UNITED STATES PATENT OFFICE.

SAMUEL JOSEPH MACKIE, OF WESTMINSTER, ENGLAND.

IMPROVEMENT IN THE MANUFACTURE OF GUN-COTTON.

Specification forming part of Letters Patent No. **141,654**, dated August 12, 1873; application filed May 29, 1873.

To all whom it may concern:

Be it known that I, SAMUEL JOSEPH MACKIE, of No. 3 Delahay street, George street, in the city of Westminster, England, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in the Manufacture of Gun-Cotton; and I, the said SAMUEL JOSEPH MACKIE, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

This invention has for its object improvements in the manufacture of gun-cotton.

It has been before proposed to reduce gun-cotton to a state of pulp by means of machinery such as is used in the manufacture of paper, and which usually consists of a drum revolving in a trough of water. This drum has steel blades on its periphery, which work against other blades fixed in the trough, and the blades shear the fiber between them again and again until it becomes very short. This process is open to the disadvantage that the capillaries of the fiber retain the acid used in its conversion with the greatest obstinacy. The product also is not suitable for granulation, or as to form a preparation which can be used like gunpowder, as the short fiber makes the granules to cling together, so that they will not run from a flask.

The preparation of the gun-cotton by reducing its fibers by the crushing operation into a state of powder, I consider to be an important improvement in my process of manufacture.

Now, according to my invention, in place of cutting up the fiber so as to form a kind of paper-pulp, I crush it to an impalpable powder by crushing-rollers or edge-runners, and so I break down the fiber, entirely destroying its capillaries and tube-like character. In this way, any acid which may have been retained by the fiber up to this point is thus set free, and it can then be washed away without any difficulty. I store the pulverized gun-cotton under water until it is convenient to complete the manufacture, as hereinafter described. I proceed as follows: The gun-cotton, when it has been washed sufficiently to remove all or all but a very small percentage of acid, and for convenience and safety's sake while still moist, is placed in a hopper, from whence it passes through the rolls. It is caught by a lifting-wheel, which returns it to the hopper, and so it is caused to pass through and through between the rolls until it is completely broken down. A tray is then put in over the top of the hopper, and in this way the charge is collected and carried away to the storing-tank. When the powdered gun-cotton is required for use the water is run off, and it takes with it any traces of acid which the cotton may have contained when it was passed through between the rollers.

In place of using a pair of rollers, one roller traveling over a surface or running around a pan, as in an edge-runner mill, may be employed.

The processes required to complete the manufacture are, as will be seen, analogous to those employed in the manufacture of common gunpowder.

I thoroughly mix in an incorporating-mill the gun-cotton after it has been crushed into powder, as above mentioned, with sugar and niter. Suitable proportions are, powdered gun-cotton, 67 parts; sugar, 28 parts; niter, 5 parts. These proportions can be varied, according to the qualities it is desired to develop in the manufactured article. If a slow-burning gunpowder be required I use a larger proportion of sugar and niter, and, on the other hand I increase the proportion of powdered gun-cotton if great disruptive power be a quality required in the manufactured powder. The materials having been thoroughly mixed I granulate the mixture or divide it into small fragments by passing it through wire-gauze, in a similar manner to that in which common gunpowder is separated into grains of various sizes.

The process of drying gun-cotton, and compounds such as are above mentioned, is as follows: I place the material to be dried in a copper or other pan upon a hot plate, kept at a uniform temperature of 100° Fahrenheit, or thereabout. The drying-vessel is inclosed beneath a dome-shaped cover, which is counterpoised so that it can readily be raised and lowered. The cover, when in its place, rests air-tight upon a ring or footing of vulcanized

India rubber, leather, or other such like material, and by opening a cock the space beneath the cover is placed in connection with an exhaust, so that the drying is carried on *in vacuo*, and thereby all danger that could arise from overheating, so as to cause ignition, is practically obviated. This I consider to be an important improvement in my process of manufacture.

Having thus described the nature of my said invention, I would have it understood that what I claim is—

1. The improvement in the art of manufacturing gun-cotton, consisting of the following operations, viz: The treatment of vegetable fiber with acids, so as to transform it into gun-cotton, the crushing of the fiber so as to destroy its capillary structure and reduce it to an impalpable mass, and the granulation of the said mass, all substantially as before set forth.

2. The improvement in the art of manufacturing dry gun-cotton, consisting of the following operations, viz: The production of the gun-cotton in a moist condition, and the drying of it *in vacuo*, all substantially as before set forth.

S. J. MACKIE.

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