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EXPLOSIVE COMPOSITION

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This invention relates to explosive compositions containing a water-soluble inorganic salt, and more particularly to ammonium nitrate high explosives having improved properties.

Ammonium nitrate is a very extensively used ingredient in present day high explosives of the dynamite type. It replaces nitroglycerin in increasingly larger proportions for a variety of reasons, particularly because it possesses high explosive strength, has outstanding safety properties, and is economically attractive. Ordinarily it is used with a certain amount of nitroglycerin or other sensitizing agent. While ammonium nitrate explosives have been used with great success, one disadvantage of this ingredient has always been evident, namely, that it has a great affinity for water. Because of this fact, there is a tendency for explosive compositions high in ammonium nitrate to become hard and set on storage in the presence of even small amounts of moisture. This brings about a decreased sensitiveness of the explosive and a lesser degree of uniformity in performance. The water resistance of ammonium nitrate explosives is generally low because of the presence of this very soluble salt.

An object of the present invention is an explosive composition containing at least one water-soluble salt and having improved water resistance. A further object is an ammonium nitrate explosive of enhanced water resistance. A still further object is an explosive containing ammonium nitrate wherein an ingredient is present which tends to prevent the harmful penetration of water. Additional objects will be disclosed as the invention is described more at length hereinafter.

We have found that the foregoing objects are accomplished and the disadvantages of the prior art overcome by introducing linseed meal as an ingredient into explosive compositions containing at least one water-soluble salt, said linseed meal being capable of functioning as a protective agent for said salt against water.

By the term "linseed meal" will be understood the product comprising in relatively finely divided form the material obtained from linseed or flaxseed, particularly after removal of the greater part of the oil by pressing or solvent extraction. Oil-free linseed meal will be a desirable ingredient for use, but under ordinary circumstances the meal will have a small residual oil content. Such oil-containing material is included within the scope of our invention.

Our invention is applicable with advantage to all explosive compositions containing a water-soluble salt, whether this salt is ammonium nitrate, sodium nitrate, a chlorate or perchlorate, or other soluble salt. We find it particularly important in the case of ammonium nitrate explosives, and especially in such compositions containing an explosive nitric ester, nitro-glycerin, for example. It should be understood, however, that the invention is applicable as well to explosive compositions which contain no ingredient which is itself an explosive. Many compositions, for instance, contain ammonium nitrate or other oxidizing agent sensitized with materials such as aluminum or other finely divided metals. Likewise, certain ammonium nitrate explosives are sensitized with various forms of carbon and nitrated hydrocarbons, for example, paraffin, charcoal, dinitrotoluene, and the like. Our invention is equally applicable to these compositions, since they contain the water-soluble salt which must be protected from wet conditions in the field.

Our invention is illustrated by the following specific embodiments, in which A and B represent ammonia dynamites of similar compositions, A containing meals or combustibles of the prior art, while B contains linseed meal.

Example

	A	B
Nitroglycerin ..... percent	14.0	14.0
Ammonium nitrate ..... do	36.5	36.5
Calcium stearate ..... do	0.3	0.3
Sodium nitrate ..... do	34.5	34.5
Wood pulp ..... do	1.0	1.0
Ivory nut meal ..... do	3.7	
Rice hulls ..... do	4.0	3.7
Linseed meal ..... do		4.0
Sulfur ..... do	5.5	5.5
Chalk ..... do	0.5	0.5
	100.0	100.0
Density—ctgs./50 lbs	111	110
Water resistance:		
6 hours	2D, 2F	
7 hours	3D, 1F	
16 hours	4F	
48 hours		4D

The improvement in water resistance through the presence of linseed meal in contrast to meals of the prior art, as shown above, is very remarkable. The test consisted in immersing the partly opened dynamite cartridge in water in a metal tube for the time designated, detonation then being attempted by means of a blasting cap. In the case of the ammonia dynamite containing the prior art meals, 4 failures to detonate resulted after 16 hours immersion of

the explosive, whereas with the dynamite containing linseed meal, 4 successful detonations were obtained, even after 48 hours.

Linseed meal, when present in explosives of the type described, is capable of forming a cohesive and protective paste with the more or less dilute solutions produced when water comes in contact with the outer or exposed portion of explosives containing water-soluble salts. Ordinary flours, meals, and starches do not disperse so readily and do not form protective pastes. As examples of these latter materials, we may mention wheat flour, corn meal, tapioca starch, and the like.

The dispersions formed by mixture of ordinary starch products with relatively small amounts of either water or dilute nitrate solutions, without application of heat, are such that there is a rapid separation of the flour, meal, starch, or the like. Linseed meal acts differently, in that the greater part of the material remains colloidally dispersed and suspended on dilution with water or dilute nitrate solution, even though no heat has been applied at any time.

When linseed meal according to our invention is used in compositions such as ammonia dynamites, it appears that the entrance of the first traces of water brings about a paste or gel formation. This gelatinization in the outer portion of the explosive retards the rate of water penetration toward the interior of the explosive column. The gelatinous structure formed also prevents segregation of liquid or solid ingredients of the explosive such as would be caused by water penetration and softening of the composition. The cohesive gel or paste also decreases the loss of solid or liquid ingredients from partly opened cartridges by reasons of gravity flow. The leaching of soluble salts is likewise lessened by the presence of the paste.

It will be understood that, in order to obtain the most favorable results, the linseed meal should be in finely divided condition. Preferably, said meal should be in a state of subdivision such that the major portion, that is more than 50%, will pass a 60-mesh screen. We do not intend to be limited to meal of this degree of fineness, however. Likewise, we may wish to introduce into the explosive composition a small amount of a water-insoluble metal soap, such as calcium stearate, which will have a protective and coating effect on the ammonium nitrate against water or moisture. The presence of this latter ingredient, together with the linseed meal, gives very beneficial results. The linseed meal is effective, however, without the presence of the water-insoluble soap. Preferably, said linseed meal will be used in an amount not greater than 15%, and we find a quantity between 1 and 9% to be advantageous.

In carrying out the invention, we may employ a meal prepared by comminuting the entire ground linseed, or we may use only a portion of the seed, for example, a definite fraction such as can be obtained by extraction with water or other solvent, or by certain solutions. In this way, it may be possible to obtain a portion of the meal richer in the most active gel-forming ingredients.

As has been stated, the invention is applicable with great advantage in ammonia dynamites containing ammonium nitrate and nitroglycerin. It has important applications, also, in the case of compositions containing other high explosive compounds, such as nitrostarch, trinitrotoluene, and the like, in the presence of ammonium nitrate or other water-soluble salt. Furthermore, it is effective in the case of compositions in which the ammonium nitrate is sensitized by means of paraffin, dinitrotoluene, carbon, aluminum, other powdered metals and alloys, and many other materials.

In addition to its effective use for the protection of explosives containing water-soluble salts, the presence of linseed meal according to our invention will prove desirable also in the case of the semi-gelatinous type of explosive, in order to decrease the tendency of the ammonium nitrate to set or become hard. The linseed meal may be employed alone for this purpose, or in the presence of a lubricating agent therefor, for example, a vegetable oil or other liquid or solid lubricant. The residual oil present in linseed meal may be beneficial from this point of view.

Our invention has been described in detail in the foregoing. It will be apparent, however, that many variations may be introduced in methods of application or in compositions without departure from the scope of the invention. We intend to be limited therefore only by the following patent claims.

We claim:

1. An explosive composition comprising a water-soluble oxygen-supplying inorganic salt, and linseed meal in pulverulent form.

2. An explosive composition which comprises ammonium nitrate and linseed meal in pulverulent form.

3. An explosive composition which comprises a water-soluble oxygen-supplying inorganic salt, an explosive ingredient, and linseed meal in pulverulent form.

4. An explosive composition which comprises a liquid explosive nitric ester, ammonium nitrate, and linseed meal in pulverulent form.

5. An explosive composition which comprises nitroglycerin, ammonium nitrate, and linseed meal in finely divided form.

6. The explosive of claim 5, in which the linseed meal is in such state of subdivision that the major portion thereof will pass a 60-mesh screen.

7. The explosive of claim 5, in which the linseed meal is present in an amount not more than 15%.

8. The explosive of claim 5, in which the linseed meal is present in amount between 1 and 9%.

9. An explosive composition comprising a water-soluble oxygen-supplying inorganic salt, a sensitizing agent, and linseed meal in pulverulent form.

10. An explosive composition comprising a water-soluble oxygen-supplying inorganic salt, a non-explosive sensitizing agent, and linseed meal in pulverulent form.

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