other polymeric material. When they are ready to be used, the bagged compositions of this invention can be merely dropped down a borehole.

Compositions of this invention are inexpensive, highly efficient and have greatly improved bulk strength, hence, strength per unit volume of borehole. The compositions of this invention are easily prepared from readily available commercial materials and can be used in a wide variety of blasting conditions including both wet and dry boreholes. The compositions of this invention have excellent storage stability and can be handled, charged and initiated in the same general manner as known slurried blasting agents such as those mentioned hereinbefore.

In the following example, which illustrates this invention, parts and percentages are by weight unless otherwise indicated.

Example

Ten parts of grained ammonium nitrate and 15.0 parts of sodium nitrate, both having a particle size less than about 20 mesh, are blended with 27.5 parts of a 60% aqueous solution of ammonium nitrate which contains 0.5 part of guar gum. To the mix is added 20.0 parts ferrophosphorus (50/50 iron/phosphorus, smaller than 100 mesh) and 27 parts of trinitrotoluene in the form of spherical or flaked particles that will pass a 3 mesh screen (A.S.T.M. standard). Mixing is continued for two minutes. The mixture, now a thick fluid slurry, is poured while at 60 to 65° F. into cylindrical polyethylene bags 8 mils in thickness, five inches in diameter and 29 inches in height.

The composition thus produced has the following content by weight:

	Percent
Ammonium nitrate	26.5
Water	11.0
Trinitrotoluene	27.0
Sodium nitrate	15.0
Ferrophosphorus	20.0
Guar gum	0.5
	100.0

The density of the composition is 1.7 grams per cubic centimeter and the composition has a Triton value (the number of grams of trinitrotoluene required to produce the same angle of recoil of a standard ballistic mortar as ten grams of explosive under test) of 9.8, equivalent to a bulk strength value of 16.6.

A comparative composition is prepared by the general procedure described above, except that an oxygen bal-

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anced mixture of ammonium nitrate and sodium nitrate is substituted for the ferrophosphorus employed in preparing the composition of this invention. The comparative blasting composition has the following overall formulation:

	Percent
Ammonium nitrate -----	34.0
Water -----	15.0
Trinitrotoluene -----	25.0
Sodium nitrate -----	25.0
Guar gum -----	1.0
	100.0

The density of the composition is 1.4 grams per cubic centimeter and the composition has a Triton value of 9.2, equivalent to a bulk strength value of 12.8.

In field trials, an increase in loading density, i.e., pounds of explosive per foot of borehole, of about 21.5% is obtained with the composition of this invention containing ferrophosphorus as contrasted with the comparative composition. Inasmuch as the Triton value of the composition of this invention exceeds that of the comparative composition, this increased loading density permits increased spacing of drilling patterns. In all trials, with the composition of this invention described above, fragmentation was very good, and superior to that obtained with the comparative composition.

The present invention has been described in detail in the foregoing. I intend, therefore, to be limited only by the following claims.

I claim:

1. An aqueous slurry blasting composition, each 100 parts by weight thereof consisting essentially of:

(a) about from 20 to 30 parts by weight of ammonium nitrate,

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(b) about from 10 to 25 parts by weight of sodium nitrate,

(c) about from 20 to 30 parts by weight of trinitrotoluene,

(d) about from 10 to 30 parts by weight of ferrophosphorus, and

(e) about from 8 to 20 parts by weight of water.

2. An aqueous slurry blasting composition, each 100 parts by weight thereof consisting essentially of:

(a) about from 25 to 28 parts by weight of ammonium nitrate,

(b) about from 14 to 16 parts by weight of sodium nitrate,

(c) about from 26 to 28 parts by weight of trinitrotoluene,

(d) about from 18 to 22 parts by weight of ferrophosphorus,

(e) about from 10 to 12 parts by weight of water, and

(f) about from 0.5 to 1.5 percent by weight of gelling agent selected from the group consisting of gelactomannans; wheat flour; cereal products; pregelatinized starch products and mixtures thereof based on the total weight of said composition.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,129,126

April 14, 1964

Harold G. Carlevato

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 21, strike out "cereal products;".

Signed and sealed this 8th day of September 1964.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents



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