UNITED STATES PATENT OFFICE.

FREDERIC LEWIS NATHAN AND WILLIAM RINTOUL, OF STEVENSTON, AND FRANK BAKER, DECEASED, LATE OF STEVENSTON, SCOTLAND, BY HENRY BAKER, OF ETON, WINDSOR, ENGLAND, ADMINISTRATOR OF SAID FRANK BAKER, ASSIGNORS TO NOBEL'S EXPLOSIVE COMPANY LIMITED, OF GLASGOW, SCOTLAND.

GELATINIZED PROPELLANT-EXPLOSIVE AND PROCESS OF PREPARING SAME.

1,280,279. Specification of Letters Patent. Patented Oct. 1, 1918.

No Drawing. Application filed February 26, 1914. Serial No. 821,337.

To all whom it may concern:

Be it known that Colonel Sir FREDERIC LEWIS NATHAN and WILLIAM RINTOUL, both subjects of the King of Great Britain and Ireland, and residing at Ardeer, Stevenston, Ayrshire, Scotland, and FRANK BAKER, deceased, late of Ardeer, Stevenston, Ayrshire, Scotland, invented a certain new and useful Gelatinized Propellant-Explosive and Process of Preparing Same, of which the following is a specification.

Present day smokeless powders are generally prepared by gelatinizing nitrocellulose, either when used alone or with nitroglycerin, by a volatile solvent but this entails certain disadvantages, the drying process for removing the solvent being lengthy and, what is worse, besides tending owing to the heating to affect the stability, is incomplete, so that during storage an after-drying and slow production of irregularities in the material can occur.

In the course of investigations upon the stabilizing of nitric-ester-containing explosives we found that certain anilids (see United States application Serial Number 771621) Patent No. 1,090,642, granted March 17, 1914, are particularly adapted for use for stabilization but we have further found that among these bodies some are also effective gelatinizers for mixtures of nitroglycerin and nitrocelluloses.

According to the present invention therefore we utilize one or more such substances to produce a gelatinized propellant explosive from these nitric esters, the gelatinizer remaining in the final product and acting as stabilizer.

The following is a list of some of the substances referred to which possess this double property namely:—

Formanilid	C_7H_7ON
Methyl formanilid	C_8H_9ON
Ethyl formanilid	$C_9H_{11}ON$
Phenyl formanilid	$C_{13}H_{11}ON$
Ethyl acetanilid	$C_{10}H_{13}ON$
Phenyl acetanilid	$C_{14}H_{13}ON$
Form ortho toluidid	C_8H_9ON
Form para toluidid	C_8H_9ON
Phenyl acet α-naphthalid	$C_{18}H_{15}ON$
Phenyl acet β-naphthalid	$C_{18}H_{15}ON$
Ethyl acet β-naphthalid	$C_{14}H_{15}ON$
Acet ortho anisidid	$C_9H_{11}O_2N$
Acet ortho phenetidid	$C_{10}H_{13}O_2N$

Moreover homologues and certain derivatives of these substances possess like properties. Thus the substitution of a methyl for an ethyl group or of a hydrogen atom in a phenyl group by the grouping —$O.CH_3$ or —$O.C_2H_5$ in one of the above compounds often but little affects their gelatinizing and stabilizing power.

In carrying the invention out in one way 7.5 parts by weight of formanilid are dissolved in 40 parts of nitroglycerin and this solution then incorporated by the wet incorporation method of Lundholm English Patent No. 10376 of 1889 with 52.5 parts of soluble nitrocellulose of 12.6% nitrogen content, which has been prepared by nitrating cotton waste at the ordinary temperature, and purified by boiling with water.

In carrying out the incorporation method which consists in bringing the nitroglycerin and nitrocellulose together in an aqueous suspension the nitrocellulose is suspended in a solution of the formanilid of a strength of 1.02 per cent.

The pasty admixture so obtained is freed as far as possible from water by pressing and rolling between rollers heated to from 40° to 50° C., after which it is again rolled at a temperature of from 50° to 70° C. and a gelatinized sheet of the desired thickness obtained which is either cut into strips or flakes or extruded from a press. Thus, to form from this compound a cord slightly more than 5 millimeters in diameter a pressure of some 470 kilograms per square centimeter would be required at a temperature of 50° C., or of 337 kilograms per square centimeter at 60° C. or of 267 kilograms per square centimeter at 70° C.

The bodies considered vary in their gelatinizing effect and the choice of the material to be used in any particular case also depends largely upon the nature of the nitrocellulose to be treated a powerful gelatinizer such as ethyl acetanilid being more suitable for gun cotton or insoluble nitrocellulose than weaker gelatinizers which may be quite satisfactory for nitrocellulose of the kind employed in making celluloid. Again the greater the proportion of nitrocellulose in the mixture the more effective the gelatinizer, which has both to colloid the fibrous nitrocellulose and to increase the plasticity of the final product, should be.

As certain of the bodies are better gelatinizers than stabilizers or vice versa it may be convenient to use mixtures thereof using for instance with a mixture of 40% nitroglycerin and 50% soluble nitrocellulose (12.6% nitrogen), 10% of a mixture of equal parts acet-ortho anisidid and phenyl acet-β-naphthalid the poorer gelatinizing power of the latter being compensated by that of the former and vice versa as regards their stabilizing effects.

The amount of the gelatinizing and stabilizing agent or agents used will vary but generally be between 5 and 12% of the whole mixture.

The physical properties of the agent or agents used will affect the above method of introduction into the mixture for while liquid bodies such as ethyl formanilid are easily dissolved in the nitroglycerin, solids require to be finely ground and thoroughly agitated with the nitroglycerin or to be melted, if of low fusing point, and so added to the nitroglycerin. By admixture the melting point may be reduced, a mixture for instance of 60% formanilid (melting point 47° C.) and 40% form-ortho-toluidid (melting point 62° C.) being liquid at 20° C. Where the substance or substances used is or are soluble in water and the wet incorporation method is used, the suspension should be effected in a solution of the substance or substances of such strength that having regard to the mixture used the right final composition results. Thus for a mixture of 35% nitroglycerin, 55% of soluble nitrocellulose (12.6% nitrogen) and 10% gelatinizer the suspension should be effected in a 1.25% solution when using formanilid or a 0.85% solution when using form-ortho-toluidid.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:—

1. The process of producing a gelatinized propellant explosive which comprises mixing together nitroglycerin, nitrocellulose and an anilid capable both of gelatinizing nitrocellulose and of stabilizing nitric esters, and a second anilid possessing both these properties, one of these anilids possessing the first mentioned property to a smaller extent and the second mentioned property to a larger extent than the other anilid, and then gelatinizing the mixture.

2. A gelatinized and stabilized propellant explosive comprising an anilid capable both of gelatinizing nitrocellulose and of stabilizing nitric esters, and a second anilid possessing both these properties, one of these anilids possessing the first mentioned property to a smaller extent and the second mentioned property to a larger extent than the other anilid.

3. A gelatinous propellant explosive containing about forty parts of nitroglycerin, about 52.5 parts of soluble nitrocellulose of 12.6% nitrogen content and about 7.5 parts of formanilid.

In testimony whereof we have signed our names to this specification in the presence of subscribing witnesses.

FREDERIC LEWIS NATHAN.
WILLIAM RINTOUL.
HENRY BAKER.
Administrator of the estate of Frank Baker deceased.

Witnesses:
N. B. MILNE,
ALEX FORBES.

Witnesses:
BERTRAM H. MATTHEWS,
P. A. OUTHWAITE.