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EXPLOSIVE

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The present invention relates to explosive compositions.

An object of the invention is the provision of a water resistant explosive composition containing a water soluble inorganic oxygen supplying salt.

Another object of the invention is the provision of a water resistant ammonium nitrate explosive composition.

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

For many years water soluble inorganic oxygen supplying salts have been used in explosive compositions. Representative of such salts are the nitrates, chlorates, and perchlorates of calcium, magnesium, potassium, sodium, and ammonium. Of these, ammonium nitrate has been by far the most important, and it is indeed the principal power producing ingredient of most explosives manufactured today.

Since explosives are often used under wet conditions, the water solubility of these salts has been a distinct disadvantage. Water tends to leach them and to desensitize the explosive.

Several methods for improving the water resistance of explosive compositions containing water soluble oxygen supplying salts have heretofore been used with various degrees of success. For example, nitrocotton has been included in the compositions; the salts have been coated with water repellant materials such as paraffin, petrolatum, and rosin; and various water dispersible starch materials which form a protective gel with water have been included in the compositions.

It has been discovered in accordance with the present invention that manno-galactans are superior gel-producing ingredients in explosive compositions containing inorganic water soluble oxygen supplying salt. Manno-galactans may be obtained from several vegetable products. Locust bean gum and carob bean gum are largely manno-galactans. Guar flour, the powdered endosperm of the guar bean, is a particularly readily available mannogalactan and is preferred for use in the present invention.

Powdered manno-galactans have the property of rapidly forming an unusually stiff sol on being mixed with water. The presence of salts dissolved in the water does not materially affect the thickening properties of the manno-galactans, and the manno-galactans are not precipitated by the salts. When an explosive composition containing a water soluble inorganic oxygen supplying salt and a manno-galactan comes in contact with water, the manno-galactan absorbs water, and apparently the resultant gel protects the ammonium nitrate, inhibiting leaching and desensitization.

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Explosive compositions usually contain carbonaceous combustible ingredients. Manno-galactans, in addition to providing water protecting properties, are also an excellent source of carbonaceous combustible, and consequently may be employed in substitution for part or all of the carbonaceous combustible usually employed in explosives.

Manno-galactans may be employed very generally in the preparation of explosives containing water soluble inorganic oxygen supplying salts. They have been found particularly advantageous in compositions sensitized with explosive liquid nitric esters such as nitro glycerine and the various nitro glycerine mixtures commonly employed in the explosives industry. Ordinarily the invention will find its principal application in explosives containing higher proportions of soluble salts, as high, for example, as about 90%. On the other hand, however, the invention improves explosives containing relatively low amounts, as low as about 15%, for example, of soluble salts. The so-called ammonia dynamites are good examples of explosives in which the present invention may be advantageously employed.

Manno-galactans will usually be found to improve water resistance markedly when amounts as low as 0.4% of the explosive compositions are employed. Amounts as high as 15% are also generally satisfactory.

Explosives made in accordance with the invention may contain any of the ingredients commonly used to obtain special effects in explosives. For example, various sensitizers or cooling salts may be employed. Also water resistant coating ingredients may be used although such coatings are usually quite unnecessary.

Since manno-galactans absorb water by means of a surface action, it is usually desirable that the manno-galactans be employed in finely divided form. Screen sizes below 100 mesh are usually preferred although satisfactory results may be usually obtained when most of the material will pass a 60 mesh screen.

The invention will be further described by means of the following specific examples:

Explosive compositions were prepared by conventional procedures to each of the formulae listed in Table I.

Each of these explosives was packed in conventional 1¼'' x 8'' paper cartridges. The ends of the cartridges were sealed with tallow. The

wrapper of each of the cartridges was perforated with sixteen ¼'' holes arranged in four longitudinal lines equidistantly spaced around the cartridge, the holes in adjacent rows being staggered. Each cartridge was placed in a vessel, was covered with sand, and water was poured into the vessel until it stood above the sand. The cartridges were then removed from the sand after a known number of hours, and their detonatability with a number 6 blasting cap was determined. The results are tabulated in Table II.

TABLE I

	Examples										
	1	2	3	4	5	6	7	8	9	10	11
Nitro Glycerine, percent	11.85	11.85	11.85	11.85	6.00	6.00	6.00	8.00	8.00	6.00	6.00
Nitro Cotton, percent	0.05	0.05	0.05	.05							
Coated Fine Ammonium Nitrate, percent	39.00	39.00	39.00	39.00	48.50	48.50	48.50	22.40	22.40		
Coated Coarse Ammonium Nitrate, percent								22.40	22.40	80.40	80.40
Fine Sodium Nitrate, percent	10.60	10.60	10.60	10.60							
Coarse Sodium Nitrate, percent	25.00	25.00	25.00	25.00	32.00	32.00	31.50	33.00	33.00	5.00	5.00
Chalk, percent	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Fine Apricot Pit Pulp, percent	3.00	3.00	3.00	3.00				7.70	6.20	4.10	4.10
Coarse Apricot Pit Pulp, percent					8.00	7.00	6.50				
Wood Pulp, percent					1.00	1.00	1.00			2.00	2.0
Ground Sulphur, percent	4.00	4.00	4.00	4.00	4.00	4.00	4.00				
Corn Flour, percent	6.00	5.00	4.00	5.00						2.00	1.00
Powdered Guar, percent		1.00	2.00			1.00	2.00		1.50		1.00
Powdered Locust Bean Gum, percent				1.00							
Ground Soft Coal, percent								6.00	6.00		

TABLE II

Ability to detonate after contact with water

Hours Immersion	Examples										
	1	2	3	4	5	6	7	8	9	10	11
0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	Yes	Yes	No			No	No		
7	No	Yes	Yes								
16											Yes
24											
48											
72											
96											
120											
144											
168		Yes	Yes								
192		No	No								

It will be seen that in each case the explosive containing a manno-galactan (Examples 2, 3, 4, 6, 7, 9, and 11) exhibited greatly increased water resistance.

What is claimed is:

1. An explosive comprising a granular, water soluble inorganic oxygen supplying salt, a sensitizer, and a manno-galactan distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

2. An explosive comprising a granular ammonium nitrate, an explosive liquid nitric ester, and a powdered manno-galactan distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

3. An explosive comprising granular ammonium nitrate, an explosive liquid nitric ester sensitizer, and guar flour distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

4. An explosive comprising granular ammonium nitrate, nitro glycerine, and guar flour distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

5. An explosive comprising granular ammonium nitrate, an explosive liquid nitric ester sensitizer, and locust bean gum flour distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

6. An explosive comprising granular ammonium nitrate, nitro glycerine, and locust bean gum flour distributed throughout said explosive in finely-divided form capable of swelling in contact with water to impart water-resistance to said explosive.

7. An explosive composition comprising a blend of a water-soluble solid inorganic oxidizing salt, a sensitizing agent therefor, and guar flour in pulverulent form in an amount between 0.4% and 15%.

8. An explosive composition comprising a blend of a water-soluble solid inorganic oxidizing salt, a sensitizing agent therefor, and a manno-galactan in pulverulent form capable of swelling in contact with water to impart water-resistance to said explosive composition in an amount between 0.4% and 15%.

9. An explosive composition comprising a blend of a water-soluble solid inorganic oxidizing salt, a sensitizing agent therefor, and locust bean gum flour in pulverulent form in an amount between 0.4% and 15%.

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