

# UNITED STATES PATENT OFFICE.

GEORGE HENRY WADSWORTH, OF LYNDHURST, ENGLAND.

## ART OF PRODUCING GELATINIZED NITROCELLULOSE EXPLOSIVES.

No. 899,577.

Specification of Letters Patent.

Patented Sept. 29, 1908.

Application filed August 9, 1907. Serial No. 387,821.

*To all whom it may concern:*

Be it known that I, GEORGE HENRY WADSWORTH, a subject of the King of Great Britain, residing at Lyndhurst, Hampshire, England, have invented a new and useful Improvement in the Art of Producing Gelatinized Nitrocellulose Explosives, of which the following is a specification.

This invention relates to the production of gelatinized nitro-cellulose explosives, in which the density of the explosive is decreased so that a given weight occupies a greater cubical space, and the explosive is rendered applicable for use in shot or sporting guns and for blank cartridges; my explosive will ignite instantaneously with ordinary percussion caps, and burn rapidly when loaded into ordinary cartridge cases under usual conditions, without the necessity of being confined as it is when the explosive is placed in a rifle cartridge with a bullet, and fired from a rifle.

The present invention consists in an improved method whereby I am enabled to produce an explosive possessing the characteristics above stated in a superior degree, the homogeneous grains of which are of a bone-like porous structure, and in which the cavities or pores are of relatively great number and relatively large aggregate area, and which is not hygroscopic and is sufficiently and practically smokeless; such method possessing certain advantages over previous methods of manufacture as hereinafter set forth.

In order to make gelatinous explosives suitable for shot guns, manufacturers have usually adopted the expedient of reducing the jelly to very small grains or thin flakes, which are known as "condensed" powders, but these powders are dense and require special cartridge cases and possess other disadvantages. Beyond this, it has been proposed to increase the volume or bulk of a specific quantity of explosive, as for example a soluble material such as sugar, saltpeter, or the like, has been proposed to be employed, the nitro-cellulose being first dissolved in a suitable solvent, and the soluble material incorporated with the paste in the proportion of about two to four parts of the soluble material to ten parts of the explosive; the paste composition thus obtained is then brought into any required shape, and then the soluble material is extracted either by washing or boiling the grains, cubes, or

other forms, in water or some other fluid, in which the added body is soluble, or by evaporating the added body, or otherwise driving it out as completely as possible. It has also been proposed to incorporate salts, such as nitrate of soda, with nitro-cellulose before gelatinization, in the proportion of about equal parts of soluble material and explosive, the mass being then formed into grains and only partially gelatinized; the grains were then to be dried and the nitrate of soda washed out with water, the effect of the added matter being to prevent shrinkage.

Now according to the present invention, grains of explosive are produced with a bone-like porous structure, which grains, as aforesaid, can be ignited by the same cap and under the same conditions as ordinary powder usually employed in sporting fire arms, and in which grains the flame from the cap instead of acting on the surface thereof only, actually penetrates the grains, which, on account of their porosity, expose a larger quantity of explosive to the flash. To this end the gelatinized nitro-cellulose is either wholly or partially dissolved in a suitable solvent to the consistency of a jelly, and then a quantity of barium nitrate in the proportion of not less than twice the quantity of barium nitrate to that of the explosive treated, is kneaded up with the gelatinous explosive, until the two substances are thoroughly intermingled, the barium nitrate having previously been very finely ground until its particles will pass through a sieve having meshes say of from one to two hundredths of an inch; the substance thus produced is then formed into grains, and after the latter have been dried, they are treated with water which penetrates the grains and dissolves out the bulk of the barium nitrate, leaving the grains in their original volume or bulk, but of an extremely porous structure. The selection of barium nitrate for this use is important to the success of the invention, because it is a hard substance which can be ground very finely, and which is not hygroscopic; beyond this, the barium nitrate presents the advantage, that any small portion of the same which is not completely dissolved out; rather improves the explosive than otherwise, as an additional oxidizer, and therefore the advantage is great over those substances—such as sodium nitrate—hitherto proposed to be employed by others, which, if they were not dissolved out entirely, would



detrimentally affect the explosive if they did not render it entirely useless. The explosive, so treated, can be practically instantaneously ignited when placed in an ordinary shot cartridge with an ordinary cap, the flame from the cap actually penetrating the grains on account of their porosity, igniting all those grains which the flame comes in contact with, and which, in their turn, ignite any grains with which the flame has not actually come into contact, and the full charge is, as aforesaid, instantaneously ignited and any hang-fire entirely obviated.

It will now be understood that the treatment, according to my invention, consists in taking a quantity of barium nitrate, so finely ground that its particles will pass through a sieve of about one to two hundredths of an inch, and mixing with that barium nitrate a quantity of nitro-cellulose explosive in the form of a jelly and of a quantity not greater than half that of the barium nitrate employed; the two substances, *i. e.* the nitro-cellulose, either wholly or partially dissolved, provided it is in the consistency of a jelly, and the finely divided barium nitrate, are then thoroughly intermingled, and the pasty mass thus produced is formed into grains in any suitable manner, which grains are then dried and afterward treated with water to dissolve out the barium nitrate, and again dried.

In one instance, given by way of example, 210 grains of barium nitrate were mixed with 70 grains of the explosive; when the mixture had been treated with water and the great bulk of the barium nitrate dissolved out, there was very little shrinkage, showing that the finished explosive had been caused to occupy a very much larger volume than it originally occupied, the barium nitrate having performed the office of dividing up the jelly and maintaining an open structure. Having performed that office, the barium nitrate or the bulk thereof is extracted, and so leaves the powder grains of a bone-like porous structure, and even, as aforesaid, if the barium nitrate is not entirely and absolutely dissolved out, the explosive is not detrimentally affected.

In practice a residue of at least 5 per cent. of the barium nitrate remains in the explosive, and it is only possible to dissolve out the bulk of the barium nitrate by reason of the extremely fine state of its division and its great excess in weight over the weight of the nitro-cellulose. A superficial skin or film naturally surrounds the particles of the barium nitrate; but, owing to the small particles and large quantity of the latter, such

film is very thin and when the granules of powder are dried, to recover the solvent, the film is cracked by contraction, leaving very small channels through which the water enters and dissolves out the barium nitrate. This would not happen if small proportions of barium nitrate or other nitrates were used, nor if the particles were relatively larger. The reduction of the barium nitrate to an extremely fine powder and its employment in the proportions above indicated are consequently considered essential characteristics of the improved process; while the peculiar chemical characteristics of the barium nitrate render the small residue thereof advantageous rather than otherwise, owing to its action as an additional oxidizer. The barium nitrate, moreover, is not hygroscopic and the product containing such residue thereof is none the less sufficiently and practically smokeless.

What I claim as my invention and desire to secure by patent is:—

1. In the art of producing gelatinized nitro-cellulose explosives the process of treatment which consists in taking a quantity of the nitro-cellulose in the consistency of a jelly and a quantity of finely ground barium nitrate, kneading the two together into a pasty mass, forming said mass into grains, drying said grains, and then treating said grains with water to dissolve out the bulk of the barium nitrate, whereby the grains are given a bone-like porous structure, and the small residue of the nitrate will assist as an additional oxidizer in producing an explosive which is not hygroscopic and is practically smokeless.

2. In the art of producing gelatinized nitro-cellulose explosives the process of treatment which consists in taking a quantity of the nitro-cellulose in the consistency of a jelly and not less than twice that quantity of barium nitrate so finely ground that its particles will pass through a sieve of about one to two hundredths of an inch, thoroughly kneading the two together into a pasty mass, forming such mass into homogeneous grains, drying said grains, and then treating said grains with water to dissolve out the bulk of the barium nitrate, whereby the grains are given a bone-like porous structure, substantially as hereinbefore specified.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

GEORGE HENRY WADSWORTH.

Witnesses:

RICHD. JONES,  
HARVEY J. BAVERSTOCK.