UNITED STATES PATENT OFFICE.

FREDERICK AUGUSTUS ABEL, OF WOOLWICH, GREAT BRITAIN

IMPROVEMENT IN THE MANUFACTURE OF GUN-COTTON.

Specification forming part of Letters Patent No. **59,888,** dated November 20, 1866.

To all whom it may concern:

Be it known that I, FREDERICK AUGUSTUS ABEL, of the Royal Arsenal, Woolwich, in the county of Kent, in the Kingdom of Great Britain, have invented an Improved Manufacture and Treatment of Gun-Cotton; and I do hereby declare that the following is a full and exact description of the said invention—that is to say:

My invention has reference to the explosive compound known as "gun-cotton." Such compound has heretofore been employed either in a loose fibrous or woolly state; or of late it has been spun into the form of rovings, yarn, or thread, and has then been formed into cartridges, either by winding, braiding, or weaving.

Now, my invention has for its object to assimilate the physical condition of gun-cotton as nearly as possible to that of gunpowder, by mechanically converting it into a solid conglomerate state, and imparting to it either a granular or other suitable form that will present the exact amount of surface and compactness required for obtaining a certain rapidity or intensity of combustion.

The method of treating the gun-cotton which I prefer to employ in carrying my invention into practice is as follows:

I first convert cotton-wool, by the processes now well known, into gun-cotton. For this purpose I prefer to use the cotton in the form of a loose roving. When the gun-cotton has been purified from acid, by washing in running water and in very dilute alkali, I transfer it to a beating-engine of the description commonly used in the manufacture of paper, where it is reduced to a pulp, which is then converted into solid masses, such as sheets, disks, cylinders, and other forms, either perforated or not, by any of the processes ordinarily em ployed for producing sheets, disks, cylinders, and other forms from paper-pulp. A small quantity of gum or other binding material soluble in water may be mixed with pulp.

To obtain any required degree of density of the solid gun-cotton, I subject the mass, while in a moist state, to the action of hydraulic or other presses, or of any other known arrangement of machinery for exerting the requisite pressure on the material. To produce a granular structure, I either cut the sheets, disks, and other solid forms into small pieces of the required size, or I introduce the pulp containing water and a small quantity of the binding material into a vessel, to which a vibrating motion is imparted, whereby the pulp is at once formed into granules of different sizes, which are subsequently sorted, if necessary.

In the above processes, in place of water, other fluids, such as wood-spirit, spirit of wine, ether, or mixtures of those liquids, with or without some binding material soluble in the liquid, may be employed. Instead of forming the whole mass of the gun-cotton into pulp, as described, a portion of the same may be left in the original state, and be mixed with the pulp in such proportions that, when subjected to the requisite pressure, such combination will become a solid conglomerate mass of the requisite density. Such solid gun-cotton, whether formed of pulp only or of pulp mixed with fiber, may also be coated or mixed with soluble gun-cotton, known as collodion, applied in the form of solution. The solidified gun-cotton may also be formed of mixtures of gun-cotton of different composition, the properties of which are well known—that is to say, of gun-cotton which is soluble in mixtures of spirit of wine and ether, and in wood-spirit, alone or mixed with spirit of wine, and of gun-cotton which is insoluble in those liquids; and the mixtures may be produced either by reducing both or only one of the varieties of gun-cotton to pulp, leaving the other in a fibrous state, or by combining them when both are in the fibrous state. Such mixtures may be converted into solid masses, either by the aid of pressure alone (that is, when one or both varieties is or are in the form of pulp) or by making the soluble gun-cotton present in the mixtures serve as a binding material by their treatment with the liquids above named, which act as solvents, in which case the mixtures may be consolidated with or without the aid of pressure.

My before-described invention is equally applicable where other material, such as paper, net, and other textile fabrics are employed in place of cotton-wool to produce the explosive compound known as gun-cotton, such mate-

rials, after conversion by well-known processes, being in all cases wholly or partly reduced to pulp, and treated as hereinbefore described.

Having now described the nature of my invention, and in what manner the same is to be performed, I wish it to be understood that what I claim is—

1. Reducing gun-cotton to a pulp, and consolidating such pulp, with or without the aid of pressure, into the form of sheets, disks, granules, cylinders, or other solid forms, either with or without the admixture of binding materials.

2. Combining with gun-cotton reduced to a pulp, gun-cotton in a fibrous state, and consolidating such mixture into sheets, disks, granules, cylinders, or other solid forms, either with or without the admixture of binding materials.

3. Combining soluble and insoluble gun-cotton, either when both are in a state of pulp, or when one is in a state of pulp and the other in a fibrous condition, and consolidating such mixtures into cylinders, sheets, disks, granules, or other solid forms, either with or without the admixture of binding materials.

4. Subjecting mixtures of soluble and insoluble gun-gotton, either when both are in a fibrous condition or when both are in a state of pulp, or when one only is in a state of pulp and the other in a fibrous condition, to the action of solvents of the soluble gun-cotton, either alone or with the employment of pressure, so as to effect the consolidation of the same.

5. The application to the surface of the consolidated gun-cotton of a solution of the soluble forms of gun-cotton, or of shellac or other suitable gums or resins.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses this 26th day of September, 1866.

F. A. ABEL.

Witnesses:
C. D. ABEL,
THOS. TAYLOR.