

UNITED STATES PATENT OFFICE.

HARVEY W. WILEY, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR
TO THE MARSDEN COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

SMOKELESS POWDER.

SPECIFICATION forming part of Letters Patent No. 673,070, dated April 30, 1901.

Application filed January 11, 1899. Serial No. 701,841. (No specimens.)

To all whom it may concern:

Be it known that I, HARVEY W. WILEY, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Smokeless Powder, of which the following is a specification.

It is well known that the basis of ordinary smokeless powders is nitrated cellulose made, as a rule, from cotton. As gun-cotton is made of nearly pure cellulose, its combustion is so rapid and violent that it is necessary to mix with it some deterrent substance, many different kinds having been employed, and certain oxygen-furnishing bodies are also added to supply the oxygen needed for complete combustion. Without such deterrent substances the powder is too violent, with them the power of the powder is often too much reduced, and in any event the effect is uncertain and irregular, constituting a grave defect when the powder is to be employed for military purposes.

I have discovered that vegetable pith (as, for instance, the pith of Indian-corn stalks, sunflower-stalks, &c., in its natural condition—that is, untreated with alkali or other solvents) contains in uniform and regular quantities certain carbohydrate substances—such as pentosans, ligno-celluloses, and lignins—in such quantities as to constitute the most perfect, effective, and properly-proportioned deterrent that could be desired. Thus the vegetable pith in its natural condition contains about fifty per cent. of pure cellulose and in addition carbohydrates constituting natural deterrent substances in proper proportion to produce the most effective explosive. Further, these natural deterrent substances are themselves of a character capable of nitration, so that they not only diminish the violence of the detonation of the explosive, but themselves store the nitryl element in a form suitable to aid combustion and render it more uniform.

In the usual manufacture of explosives where cotton is not employed it is common to treat the material (wood fiber, pulp, &c.) with alkalis, which have the effect of removing any carbohydrates which would constitute natural deterrents. In nitrating cellu-

lose also it has been the custom to use acid mixtures, which are very expensive and which are dangerous, causing frequent explosions by the heat generated in the process.

My improvement is attended with the great advantage that the material may be nitrated in the novel manner constituting the subject of my application for Letters Patent, Serial No. 671,687—*i. e.*, the nitrate of soda is used in quantities about five times the weight of fiber or pith employed. After saturating and drying, the mass is treated at a very low temperature (secured by immersing the containing vessel in cold or ice water) with eight to twelve grams of sulfuric acid for each gram of pith which has been used. The mass is well mixed with the acid, so as to insure its contact with all parts thereof, and is set aside for from six to twenty-four hours. At the end of this time the nitration is complete. The mass is washed repeatedly in water to remove as much as possible of the free acid, and finally the last traces which are not readily removed by water may be neutralized by a weak alkali, such as carbonate of sodium or barium hydrate. The nitrated mass is then dried and dissolved in the desired reagent. For other grades of nitration or for other purposes the details of the process may be varied; but the essential principles are not altered. The natural pith thus nitrated constitutes of itself a most desirable and effective explosive, safe to handle, not subject to decomposition, capable of preservation for any desired length of time, and uniform in character, while it is safely and easily manufactured from a single natural substance.

I will now proceed to describe certain forms of explosives in which my invention has been embodied, premising the statement, however, that the proportions and nature of the various ingredients employed may be varied and have been varied in the actual manufacture of numerous different varieties of explosives.

1. A smokeless powder prepared from nitrated maize-stalk pith without the addition of any other explosive substance. The nitrated maize-pith is macerated until plastic with a suitable solvent, as ether, acetone, &c.; but amyl acetate has been found to be the best solvent for the purpose. It is then rolled

into a thin sheet and cut into small pieces and dried, or it is molded in any suitable manner.

2. A formula suitable for blasting consists of nitrated maize-pith, eighty parts; barium nitrate, fifteen parts; potassium nitrate, four parts; calcium carbonate, one part. The salts are dissolved in just sufficient water to thoroughly moisten the nitrated pith, and the solution, together with the calcium carbonate, is incorporated with the nitrated pith. The material is dried, ground, and macerated with amyl acetate, as above described. (No. 1.) The plastic mass is rolled into a thin sheet and cut into small pieces and dried.

3. Where greater sharpness of explosion is required, I use the following: Nitrated pith, eighty parts; ammonium trinitro cresylate or picrate, twenty parts; barium nitrate, ten parts; calcium carbonate, two parts. The preparation is similar to that of mixture No. 2.

This formula is varied by using instead of the ammonium trinitro cresylate or picrate the nitro derivatives of the aromatic hydrocarbons, such as trinitro-phenol, tri-nitro-benzol, nitro-naphthalene, &c.

The solvent above referred to is intended to act partially only on the pith, securing a solution which acts as a paste or cement to insure under pressure the adhesion of the undissolved particles, so that they can be formed into a comparatively solid body, retaining its shape and condition.

The proper adhesiveness of the nitrated pith and a convenient density is also secured by subjecting it in suitable quantities to hydraulic pressure, thus securing a highly-useful explosive without any treatment with a solvent or otherwise. The nitrated pith before being subjected to such pressure is ground to a very fine powder or dust.

The "nitrated pith" mentioned in the specification can be defined as follows: The product arising from nitrating the natural untreated pith—that is, pith without preparatory treatment—of the maize or other plant in the manner described, said product consisting of a mixture of di and tri nitrocellulose, the latter predominating, together with the nitrated products of the pentosans and ligno-celluloses present in the natural pith. It contains a percentage of nitrogen varying from nine to eleven.

Without limiting myself to the materials and proportions specified, I claim—

An explosive consisting of a nitrated natural pith composed of nitrated cellulose, nitrated ligno-cellulose and nitrated pentosans, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

H. W. WILEY.

Witnesses:

LAURA B. HOLDERBY,
A. O. VON HERBULIS.