(No Model.)

B. S. SUMMERS & C. O. BORING.

ELECTROLYTIC SEPARATION OF VEGETABLE FIBERS.

No. 565,706. Patented Aug. 11, 1896.

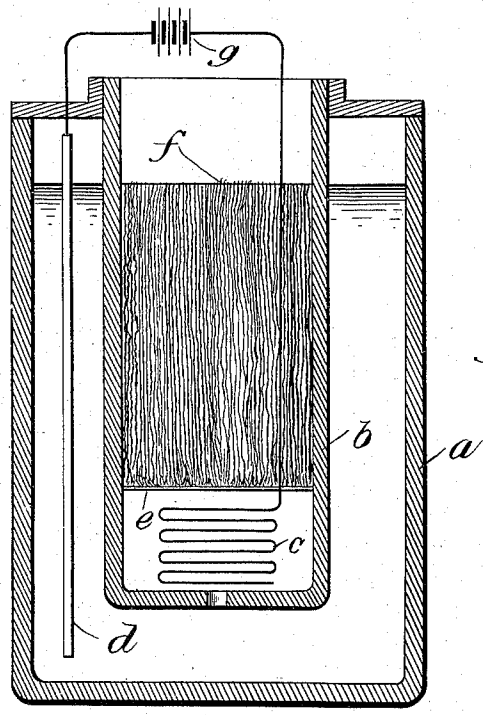

Fig. 1

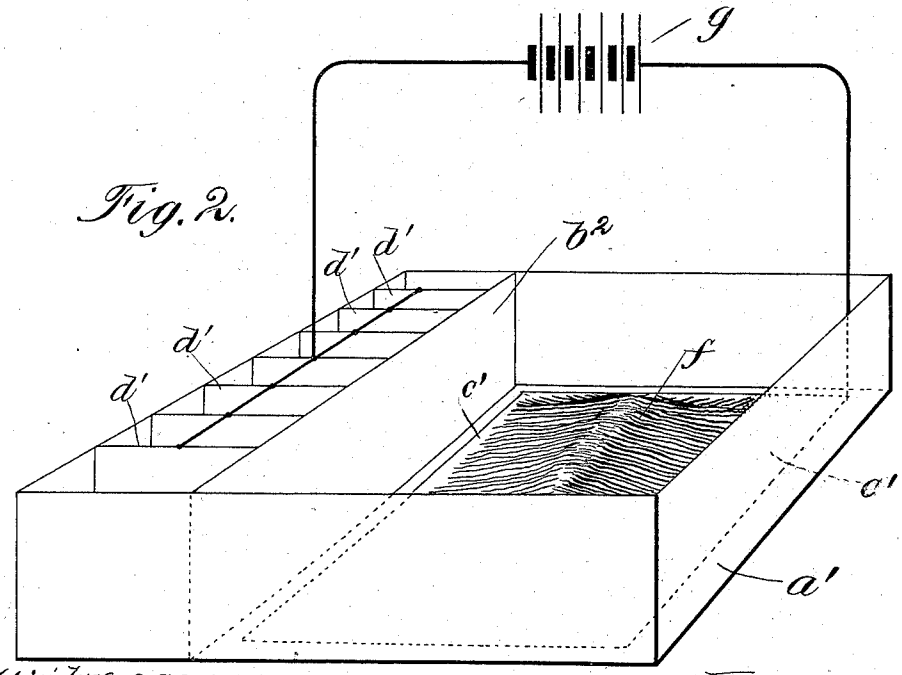

Fig. 2.

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UNITED STATES PATENT OFFICE.

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ELECTROLYTIC SEPARATION OF VEGETABLE FIBERS.

SPECIFICATION forming part of Letters Patent No. 565,706, dated August 11, 1896.

Application filed November 4, 1895. Serial No. 567,847. (No model.)

To all whom it may concern:

Be it known that we, BERTRAND S. SUMMERS and CHARLES O. BORING, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electrolytic Separation of Vegetable Fibers, (Case No. 1,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to the electrolytic separation of vegetable fibers, its object being to provide an improved method and apparatus for degumming vegetable fibers; that is, removing the gluten or cementing material that binds the fibers together, whereby the fibers may be separated and rendered available for use in the manufacture of textile fabrics.

Our invention is applicable to the refining of the fibers of various materials, such as ramie, jute, hemp, flax, and the like. Our invention is particularly applicable to the preparation of the fibers of ramie, china-grass, or rhea, which has heretofore been prepared by a tedious and expensive process that has prohibited its extensive use in the arts. Ramie is a grass which grows quite abundantly in China, and the fibers have heretofore been separated by a so-called "retting process," in accordance with which the stocks of the grass, which are some fifteen to twenty feet in length, are immersed in the rivers of the country and the germs or bacteria of fermentation are thus permitted to take seat in and act upon the gum or gluten that binds the fibers together. After having been subjected for some time to the action of the germs of the water the stocks are removed and placed in piles, where they are permitted to remain for a considerable time and until the germs or bacteria have destroyed the gum or cementing material. The fibers are thus more or less loosened, and after a washing or steaming process and a combing process the fiber is obtained in condition to be spun and employed in the arts. This process, as before stated, is tedious and impracticable for manufacture on a large scale, and hence ramie has been employed in the arts to a very limited extent. The fibers of this material possess remarkable strength and find a ready application in the arts so soon as a cheap and practicable method of separating the fibers is produced. It has also been proposed to effect the degumming of vegetable fibers by mechanical and chemical processes, but by these processes the product has been either costly in production or has not possessed the necessary properties for commercial application. For commercial purposes the fibers must be soft, white, and not impaired in strength. By chemical process the gum cannot be effectually removed without subjecting the fibers to the action of chemicals, which either impair the strength of the fibers immediately or so affect them that they in time become brittle and fall to pieces.

In accordance with our invention the ramie is subjected to electrolytic action in the presence of a solution which is adapted to act upon and destroy the gum or cementing material while not affecting the fibers themselves. In this manner the fibers are left in a separated condition and after being combed are available for use in the arts.

In practicing our invention we have found that the fluorides of the alkaline metals give the best results, the fluorides acting to effectually remove the gum or cementing material, while leaving the fibers themselves intact and in no manner impairing their strength. We have employed sodium fluoride, potassium fluoride, and cryolite for this purpose. We prefer, however, to employ sodium fluoride, as it is not very expensive and possesses the desirable property, as do all of the alkali fluorides, of bleaching the fibers and imparting a desirable white color thereto.

The bath or electrolytic cell which we have employed in practice comprises two electrodes, preferably of platinum, separated by a porous partition. The ramie or other vegetable fiber is placed at the positive electrode. Before placing the ramie in the bath the stocks are preferably subjected to a mechanical process whereby the bark or cortex is first removed, after which the bundles or fascicles of fiber are separated. The bundles of fibers may be placed directly in the bath and the degumming process performed wholly by

the electrolytic action, or a portion of the gum may first be removed by a chemical process, such, for instance, as the immersion of the fibers in caustic soda, after which the partially-degummed fibers may be subjected to the electrolytic action and the thorough removal of the cementing material effected. By the employment of the electrolytic process of our invention the fibers are obtained with a whiteness and softness which has been impossible by chemical processes, which, at most, have been able to remove only a portion of the cementing material and do not produce the fibers in the desirable form in which they are obtained by the hereinbefore-described retting process. By our invention, however, the product is practically the same as that produced by the tedious retting process. By the action of the current heat is produced in the bath, which acts in conjunction with the electrochemical effects to not only remove the cementing material or gum, but also to impart the desired softness to the fibers. When alkali fluorides are employed, a better bleaching effect is produced than when some other fluorides, as cryolite, are employed.

The employment of the fluorides for the electrolytic separation of the fibers of vegetable material we consider the important feature of our invention, as the products resulting from the electrolytic action of these fluorides possess the peculiar property of destroying the gum or cementing material of the stocks, while leaving the fibers themselves intact and in no manner impaired. We have experimented with the chlorids, but find that they completely destroy the fibers themselves, as do, also, in a lesser degree, the bromides and iodides, which, however, are additionally objectionable for the reason that they color or dye the fibers.

We are aware that hypochlorites formed by electrolysis of chlorids in alkaline solution have been used for bleaching, but we are not aware that fluorides have been so used in practice, and we are not aware that a fluorin compound in any form has ever been used for removing the gum and cementing material from vegetable fibers for separating and refining the fibers and imparting a soft texture thereto.

The degumming process of our invention comprehends the employment of a fluoride, that is, a binary compound of a fluoride and a metal, vegetable fibers in their unseparated and unrefined state being immersed in the region of the positive pole in a bath containing a fluoride, the current being then passed through the bath to electrolyze the same and to produce at the positive pole chemical agents having the property of removing the gum or cementing material without impairing the fibers themselves, the portion of the bath at the positive pole in which the fibers are immersed being isolated from the remainder of the bath by a porous partition or septum, which prevents access to the fibers of agents liberated at the negative pole and which may have a neutralizing or otherwise deleterious effect.

We will describe the apparatus employed in practicing our invention, in connection with the accompanying drawings, in which—

Figure 1 is a view of a laboratory apparatus which we have employed in performing the process of our invention. Fig. 2 is a view of apparatus devised for commercial purposes for the separation of the fibers on a large scale.

Like letters refer to like parts in both figures.

Referring to Fig. 1, a casing is provided within which is supported a porous cup *b*. The vessel *a* is filled with a solution of the electrolytic liquor, and an electrode *c*, which may be a piece of coiled platinum wire, is placed within the porous cup, while an electrode *d*, which may take the form of a platinum foil or plate, is placed on the outside of the porous cup. A perforated or porous diaphragm or support *e* is placed within the porous cup, upon which a quantity *f* of ramie or other vegetable fiber to be separated may be placed. The electrode *c* is connected with the positive side of a battery or source of electricity *g* and the passage of the current through the cell produces the destruction and removal of the gum or cementing material of the fiber, leaving the fiber themselves in a free and separated condition, as before described. The process is facilitated by providing a hole or opening in the bottom of the porous cup *b* to facilitate the passage of the liquid. By the employment of this apparatus we have been enabled to complete the process of separating the fibers by the passage of a current of five amperes for from three to four hours.

In Fig. 2 a vat a' is shown, within which is a porous partition b^2, a number of plates or electrodes d' d' being placed upon one side of the partition and connected with the negative pole of the battery or source of electricity *g*, while a plate c' is provided upon the other side of the partition and occupies a horizontal position, being connected with the positive pole of the battery *g*. The ramie or other vegetable fiber *f* is placed upon the face of the electrode c' and completely submerged in the electrolyte.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The herein-described method of removing the gum or cementing material from vegetable fibers and leaving the fibers in a separated and refined condition, which consists in immersing the fibers in their unseparated and unrefined state in the region of the positive pole in an electrolytic bath containing a fluoride, passing a current of electricity through the bath to electrolyze the same, and isolating the chemical agents passing to the positive pole which come in contact with

the fibers from the agents passing to the negative pole; substantially as and for the purpose set forth.

2. The herein-described method of removing the gum or cementing material from vegetable fibers and leaving the fibers in a separated and refined condition, which consists in immersing the fibers in their unseparated and unrefined state in the region of the positive pole in an electrolytic bath containing a fluoride of the alkaline metals, passing a current of electricity through the bath to electrolyze the same, and isolating the chemical agents passing to the positive pole, which come in contact with the fibers, from the agents passing to the negative pole; substantially as described,

In witness whereof we hereunto subscribe our names this 29th day of October, A. D. 1896.

BERTRAND S. SUMMERS.
CHARLES O. BORING.

Witnesses:
DE WITT C. TANNER,
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