149-11

Draftsmar

Patented Sept. 17, 1929

1,728,307

UNITED STATES PATENT OFFICE

GUY A. RUPP, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO TROJAN POWDER COMPANY, A CORPORATION OF NEW YORK

EXPLOSIVE

No Drawing. Application filed February 29, 1928. Serial No. 258,146.

My invention relates to improvements in explosives and more particularly relates to improvements in explosives of the nitric acid ester type. The principal object of my invention is the preparation of explosives of a nitrostarch or nitrocellulose base, possessing improved characteristics as compared with corresponding types of explosives made by methods now known.

Dry nitrostarch as employed in the manufacture of nitrostarch explosives is a dry pulverulent material composed of nitrated granules of starch, and depending upon the kind of starch used as a raw material, the granules may vary from 5 microns or .005 mm. to 60 microns or .06 mm. in diameter. Because of the very minute size of the granules of nitrostarch, dry nitrostarch is a very "dusty" material, and in the manufacture of nitrostarch explosives it is customary to employ a liquid dust-reducing agent as one component of the explosive, lubricating oil of medium viscosity being the preferred agent.

Up to this time the dust-reducing agent has invariably been added to the explosive in the final mixing operation, a quantity of the mineral oil varying from one-tenth of one percent of the entire weight of the explosive, up to one percent or more of the entire weight of the explosive in exceptional cases, being added to the explosive mixture at the time of the final incorporation of the ingredients of the explosive in a dry mixing operation.

My present invention relates to an improved means of incorporating a non-aqueous dust-reducing agent with nitrostarch, and by the application of my present invention I obtain a uniformity in the incorporation of the dust-reducing agent entirely impossible to obtain by the methods previously employed while I also obtain by my new method greatly improved efficiency through the use of any given quantity of oil, through the fact that the oil which I employ is in direct contact with the nitrostarch granules instead of being distributed over the surface of all the components of the explosive mixture. It will be evident that since the nitrostarch is the only component of the explosive mixture which is normally present in so finely divided a state as to be a cause for dusting under ordinary conditions, any means which limits the absorption of the oil or other dust-reducing agent to the nitrostarch granules offers a means to increased efficiency in the use of the oil, and improved results in the finished explosive through limiting the amount of oil required to prevent dusting to an amount smaller than gives efficient results when employed in conjunction with such mixing methods as have hitherto been used.

My present invention rests upon the discovery which I have made that although oil and water are mutually immiscible, nitrostarch wet with water may be uniformly "oiled" when strongly agitated in aqueous suspension in the presence of a small amount of oil, and that the distribution of the oil upon the nitrostarch granules under the circumstances named is notably greater than can be obtained by any incorporation of dry nitrostarch and oil, either alone or in the presence of other agents added for the purpose of facilitating mixing.

As an example of my present invention, I will describe one method which I may employ in the preparation of a nitrostarch explosive containing 35% of nitrostarch and .3% of oil.

350 pounds of nitrostarch is preferably suspended in 1000 pounds of water in a tank of any suitable type, such tank being provided with a propeller wheel, beater arms, or other means for securing efficient agitation. The water is preferably first introduced into the tank, the agitating means are then set in operation, and while the water is being vigorously stirred the 350 pounds of nitrostarch, either as dry nitrostarch or as wet nitrostarch cake of a weight equivalent to 350 pounds of dry nitrostarch, is introduced into the tank. The nitrostarch will rapidly form a suspension or slurry, and when completely in suspension 3 pounds of lubricating oil of medium viscosity is poured on to the surface of the liquid in the tank. The agitation of the contents of the tank is continued for a period of thirty minutes, and at the end of this time it will be found that no oil is present on the surface of the liquid, and chemical

examination will indicate the oil to be present with the nitrostarch granules, having been taken up by the wet nitrostarch in opposition to the repellent action of the water, but probably as a result of some natural affinity of nitrostarch for oil which is active even when the nitrostarch is wet with water.

The nitrostarch suspension is next separated from surplus water, by filtration or decantation, and the nitrostarch cake obtained by either method is dried by the action of warm air or in any other convenient way, until an average moisture content of less than 1% has been obtained. The nitrostarch may then be conveniently mixed with 545 pounds of sodium nitrate, 100 pounds of ammonium nitrate, and 2 pounds of zinc oxide. The dried nitrostarch is thoroughly admixed with the other ingredients, and the final mixture, excluding the small amount of moisture which may be present in the nitrostarch and in association with the sodium nitrate and the ammonium nitrate will have the following composition:

	Per cent.
Nitrostarch	35.00
Ammonium nitrate	10.00
Sodium nitrate	54.50
Zinc oxide	.20
Mineral oil	.30
	100.00

It will of course be recognized that the above example is illustrative only, and that my present invention may be used in conjunction with the preparation of any other type of nitrostarch explosive. My invention is not limited to the use of nitrostarch explosives, however, since I have discovered that fibres of nitrocellulose when suspended in water may be similarly "oiled" to secure substantially equivalent results. My invention is limited in a practical way to the treatment of finely divided organic esters of nitric acid, and is of particular advantage in connection with the treatment of nitrostarch and the manufacture of nitrostarch explosives.

Although I have referred to the use of mineral oil as the dust-reducing agent which I prefer to use, my invention is not limited to the use of mineral oil, and may be applied with equal success in the treating of finely divided nitrostarch with any other liquid water-immiscible dust-reducing agent. Instead of mineral oil I may employ vegetable or animal oils, or I may employ solid hydrocarbons, fats and waxes, by performing my incorporating operation at a temperature in excess of the melting point of the dust-reducing agent used. As an example of this phase of my invention, I may employ 1,000 pounds of water at the boiling temperature, and may incorporate with this water 350 pounds of nitrostarch and 3 pounds of paraffin wax. At the temperature of the water used the paraffin wax will melt to form a thin fluid, and this fluid will be absorbed by the nitrostarch granules during the mixing operation, and on subsequent drying will give particles of nitrostarch each thoroughly impregnated or coated with solid paraffin.

I find that liquid oils give the greatest dust-reducing effect, but solid fats and waxes, owing to their oily nature, perform a similar result although not to quite the same degree. I find the incorporation of solid fats and waxes of principal advantage in the combination which they give of improved water resistance and dust-reducing ability, the treated granules of nitrostarch tending to give to the finished explosive an excellent combination of water resistance and non-dusting characteristics.

Instead of employing an agent that is solid at ordinary temperatures and liquid at elevated temperatures as a means of obtaining the impregnation of nitrostarch granules with a solid dust-reducing or water-resisting agent, I may employ any of the other methods known in the art for transforming a liquid agent to solid consistency. I may for example, impregnate my nitrostarch granules by agitation in water with a liquid oil capable of being hydrogenated to give a solid fat, and I may then hydrogenate the oil-impregnated nitrostarch particles, or I may similarly impregnate my nitrostarch in the described way with an oil capable on oxidation of yielding a solid product, and subsequently exposing the treated nitrostarch to oxidizing conditions sufficient to cause the solidification of the absorbed oil. In one development of my present invention I use tung oil, often known as China-wood oil, as my impregnating agent, and subsequently transform the absorbed tung oil into a sticky solid product by the effect of heat and moderate oxidation, employing of course a temperature well under that at which nitrostarch begins to decompose.

Although the principal object of my present invention is to impart to nitrostarch or other finely divided nitric acid carbohydrate ester improved non-dusting and water-resisting characteristics, it is important to note that nitrostarch or nitrocellulose treated by my new process possesses other characteristics which make it superior to nitrostarch made by known processes. I have discovered, for example, that nitrostarch impregnated with oil by the process herein described shows a much reduced tendency to "lump" when dried, and instead of producing occasional hard lumps that are not easily reduced to pulverulent condition, tends to give only "soft" lumps, that are readily reduced by simple pressure to finely divided condition.

It will be noted that my invention has a very broad application, and offers a new and very useful method of introducing into nitro-

& MATERIAL COMPOSITIONS.

starch explosives a water-immiscible dust-reducing and moisture-resisting agent, by treating nitrostarch while suspended in a large excess of water under conditions of vigorous agitation with a liquid of oily nature and immiscible in the aqueous agent used to suspend the nitrostarch.

I claim:

1. The process which comprises suspending the nitric acid ester of a carbohydrate in water, adding a liquid immiscible with water to the slurry, and stirring until the water-immiscible agent has been absorbed by the carbyhydrate ester.

2. The process which comprises suspending nitrostarch in water, adding oil, and stirring until free oil is no longer visible upon the surface of the water.

3. As a step in the manufacture of explosives, the process which comprises suspending nitrostarch in water, adding oil, stirring until the oil has been absorbed by the nitrostarch, and separating the nitrostarch from the excess of water.

In testimony whereof, I have hereunto subscribed my name this 23rd day of February, 1928.

GUY A. RUPP.