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UNITED STATES PATENT OFFICE.

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AMMONIUM-NITRATE EXPLOSIVE.

No. 850,325.

Specification of Letters Patent.

Patented April 16, 1907.

Original application filed October 24, 1905, Serial No. 284,152. Divided and this application filed May 31, 1906. Serial No. 319,491.

To all whom it may concern:

Be it known that I, FIN SPARRE, a subject of the King of Norway, residing at Wilmington, county of Newcastle and State of Delaware, have invented a new and useful Improvement in Ammonium-Nitrate Explosives, of which the following is a full, clear, and exact description.

My invention relates to nitrate-of-ammonia explosives—that is, those explosives in which the chief oxygen-carrier is nitrate of ammonia, and has for its object to render the same non-hygroscopic.

The invention consists in a nitrate-of-ammonia explosive containing nitrate of ammonia or nitrate of ammonia in conjunction with other ingredients of a nitrate-of-ammonia explosive and a waterproof composition consisting of a liquid nitro compound (in which preferably has been dissolved a solid nitro compound) in which is dissolved guncotton or other nitrated cellulose, the composition when mixed with the nitrate of ammonia or nitrate-of-ammonia explosive coating the particles of the latter and producing a new nitrate-of-ammonia explosive impervious to moisture.

The invention also consists in the process of making such non-hygroscopic nitrate-of-ammonia explosive.

It has been proposed to manufacture non-hygroscopic nitrate-of-ammonia powder by dissolving a solid body, such as rosin, in a volatile solvent, such as alcohol, then mixing the solution with the ingredients of the powder, and then evaporating the solvent. It has also been proposed to add to the powder waterproofing liquids, such as kerosene or nitroglycerin. It has also been proposed to mix nitrate of ammonia or nitrate-of-ammonia powder with solid nitro compounds, such as dinitrobenzol or mononitronaphthalene, and heating the mixture to a temperature at which the compounds will melt and then permitting the powder to cool, thereby producing supposedly a powder whose particles were provided with a waterproof coating. These attempts, however, have not been successful. There has either been no reduction of the hygroscopicity or it has been too slight to be of practical value.

Additions of small amounts of the liquids mentioned produce no appreciable beneficial

results. Addition of larger amounts of these liquids not only fails to reduce the hygroscopicity to any practical extent, but it is impracticable to add large amounts, as they exude rapidly and spoil the explosive. Moreover, such liquids are easily washed out by water, and thus are of no practical use so far as waterproof qualities are concerned. So far as nitroglycerin is concerned its addition in large enough quantities to be appreciably efficient to reduce hygroscopicity robs the powder of the very qualities that commend it to use—that is, the powder is no longer fumeless, it freezes at a relatively high temperature, and it is less safe.

The failure of melted solid nitro compounds to act efficiently is doubtless due to the fact that these compounds crystallize, and therefore coat the particles of powder imperfectly and unevenly, and are brittle and porous at lower temperature.

It is essential in order to obtain non-hygroscopicity and waterproofing that the nitrate of ammonia or nitrate-of-ammonia powder should be coated with or absorb a material that is amorphous, viscous, insoluble in water, and waterproof and also combustible, non-freezing, stable, safe, and practically non-volatile at high or low temperature. This material I obtain, as before stated, by dissolving guncotton in a liquid nitro compound in which, preferably, has previously been dissolved a solid nitro compound. As examples of liquid nitro compounds that may be used may be specified mononitrobenzol and mononitrotoluol. As examples of solid nitro compounds that may be used may be specified dinitrobenzol, dinitrotoluol, and trinitrotoluol. The guncotton used may be nitrocellulose of high or low nitration.

Of the two liquid nitro compounds named mononitrotoluol is preferred on account of being less volatile, having a less strong smell, and capable of dissolving nitrocellulose a little better than mononitrobenzol.

I have found that nitrocellulose is more easily dissolved by liquid mononitro compounds if a normally solid higher nitro compound (say trinitrotoluol) is present in the solution, and the solution is less thick, so that more nitrocellulose can be dissolved.

Another reason for the employment of a higher nitro compound is that the mixture

contains more oxygen than if a mononitro compound only is present.

My preferred waterproof composition is as follows: mononitrotoluol, eighty per cent; 5 trinitrotoluol, ten per cent; guncotton, ten per cent. The liquid nitro compound may, however, vary from sixty per cent. to ninety-nine per cent. The solid nitro compound should not exceed twenty-five per cent., as a 10 larger proportion produces crystallization. It may be omitted altogether, but with less completely satisfactory results, for the reasons above stated. The guncotton may vary from one per cent. to fifteen per cent. 15 Its addition is essential, as otherwise the solution would be too thin. The guncotton is gelatinized, and therefore perfectly safe.

The solution may be prepared cold or warm, application of heat not being necessary.

20 As examples of known nitrate-of-ammonia powders to which the above waterproof composition is applicable may be mentioned the following: nitrate of ammonia, eighty-five per cent.; aluminium, fifteen per cent., also, 25 nitrate of ammonia, seventy-eight per cent.; ferrosilicon, twelve per cent.; ungelatinized nitrocellulose, ten per cent., also, nitrate of ammonia, eighty-eight per cent.; trinitrotoluol, six per cent.; trinitronaphthalene, six 30 per cent.

To apply the composition, the previously-prepared powder is mixed therewith in an ordinary mixing apparatus with or without application of heat. The following proportions are preferable: nitrate-of-ammonia 35 powder, eighty-five per. cent.; waterproof composition, fifteen per cent.

The proportion of the composition may vary from five per cent. to thirty per cent.

40 In addition to the composition a quantity of nitrate of ammonia may be added to the previously-prepared powder—for example, nitrate-of-ammonia powder, seventy-five per cent.; nitrate of ammonia, five per cent.; wa- 45 terproof composition, twenty per cent.

Instead of adding the composition to a nitrate-of-ammonia powder it may be added to nitrate of ammonia alone, thus producing a nitrate-of-ammonia powder of non-hy- 50 groscopic properties—for example, nitrate of ammonia, eighty-two per cent.; waterproof composition, eighteen per cent.

Another example of such powder is as follows: nitrate of ammonia, seventy-five per 55 cent.; waterproof composition, twenty per cent.; nitroglycerin, five per cent.

The nitroglycerin may also first be dissolved in the composition and the nitrate of ammonia incorporated with this mixture.

60 An explosive may also be made of the following composition: nitrate-of-ammonia powder, seventy per cent.; nitrate of ammonia, seven and one-half per cent.; nitroglycerin, seven and one-half per cent.; water- 65 proof composition, fifteen per cent. In this

case the nitrate of ammonia may first be mixed with the powder and the nitroglycerin dissolved in the composition and then these two mixtures incorporated, or all four may be incorporated together. 70

The following is an example of a waterproof composition containing nitroglycerin: mononitrobenzol, sixty-two per cent.; trinitrotoluol, ten per cent.; nitroglycerin, twenty 75 per cent.; nitrocellulose, eight per cent.

An explosive may also be made by adding nitrocellulose, as well as the composition, to nitrate of ammonia or a nitrate-of-ammonia powder.

Both the nitroglycerin and the nitrocellu- 80 lose, if not gelatinized or in solution, act as sensitizing ingredients.

I have hereinbefore stated that the waterproof composition may comprise between five and thirty per cent. of the explosive, 85 while in the examples the proportions vary from fifteen to twenty per cent. Certain known nitrate-of-ammonia powders to which the said waterproof composition is applicable have also been set forth. As an example of a 90 waterproofed nitrate-of-ammonia explosive embodying my invention, with the proportions of the various ingredients to the explosive as a whole, may be mentioned the following: nitrate of ammonia, from fifty per cent. 95 to eighty-five per cent., preferably sixty-five per cent.; ferrosilicon, from five per cent. to twenty per cent., preferably ten per cent.; ungelatinized nitrocellulose, from five per cent. to twenty per cent., preferably ten per 100 cent.; mononitrobenzene, from five per cent. to thirty per cent., preferably twelve per cent.; trinitrotoluol, less than 7.5 per cent, preferably 1.5 per cent.; gelatinized nitrocel- 105 lulose, less than 4.5 per cent., preferably 1.5 per cent.

This application is a division of an application filed by me October 24, 1905, Serial No. 284,152.

Having now fully described my invention, 110 what I claim, and desire to protect by Letters Patent, is—

1. A nitrate-of-ammonia explosive containing of nitrate of ammonia fifty to eighty-five per cent., of a liquid nitro compound 115 three to thirty per cent., and of nitrocellulose dissolved in the liquid nitro compound less than 4.5 per cent. substantially as described.

2. A nitrate-of-ammonia explosive containing of nitrate of ammonia fifty to eighty-five per cent., of a liquid nitro compound 120 three to thirty per cent., of a normally solid nitro compound less than 7.5 per cent., and of nitrocellulose less than 4.5 per cent. substantially as described. 125

3. A non-hygroscopic nitrate-of-ammonia explosive containing a nitrate-of-ammonia powder coated with a liquid nitro compound in which has been dissolved nitrocellulose, in 130 substantially the described proportions.

4. A non-hygroscopic nitrate-of-ammonia explosive containing a nitrate-of-ammonia powder coated with a liquid nitro compound in which has been dissolved nitrocellulose, and
5 a normally solid nitro compound, in substantially the described proportions.

10 5. A nitrate-of-ammonia explosive containing of nitrate of ammonia fifty to eighty-five per cent., of mononitrotoluol three to thirty per cent., and of nitrocellulose dissolved in the liquid nitro compound less than 4.5 per cent. substantially as described.

15 6. A nitrate-of-ammonia explosive containing of nitrate of ammonia fifty to eighty-five per cent., mononitrotoluol three to thirty per cent., trinitrotoluol less than 7.5 per cent., and of nitrocellulose less than 4.5 per cent. substantially as described.

7. A non-hygroscopic nitrate-of-ammonia explosive containing a nitrate-of-ammonia 20 powder coated with mononitrotoluol in which has been dissolved nitrocellulose in substantially the described proportions.

8. A non-hygroscopic nitrate-of-ammonia explosive containing a nitrate-of-ammonia 25 powder coated with mononitrotoluol in which has been dissolved nitrocellulose and trinitrotoluol in substantially the described proportions.

In testimony of which invention I have 30 hereunto set my hand, at Philadelphia, on this 22d day of May, 1906.

FIN SPARRE.

Witnesses:

M. M. HAMILTON,
E. E. WALL.