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[54] **AQUEOUS SLURRY EXPLOSIVE CONTAINING A NITRATOALKANOLAMINE NITRATE SENSITIZER**

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[58] **Field of Search** 149/2, 21, 38, 46, 60, 62, 149/74, 92

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[57] **ABSTRACT**

A salt explosive of the aqueous slurry type containing a nitratoalkanolamine nitrate as a sensitizer, soluble, and dissolved, in sensitizing amount in the aqueous solution phase.

Method for in-situ formation of the sensitizer along with all or part of the salt component in aqueous solution for incorporation into the finished explosive as aqueous solution phase; and method for manufacture of the explosive, including preparation of the aqueous phase solution and mixing the remaining ingredients for the explosive therewith to form the finished explosive.

23 Claims, No Drawings

AQUEOUS SLURRY EXPLOSIVE CONTAINING A NITRATOALKANOLAMINE NITRATE SENSITIZER

This invention relates to aqueous slurry salt type explosives containing a new class of water-soluble sensitizer components dissolved in the aqueous phase. In one aspect this invention relates to such slurry type explosives having improved sensitivity and detonation velocity characteristics imparted by the sensitizer component. In another aspect this invention relates the the manufacturer of an aqueous solution of an oxidizer salt and a sensitizer of the above class, including in-situ sensitizer and salt formation, for use as aqueous solution phase in aqueous slurry type explosives above described. In still another aspect this invention relates to a method for the manufacture of the above slurry explosives, including preparation and use of the above aqueous solution of in-situ formed salt and sensitizer. Other aspects will be apparent in light of the accompanying disclosure and the appended claims.

Salt type explosives of the aqueous slurry type include the salt, water, and sensitizer components, often with a thickener and one or more of supplemental fuel, salt, and energizing ingredients, and have had extensive use in recent years.

In such slurry type explosives, the sensitizer has generally been a smokeless powder, or a high explosive such as TNT or PETN, or a nonexplosive such as particulate aluminum, DNT oil and the like; and in numerous instances gas particles have been added to enhance density control and sensitivity. A separate fuel component is often utilized for suitable oxygen balance and available energy properties. Generally the explosive contains a gelation agent as a thickener component, often in crosslinked form and in a sufficient amount to cause the slurry ingredients to be retained in aqueous suspension. The salt component is of the inorganic oxidizer and/or oxidizer-fuel type, exemplary of which are alkali metal, ammonium, and alkaline earth metal nitrates, and alkyl amine nitrates, respectively.

These aqueous slurry explosives are in some instances cap-sensitive, although they are generally insensitive to initiation by detonating action of a No. 8 commercial blasting cap and hence are considered in the art to be cap-insensitive although they readily detonate in response to action of a suitable booster charge.

The sensitizer components are generally present in the explosive as particulate solids and, in that form, they have presented mixing problems, often with accompanying nonuniformity of suspension in the slurry explosive, and safety hazards during handling of the slurry explosive, particularly during its manufacture. The suspension of solid particulate sensitizer components has often impaired fluidity, and hence pourability characteristics of the explosive to the extent of precluding efficient handling, particularly emplacement at maximum loading densities. Further, the sensitizer component, as a separate solid phase has often adversely affected detonation velocity and sensitivity characteristics of the explosive. The use of water-soluble sensitizers, and, particularly, selected nitratoalkanols as disclosed in copending application Ser. No. 16,939 filed Mar. 5, 1970, has eliminated many of the problems associated with such water-insoluble sensitizer slurry ingredients.

This invention is concerned with aqueous slurry salt type explosives containing a water-soluble sensitizer component, of a new class, dissolved in the aqueous phase of the explosive, and imparting improved fluidity, sensitivity, and detonation velocity characteristics to the explosive product. Further, the invention is concerned with manufacture of such slurry explosives, and with the manufacture of aqueous solution phase therefor, including in situ salt and sensitizer formation.

In accordance with the invention, salt explosives of the aqueous slurry type are provided which contain, as a sensitizer component, a nitratoalkanolamine nitrate, soluble, and dissolved, in sensitizing amount in the aqueous solution phase.

The nitratoalkanolamine nitrate sensitizer components of the slurry explosives of the invention, as a new class, contain a combination of nitrate ester and nitrate salt moieties, the nitrate ester moiety functioning as a strong sensitizer group, and the nitrate salt moiety functioning to impart both water solubility and sensitizing properties.

Although a high degree of solubility of the sensitizer component in the aqueous solution phase of the explosive is advantageous, it is only essential in practice of the invention that the solubility be sufficiently high that a senitizing amount of the sensitizer is dissolved in the aqueous solution phase.

A now preferred group of the class of sensitizer components of the invention is defined by the structural formula,

$$(O_2NO-R)_n-NR'_{n'}\cdot HNO_3$$

wherein each R is an N-substituent of the group of alkylene, hydroxyalkylene, and aminoalkylene, each R′ is an N-substituent of the group of H, alkyl, hydroxyalkyl and aminoalkyl, one carbon-containing member of the total of said N-substituents containing from one to four carbon atoms and all remaining carbon-containing members of said total containing from one to three carbon atoms, n and n' are whole integers of the respective groups of 1–3 and 0–2 and n is one of the group of 1, 2 and 3 when n' is respectively one of the group of 2, 1, and 0.

Of the above defined now preferred group of sensitizer components, 2-nitratoethylammonium nitrate, bis(2-nitratoethyl)- ammonium nitrate, and tris(2-nitratoethyl)ammonium nitrate are particularly preferred due to the high degree of solubility of each in the aqueous solution phase of the explosive, and hence the high proportion of sensitizer that can be maintained in the explosive to impart sensitivity, fluidity and detonation velocity characteristics, over a broad range at substantially all blasting and storage temperature levels encountered. Further, each of the mono-, bis-, and tris(2-nitratoethyl)ammonium nitrate sensitizers exhibits especially low sensitivity to impact coupled with strong explosive strength, to provide for minimization of safety hazards during manufacture and handling of the explosive, without sacrifice of performance of the explosive product.

Further exemplary of the nitratoalkanolamine nitrate sensitizer components of the invention are: mono-, bis-, and tris-, (2-nitrato-1-propyl)ammonium nitrate, methyl-2-nitratoethylammonium nitrate, methyl bis(2-nitratoethyl)ammonium nitrate, dimethyl-2-nitratoethylammonium nitrate, diethyl-2-nitratoethylammonium nitrate, ethyl bis(2-nitratoethyl)am-

moniun nitrate, 2-butyl-2-nitratoethylammonium nitrate, 2-(1-nitratobutyl)ammonium nitrate, 2-(1-nitrato-2-methylpropyl)ammonium nitrate, 2-nitratoethyl-2-aminoethylammonium dinitrate, 2-nitratopropyl-2-aminoethylammonium dinitrate, 2-(1,3-dinitrato-2-ethylpropyl)ammonium nitrate, 2-(1,3-dinitrato-2-methylpropyl)ammonium nitrate, and tris(nitratomethyl)methylammonium nitrate.

The aqueous slurry explosives of the invention generally require a small amount of aeration in order to have a satisfactory degree of sensitivity. In those instances, however, the minimum degree of aeration required is substantially less than that generally required heretofore in aerated aqueous slurry type salt explosives. Often, the proportion of gas particles, or bubbles, utilized in practice of the invention for suitable sensitivity is that which will hold, or maintain, the absolute density of the slurry explosive at a level not exceeding about 99 percent of the theoretical (density when free from entrapped air) and generally, within a range of from 70 to 98 percent of the theoretical.

The sensitizing proportion of dissolved nitratoalkanol-amine nitrate can be, on a weight basis, as high as about 75 percent and as low as about 1 percent of the finished explosive, generally in the range of from about 3 to 50 percent, more often from about 5 to 35 percent. Generally, the slurry compositions of the invention comprise (weight basis) from about 10 to about 40, often about 12 to 30, percent water, a thickening amount of a suitable thickening agent, from 35 to 85, often about 45 to 70, percent of the salt, and the dissolved sensitizer. The sensitizer component although often a single nitratoalkanolamine nitrate can, when desired, constitute any suitable mixture of nitratoalkanolamine nitrates.

Exemplary salt components of the invention include inorganic oxidizer salts such as alkali metal and alkaline earth metal nitrates and perchlorates such as, for example, ammonium nitrate, sodium nitrate, magnesium nitrate, calcium nitrate, potassium nitrate, barium nitrate, sodium perchlorate, ammonium perchlorate, calcium perchlorate and magnesium perchlorate; and organic salt components such as nitrogen based oxidizer-fuel salts including hexamethylenetetramine mono- and di-nitrates, primary, secondary and tertiary alkyl, and alkanol, amine nitrates, generally containing one to four carbon atoms in each alkyl, or alkanol group, as for example, monomethylamine nitrate, dimethylamine nitrate, trimethylamine nitrate, monoethylamine nitrate, diethylamine nitrate, triethylamine nitrate, monopropylamine nitrate, dipropylamine nitrate, tripropylamine nitrate, monobutylamine nitrate, dibutylamine nitrate, monoethanolamine nitrate, diethanolamine nitrate, triethanolamine nitrate, and the like. Particle size of the salt ingredients, which are normally solid, is generally not critical. For example, ammonium nitrate can consist of prills such as used in fertilizers or it can be granular and in form varied from coarse to fine, and when desired, all or any portion of it can be added to the slurry formulation in aqueous solution. The salt component can be solely inorganic, or organic, as above illustrated, or it can constitute a mixture of organic and inorganic salts either one of which can be in major proportion.

A thickener component can be utilized in any suitable proportion and can be of any of those well known in the art including such as Karaya gum, water-soluble starches, mannogalactans, preferably guar gum in crosslinked form, locust bean gum, cereal products, hydroxyethylcellulose, generally crosslinked, acrylic type thickeners such as sodium acrylate-acrylamine copolymer, and the like. The proportion of thickener does not generally exceed about 10 weight percent, from about 0.5 to 2 percent being often sufficient, particularly when the thickener is a crosslinked gelation agent. When the thickener content is within the range of from 0.2 to 0.5 percent, there is generally sufficient thickening to prevent settling of the composition ingredients although additional thickener is often utilized in order to impart a greater degree of cohesiveness.

In some instances, the proportion of nitratoalkanolamine nitrate sensitizer may influence the choice of thickener. For example, at concentrations of 2-nitratoethylammonium nitrate of at least about 30 weight percent, hydroxyethylcellulose, in cross-linked form, is advantageously utilized, whereas an acrylic type thickener is often less suitable. On the other hand, at 2-nitratoethylammonium nitrate concentrations not exceeding about 30 percent an acrylic, or guar gum, type thickener is often preferred.

It is advantageous from the standpoint of oxygen balance to, at times, include in the formulation one or more supplemental fuels, sensitizers and fluidizers. By way of example, ethylene glycol is a now preferred supplemental fuel and fluidizer and other suitable and now preferred supplemental fuels are particulate silicon and silicon alloys, and particulate metals such as aluminum, although any suitable supplemental fuel(s) such as ground coal, sugar, and the like, can be advantageously utilized. Supplemental sensitizers include such as TNT, smokeless powder, particulate aluminum, DNT oil, and the like, and are preferably those which are not per se self-explosives. The total amount of each of such supplemental fuel and sensitizers does not generally exceed 35 weight percent of the finished composition, often being within the range of from about 5 to 25 percent.

The aqueous slurry type compositions of the invention are characterized by high sensitivity at densities (grams/cc.), after aeration as described, often as high as 1.4 and somewhat higher, such densities in the range of from about 1.00 to 1.40 being generally preferred. Detonation velocities at these density levels are often within the range of from 4,000 to 7,000 meters per second (m/s) to provide available energy approximating, in many instances, the energy delivered by conventional dynamite type explosives.

A specific aeration step for regulation of density to desired levels in the range of about 1.00 to 1.40 may not be required, inasmuch as, generally, sufficient aeration is inherent during mixing of ingredients in an open air atmosphere. However, in the event that aeration steps are required, such can be accomplished by any of well known procedures such as disclosed in U.S. Pats. Nos. 3,390,031, 3,390,032 and 3,449,181. Direct aeration or in-situ generation by other means can be utilized when desired. Other suitable means for aeration include incorporation of microballoons, i.e., hollow gas-filled plastic, or glass, spheres well known in the art.

Although the nitratoalkanolamine nitrate sensitizer component can be incorporated into the finished explosive product, in any suitable manner, it is advantageously formed in-situ along with all or part of the salt

component in aqueous solution for incorporation of the latter into the finished explosive as aqueous phase component.

Further in accordance with the invention, therefore, a process is provided for the manufacture of an aqueous solution phase for a salt explosive of the aqueous slurry type, wherein said solution phase contains sensitizer and salt components dissolved therein for said explosive, including a sensitizing amount of said sensitizer, said process comprising reacting at least one of the group of alkanolamine nitrates and alkanolamines as a precursor for said sensitizer, with aqueous 90 to 98 weight percent HNO_3 present in stoichiometric excess to form nitratoalkanolamine nitrate product as said sensitizer component; adding an alkaline neutralizing agent to the resulting aqueous sensitizer-containing reaction mixture to neutralize the excess HNO_3 therein to form water-soluble nitrate neutralization product as said salt component; introducing water into the zone of at least one of said sensitizer forming-, and neutralization-, reactions at any time, i.e., before, during, or after the reaction(s), to provide a total water content in the resulting neutralization reaction mixture not exceeding that required for said explosive but sufficient to dissolve at least a sensitizing amount of said sensitizer and at least a part of said salt, therefor; and recovering resulting aqueous solution product.

The alkanolamine nitrate and alkanolamine precursors reacted with HNO_3 to form the corresponding nitratoalkanolamine nitrate sensitizer, in accordance with process of the invention above described, are further illustrated with reference to those counterpart nitratoalkanolamine nitrate sensitizers specifically disclosed herein, and illustrated with reference to the above generic formula $(O_2NO-R)_n-NR'_{n'} \cdot HNO_3$.

The in-situ formation of sensitizer and salt components in aqueous solution, in accordance with the invention, eliminates the need for any preparative procedure requiring isolation of the sensitizer product for incorporation into the explosive. The invention in this respect is further unique inasmuch as the defined excess of HNO_3 is required for nitration of the hydroxyl(s) to form the ester moiety; and the excess HNO_3, which normally would require its removal from the sensitizer-forming reaction mixture, is neutralized to form salt product which can be incorporated into the explosive in admixture with the sensitizer without requirement for further processing either product component.

When reacting an alkanolamine precursor for the sensitizer, with the aqueous excess 90 to 98 percent HNO_3, nitration of the hydroxyl group(s) and the nitrate salt formation, proceed in a single step. However, the single step method is less preferred in view of its highly exothermic nature.

In carrying out the above, and preferred, in-situ, formation of the sensitizer and salt, the precursor reactant is preferably at least one of the group of mono-, di-, and tri-ethanolamine nitrates and is introduced into contact with at least 95 percent aqueous HNO_3 in an HNO_3:ethanolamine nitrate equivalent ratio of at least 2:1, generally within the range of about 4:1 to 7:1, and the excess HNO_3 is neutralized to form the water-soluble oxidizer salt.

Any suitable alkaline neutralization agent, reactable with the excess HNO_3 above described to form a corresponding water-soluble nitrate salt for the explosive can be utilized, exemplary of which are free ammonia, alkyl and alkanol, amines, ammonium hydroxide, alkali-, and alkaline earth-, metal hydroxides, carbonates, and the like; and, now preferred neutralization agents include free ammonia, methyl amine, ethanolamine, sodium hydroxide, ammonium hydroxide, sodium carbonate, calcium carbonate, calcium oxide (lime), and calcium hydroxide (slake) lime. A mixture of suitable alkaline neutralization agents is often advantageously utilized to provide a corresponding, and predetermined, salt mixture for the explosive.

The HNO_3 is present in the in-situ formation system in any suitable excess for the salt formation, ranging from a slight excess to form a part of the oxidizer salt ultimately required, to a sufficient excess providing for the formation of substantially the salt in the entire required amount. The water present in the aqueous solution product is water of esterification and that introduced with the aqueous HNO_3, and includes any water inherently in the alkanolamine nitrate or alkanolamine reactants, and any water added as aqueous alkaline neutralization agent, together with any additional water added to either of the reaction zones as above described.

In most embodiments, the pH of the resulting aqueous product solution is adjusted to a value in the range of from about 4 to 7, preferably from 5 to 6, in order to minimize the formation of free nitric acid; and water content of the resulting product solution is up to about 40 weight percent, based on the finished explosive. Formation of the aqueous solution product phase is carried out at any suitable ambient temperature, e.g., in the range of from about 0–50°C.

When carrying out the above procedure for preparation of the aqueous product solution, utilizing the alkanolamine as the precursor reactant, the conditions are substantially the same as when the alkanolamine nitrate precursor is utilized, except that the quantity of HNO_3 introduced into the HNO_3-alkanolamine reaction is correspondingly greater; and when utilizing the alkanolamine as the initial reactant it is important that special care be taken to preclude undue temperature build-up due to the exothermic heat of reaction developed.

It will be appreciated that when referring hereinabove to the step of maintaining total amount of water in the neutralization reaction product by introducing additional water into one or both of the sensitizer-forming and neutralization reaction zones, it is contemplated that, in many instances, aqueous precursor reactants and/or aqueous alkaline neutralization agent will be utilized and/or that water-dilution of either or both of the reaction mixtures will be required, the basic requirement being that sufficient water is present in the final product solution to retain a sensitizing amount of the in-situ formed sensitizer together with at least a part of the in-situ formed salt dissolved therein.

In some embodiments of the above-described in-situ formation, the amount of water in the final product solution is less than that required for the explosive, albeit sufficient to retain a sensitizing amount of sensitizer, and at least part of the salt, in solution, so as to provide for incorporation of one or more aqueous remaining ingredients into the finished explosive.

The invention further provides a method for the manufacture of a salt explosive of the aqueous slurry type containing, as a sensitizer component, a nitratoalkanolamine nitrate soluble, and dissolved, in sensitizing amount in the aqueous solution phase of the explosive,

said method comprising forming an aqueous product solution of in-situ formed nitratoalkanolamine nitrate sensitizer and salt, utilizing an alkanolamine or an alkanolamine nitrate precursor reactant, as above described, and mixing the remaining ingredients for the explosive with said product solution.

The invention is further illustrated with reference to the following examples

Example 1

675 grams of 2-nitratoethylammonium nitrate was dissolved in 410 grams of water at about 40°C. and then admixed, without further heating, with a dry mixture of 1,080 grams ammonium nitrate, 270 grams sodium nitrate, and 27 grams glass microballons, with stirring. The pH of the resulting mixture was adjusted to 5.6 by addition of ammonium hydroxide, and warmed to 40°C.

A dispersion of 27 grams of natural guar gum in 189 grams ethylene glycol was then added to the resulting mixture of microballons, 2-nitratoethylammonium nitrate, and nitrate salts, with stirring for a period of 10 to 15 minutes during which time the mixture thickened sufficiently to maintain the undissolved ingredients in uniform suspension. A dispersion of 1.35 grams potassium pyroantimonate in 22 grams water was added to the resulting suspension under agitation conditions over a period of several minutes. The resulting product mixture was then packaged in a 3 inch plastic container during which time the crosslinking of the guar gum with the pyroantimonate was substantially completed to provide a resulting gelled explosive product containing 25 weight percent of the 2-nitratoethylammonium nitrate sensitizer, all dissolved in the aqueous solution phase. Two additional gelled explosive compositions were made in accordance with the above procedure except that the procedural conditions were varied to provide explosives product containing lesser amounts of dissolved 2-nitratoethylammonium nitrate sensitizer, viz., 5 and 10 percent.

Two compositions were prepared in accordance with the same general procedure, but containing monoethanolamine nitrate in lieu of the nitratoalkanolamine nitrate sensitizer.

Detonation tests were carried out in a 3 inch diameter schedule 40 black pipe 28 inches in length, containing from 5.8 to 6.7 lbs. of each of the above formulations, and are summarized in the following table:

Although the shot failed at the 5 percent level of 2-nitratoethanolamine nitrate sensitizer (formulation 3) contents as low as 1 weight percent of the nitratoalkanolamine nitrate sensitizer can be utilized depending upon the particular formulation, detonation temperature, booster system, and density.

With reference to formulations 4 and 5 of the table, the utilization of ethanolamine nitrate, a well known sensitizer for aqueous explosives, in a proportion of 10 weight percent resulted in failure of the shot; and when the latter was present in a proportion of 25 percent, the detonation rate was significantly less than that obtained when the same proportion of nitratoammonium nitrate sensitizer was utilized.

The above tabulated data demonstrate high detonation rates obtained at the 10 and 25 percent content levels of the 2-nitratoethanolamine nitrate (2-nitratoethylammonium nitrate) sensitizer, formulations 1 and 2, and are indeed significantly higher than observed for the same content level for ethanolamine nitrate sensitizers of the prior art, formulations 4 and 5.

Example 2

506 grams (4.04 moles) of 98 percent ethanolamine nitrate (2 percent water, 11 grams) is added in small portions, with agitation, to 1100 grams (17.5 moles) of 98 weight percent aqueous HNO_3 (2 percent water, 22 grams) at 0–5°C. over a period of about 1 hour. The resulting clear solution is stirred an additional 0.5 hour at 0°C. and then diluted with 305 grams water and warmed to 30°C. Total water present in the diluted solution is 410 grams including 72 grams formed by the nitration reaction and 33 grams present in the ethanolamine nitrate and aqueous HNO_3 reactants.

Unreacted excess HNO_3 (13.5 moles) is then neutralized to a pH of 5.6 by action of gaseous ammonia. The final resulting aqueous solution product contains 4.0 moles (675 grams) of 2-nitratoethylammonium nitrate and 13.5 moles (1,080 grams) ammonium nitrate dissolved in 410 grams water.

The product solution is then admixed with a dry mixture of 270 sodium nitrate and 27 grams glass microballoons with stirring and warming to 40°C. The pH of the resulting mixture is then adjusted to 5.6 by addition of ammonium hydroxide or nitric acid as required.

Formulation	1	2	3	4	5
			Weight Percent		
Water	16.0	16.0	16.0	16.0	16.0
Ammonium Nitrate	40.0	50.0	52.0	40.0	51.5
Sodium Nitrate	10.0	12.0	13.0	15.0	12.5
2-Nitratoethylammonium Nitrate (Nitrato-MEAN)	25.0	10.0	5.0	—	—
Ethanolamine Nitrate (MEAN)	—	—	—	25.0	10.0
Glycol	7.0	10.0	12.0	2.0	8.0
Guar Gum	1.0	1.0	1.0	1.0	1.0
Potassium Pyroantimonate	0.05	0.05	0.05	0.05	0.05
Glass Microballoons	1.0	1.0	1.0	1.0	1.0
Oxygen Balance - percent	−1.0	+0.17	−0.82	−1.56	−0.42
Specific Gravity	1.32	1.33	1.33	1.38	1.34
Test Temperature °F.	62	63	69	68	68
Booster - 225 grams PETN Detonation Rate - meters/second	6,250	4,000	Failed	4,350	Failed

27 grams natural guar gum in 189 grams ethylene glycol, with 1.35 grams potassium pyroantimonate in 22 grams water, are then added to the resulting aqueous mixture of microballoons, 2-nitratoethylammonium nitrate and nitrate salts and the resulting explosive composition is packed with final crosslinking, as described with reference to Example 1.

What I claim and desire to protect by Letters Patent is:

1. In an aqueous slurry salt explosive, the improvement comprising a nitratoalkanolamine nitrate, as a sensitizer conponent, soluble, and dissolved, in sensitizing amount in the aqueous solution phase.

2. An improved explosive of claim **1** wherein said nitratoalkanolamine nitrate is according to the structural formula

$$(O_2NO-R)_n-NR'_{n'}\cdot HNO_3$$

wherein each R is an N-substituent of the group of alkylene, hydroxyalkylene, and aminoalkylene, each R' is an N-substituent of the group of H, alkyl, hydroxyalkyl and aminoalkyl, one carbon-containing member of the total of said N-substituents contains from one to four carbon atoms and all remaining carbon-containing members thereof contain from one to three carbon atoms, *n* and *n'* are whole integers of the respective groups of 1—3 and 0—2, and *n* is one of 1, 2 and 3, when *n'* is respectively one of 2, 1 and 0.

3. An explosive of claim **2,** containing a thickening amount of a thickener therefor, and aerated sufficiently to regulate the absolute density thereof at a level not exceeding about 99 percent of the theoretical.

4. An explosive of claim **3** aerated by the presence of gas filled hollow spheres.

5. An explosive of claim **3** containing as said sensitizer at least one of the group of mono-, bis-, and tris-, (2-nitratoethyl)ammonium nitrates.

6. An explosive of claim **5** wherein said sensitizer comprises 2-nitratoethylammonium nitrate.

7. An explosive of claim **5** containing on a weight basis from 10 to 40 percent water, and from 35 to 85 percent of said salt.

8. An explosive of claim **7** containing a supplemental fuel.

9. An explosive of claim **8** containing on a weight basis from 12 to 30 percent water, from 5 to 25 percent of said supplemental fuel, from 45 to 70 percent of said salt, from 3 to 50 percent of said sensitizer, and not exceeding about 2 percent of a crosslinked gelation agent as said thickener.

10. An explosive of claim **7** wherein said salt is at least one of the group of alkylamine nitrates, alkanolaminenitrates, and ammonium nitrate.

11. In an explosive of claim **10,** said salt comprising ammonium nitrate in at least major proportion.

12. An explosive of claim **11** containing sodium nitrate as an oxidizer salt.

13. An explosive of claim **6** wherein the proportion of said sensitizer is at least about 30 percent and said thickener is hydroxyethylcellulose in crosslinked form.

14. An explosive of claim **6** wherein the proportion of said sensitizer does not exceed about 30 percent, and said thickener comprises guar gum and/or an acrylic type thickener.

15. An explosive of claim **9,** containing from 5 to 35 weight percent 2-nitratoethylammonium nitrate as said sensitizer.

16. An explosive of claim **9** containing ethylene glycol as said supplemental fuel.

17. A process for the manufacture of an aqueous solution phase for an aqueous slurry salt explosive, wherein said solution phase contains sensitizer and salt components dissolved therein for said explosive, including a sensitizing amount of said sensitizer, said process comprising reacting at least one of the group of alkanolamine nitrates and alkanolamines as a precursor for said sensitizer, with aqueous 90 to 98 percent HNO_3 present in stoichiometric excess to form nitratoalkanolamine nitrate product as said sensitizer component; adding an alkaline neutralization agent to the resulting aqueous sensitizer containing reaction mixture to neutralize the excess HNO_3 therein to form water-soluble nitrate neutralization product as said salt component; introducing water into the zone of at least one of said sensitizer forming-, and neutralization-, reactions at any time to provide a total water content in the resulting neutralization reaction mixture not exceeding that required for said explosive but sufficient to dissolve at least a sensitizing amount of said sensitizer and at least a part of said salt, therefor; and recovering resulting aqueous solution product.

18. A process of claim **17** wherein said precursor is an ethanolamine nitrate of the group of mono-, bis-, and tris-, ethanolamine nitrates, and wherein said neutralizing agent is one of the group of free ammonia, alkylamines, alkanolamines, ammonium hydroxide, and alkali metal- and alkaline earth metal-, alkaline reacting neutralization agents.

19. A process of claim **18** wherein said HNO_3 is introduced into the sensitizer-forming zone in an equivalent ratio to the alcohol moiety of said ethanolamine nitrate of at least 2:1.

20. A process for the manufacture of an aqueous slurry salt explosive containing, as a sensitizing component, a nitratoalkanolamine nitrate, soluble, and dissolved in sensitizing amount in the aqueous solution phase, comprising forming an aqueous solution phase product in accordance with the process of claim **17,** and mixing the remaining ingredients for said explosive with said product solution.

21. A process of claim **20** wherein said precursor is an ethanolamine nitrate of the group of mono-, bis-, and tris-, ethanolamine nitrates.

22. A process of claim **21** wherein said ethanolamine nitrate is monoethanolamine nitrate.

23. A process of claim **22** wherein said HNO_3 is introduced into contact with said monoethanolamine nitrate in an equivalent ratio to the alcohol moiety thereof with the range of 4:1 to 7:1.

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