UNITED STATES PATENT OFFICE.

FREDERICK WILLIAM JONES, OF BARWICK, NEAR WARE, ENGLAND.

METHOD OF TREATING GUNPOWDER.

SPECIFICATION forming part of Letters Patent No. 692,142, dated January 28, 1902.

Application filed December 6, 1898. Serial No. 698,413. (No specimens.)

To all whom it may concern:

Be it known that I, FREDERICK WILLIAM JONES, a subject of the Queen of Great Britain, residing at Barwick, near Ware, in the county of Hertford, England, have invented an Improvement in the Method of Treating Granulated Gelatinized Gunpowder, (for which I have obtained a patent in Great Britain, No. 15,553, dated July 15, 1898,) of which the following is a specification.

This invention refers to granulated gelatinized gunpowder, treated as hereinafter described, whereby the time occupied in the combustion of such gunpowder is efficiently regulated and controlled.

There may be said to be two purposes for which explosives are commonly employed. The first is for blasting, where the explosive is employed to rend adjacent surfaces or bodies by the practically instantaneous production of gases, and the second purpose is for bringing about the propulsion of a movable body or projectile with the object of propelling the same to a distance.

Now the present invention deals exclusively with explosives for the purpose last named. For this purpose the ideal explosive charge when employed in a gun does not suddenly give off all the gases due to its weight and constituents, but gives off these gases at a properly increasing or accelerated speed as the projectile travels within the gun-barrel, the produced pressure increasing at a proper and controlled rate up to the time when all the powder is ignited. Hitherto the regulation of the rapidity of the evolution of the gases has been attempted by varying the composition or varying the size or shape of the grains or forming perforations through the grains, and thus enabling the time occupied by the combustion of the individual grains, and consequently the combustion of the charge, to be varied. Such modes of variation are the common well-known methods now employed.

In all the many inventions for regulating explosives for guns the main object has been to produce such an ideal explosive; but in endeavoring to achieve this end previous inventors, so far as I am advised, have proceeded on the hypothesis that all the grains of a charge were practically simultaneously ignited, and their efforts have been limited to reducing or regulating the rate of combustion of each single ignited grain by some of the various means above broadly indicated. No inventor, so far as I am advised, has heretofore attempted by a treatment of gunpowder to insure the ignition of, say, one-tenth of the powder while the projectile travels three calibers of the length of the gun and a further two-tenths of the powder while the projectile travels another three calibers of the length of the gun and a further three-tenths of the powder while the projectile travels still another three calibers of the length of the gun, and the remaining four-tenths of the powder while the projectile travels a further three calibers of the length of the gun. Such, broadly and generally speaking, is the object of my present invention, not, be it understood, in such exact and literal proportions as I have mentioned, merely by way of illustration, but generally, as I think will be well understood from such an example.

Now instead of endeavoring to regulate the time occupied in what I may term the "consumption" of the practically simultaneously ignited powder-grains, as has heretofore been attempted, I have found that a more beneficial effect can be obtained by delaying the passage of ignition from grain to grain, and therefore the object of my present invention is limited to regulating and delaying the progressive ignition of the grains—that is, the communication of ignition from the grains which have been ignited by the primer to the other grains and from grain to grain, the whole of the grains not being ignited until, for instance, an appreciable time after the initial ignition. The evolution of the gas under these circumstances will commence successively in different parts of the charge, and not practically at the same moment in all parts, as heretofore, and whereby I can use larger charges of powder than heretofore with lower initial pressures without having the grains of a size, form, or composition which will render the combustion of same too slow to become complete before the projectile reaches the end of the gun-barrel. Thus and in this manner the combustion of a whole charge is regulated without slowing the combustion or affecting the explosiveness of any individual grain con-

sidered separately. According to my invention and to effect this object I take granulated gelatinized gunpowder prepared by any of the well-known methods, and I apply thereto a thin adhering and practically continuous coating or glazing or inclosing shell of a non-explosive, but combustible, solid nitro-hydrocarbon of high melting-point having no chemical action on the substance of the grain and not capable of appreciably penetrating the same nor in any manner affecting the composition, the speed of combustion, or the explosiveness of the grains when once ignited, but serving simply to delay or prolong the time which it takes for one ignited grain to communicate ignition to the adjacent grain. As such solid nitro-hydrocarbon I prefer to employ dinitrotoluene, which when heated is a solvent of the nitrocellulose forming an ingredient of the gelatinized gunpowder which is to be treated. In the method of treating such gelatinized gunpowder the solid nitro-hydrocarbon is first crushed to an impalpable powder. It is then added in the proper proportion to a given quantity of the gelatinized gunpowder to be treated. I prefer to employ the said solid nitro-hydrocarbon to the extent of five per cent. of the gelatinized gunpowder. This, however, will be somewhat in excess of the amount which will be required to adhere to the grains of powder.

The grains of gelatinized gunpowder and the powdered solid nitro-hydrocarbon, such as dinitrotoluene, are placed in a suitable receptacle and subjected to an agitation for the purpose of applying to the grains of powder a thin surface coating or glaze of said nitro-hydrocarbon. The thickness of this coating or glaze is to be determined by the period of agitation and the quantity of nitro-hydrocarbon in the agitating vessel along with the grains of powder. This thickness or coating may advantageously vary in different powders for use in guns of different calibers; but this forms no necessary part of my invention. After the grains of powder have been thus surfaced the surplus free nitro-hydrocarbon is to be removed from the grains of powder by sifting. The coated powder grains are then exposed in a suitable oven to a temperature of about 158° Fahrenheit, at which temperature the solid nitro-hydrocarbon or dinitrotoluene will melt and become a solvent for the nitrocellulose of the gunpowder grain, but being already evenly distributed in the form of an attenuated film over the surface of the grains it does not penetrate the explosive substance of the said grains, owing, in part, to the viscid nature of the liquid nitro-hydrocarbon or dinitrotoluene and also to the small amount of the solvent present, which of necessity can only dissolve a very small amount of the nitrocellulose of the grain. In fact the solid nitro-hydrocarbon remains where it was placed—that is, upon the surface of the grain—and the only appreciable effect produced by its being brought into a melted condition is that it becomes strongly adherent to the grains of powder, forming thereon a non-explosive but combustible shell. I prefer thereafter to subject the surfaced grains of powder to a polishing or glazing by agitation in the presence of powdered graphite in order to render the gunpowder smooth and easy to handle and load into the gun.

The term "grain" is herein used in its ordinary sense as applied to gunpowder, and does not include the particles of which such grains are composed, nor the relatively granular particles of non-granulated explosives.

I claim as my invention—

1. The method herein specified of taming and regulating granulated explosives for guns consisting in coating the individual grains with a solid substance which when melted is a solvent for the substance of the grain, and subsequently finishing the coating or shell and rendering it closely adherent to the grain by heating the coated grain to a temperature above the melting-point of said solid substance, substantially as specified.

2. The method herein specified of treating already-manufactured granulated gelatinized gunpowders, for the purpose of delaying the passage of ignition from grain to grain, consisting in mixing together a quantity of a granulated gelatinized gunpowder and a quantity of a dry finely-divided solid nitro-hydrocarbon, subjecting the commingled materials to prolonged agitation and thereby coating the powder grains with particles of the nitro-hydrocarbon, and then heating the coated powder grains to a temperature above the melting-point of said nitro-hydrocarbon, to melt such particles and thereby cause the same to unite with one another and with the grains which they cover, whereby each grain is provided with a relatively slow burning shell or glaze adhering to and covering its exterior surfaces, substantially as set forth.

3. The method herein specified of treating already-manufactured granulated gelatinized gunpowders, for the purpose of delaying the passage of ignition from grain to grain, consisting in mixing together a quantity of a granulated gelatinized gunpowder and a quantity of dry finely-divided solid dinitrotoluene, subjecting the commingled materials to prolonged agitation, and thereby coating the powder grains with particles of the dinitrotoluene, and then heating the coated powder grains to a temperature of about 158° Fahrenheit to melt such particles and thereby cause the same to unite with one another and with the grain which they cover, whereby each grain is provided with a relatively slow burning shell or glaze adhering to and covering its exterior surfaces, substantially as set forth.

FREDERICK WILLIAM JONES.

Witnesses:

THOMAS WILLIAM ROGERS,

WILLIAM ANDREW MARSHALL.