(No Model.)

B. S. & L. L. SUMMERS.

ELECTROLYTIC PROCESS OF BLEACHING AND REFINING.

No. 569,680. Patented Oct. 20, 1896.

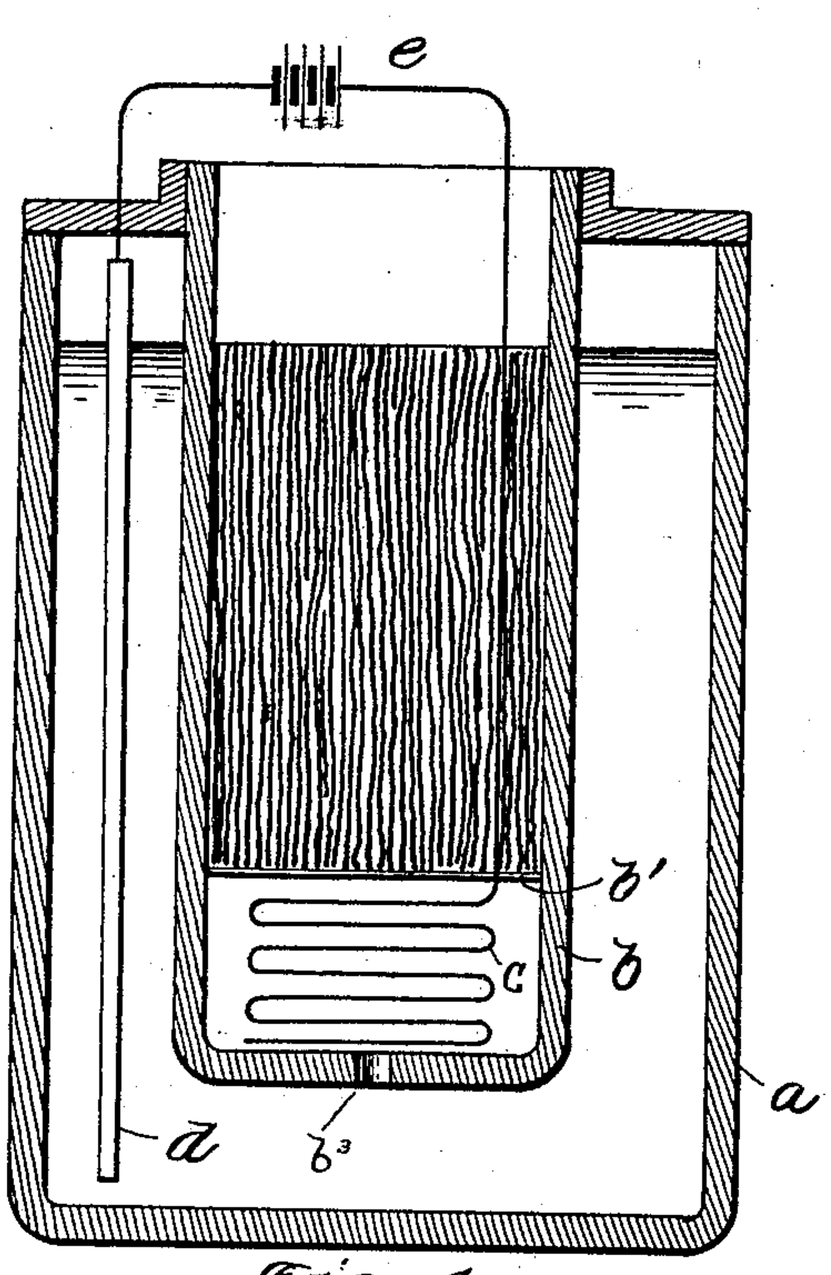

Fig. 1

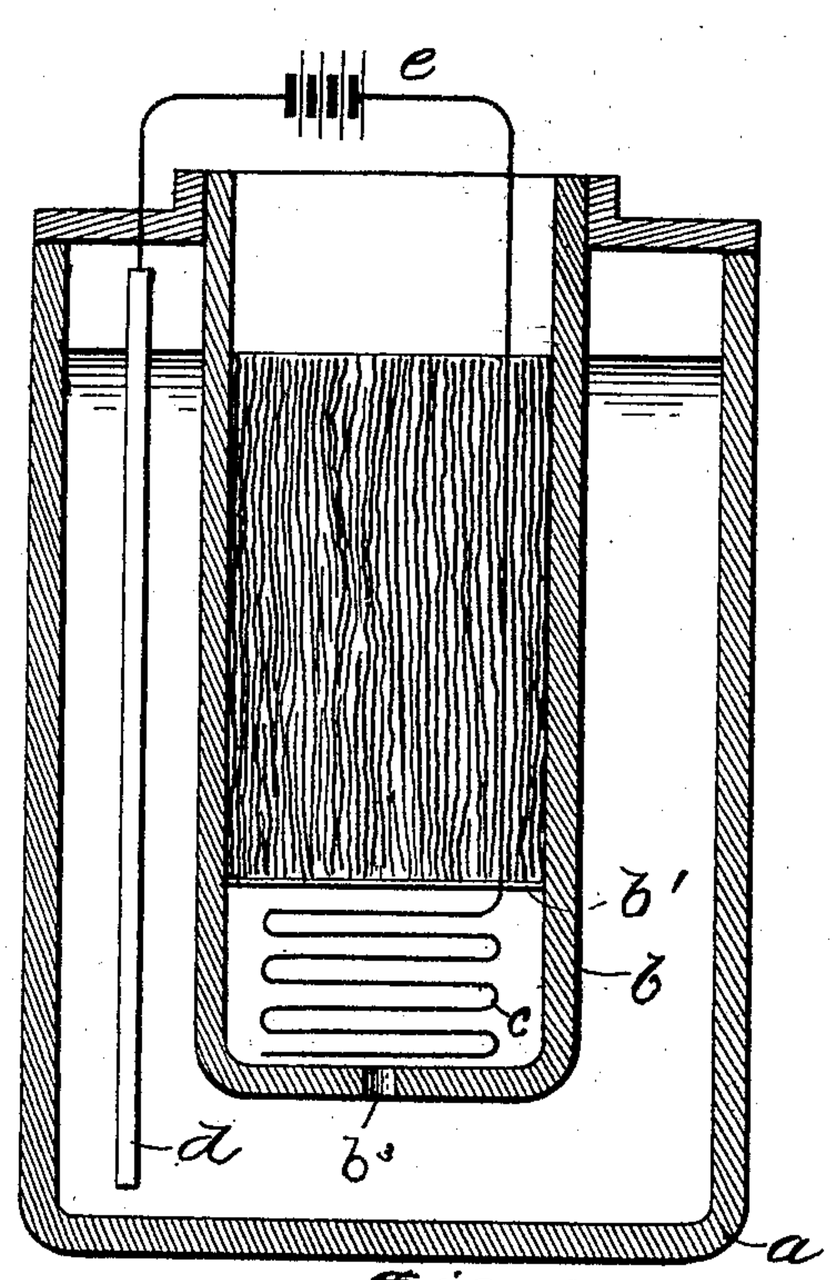

Fig. 2.

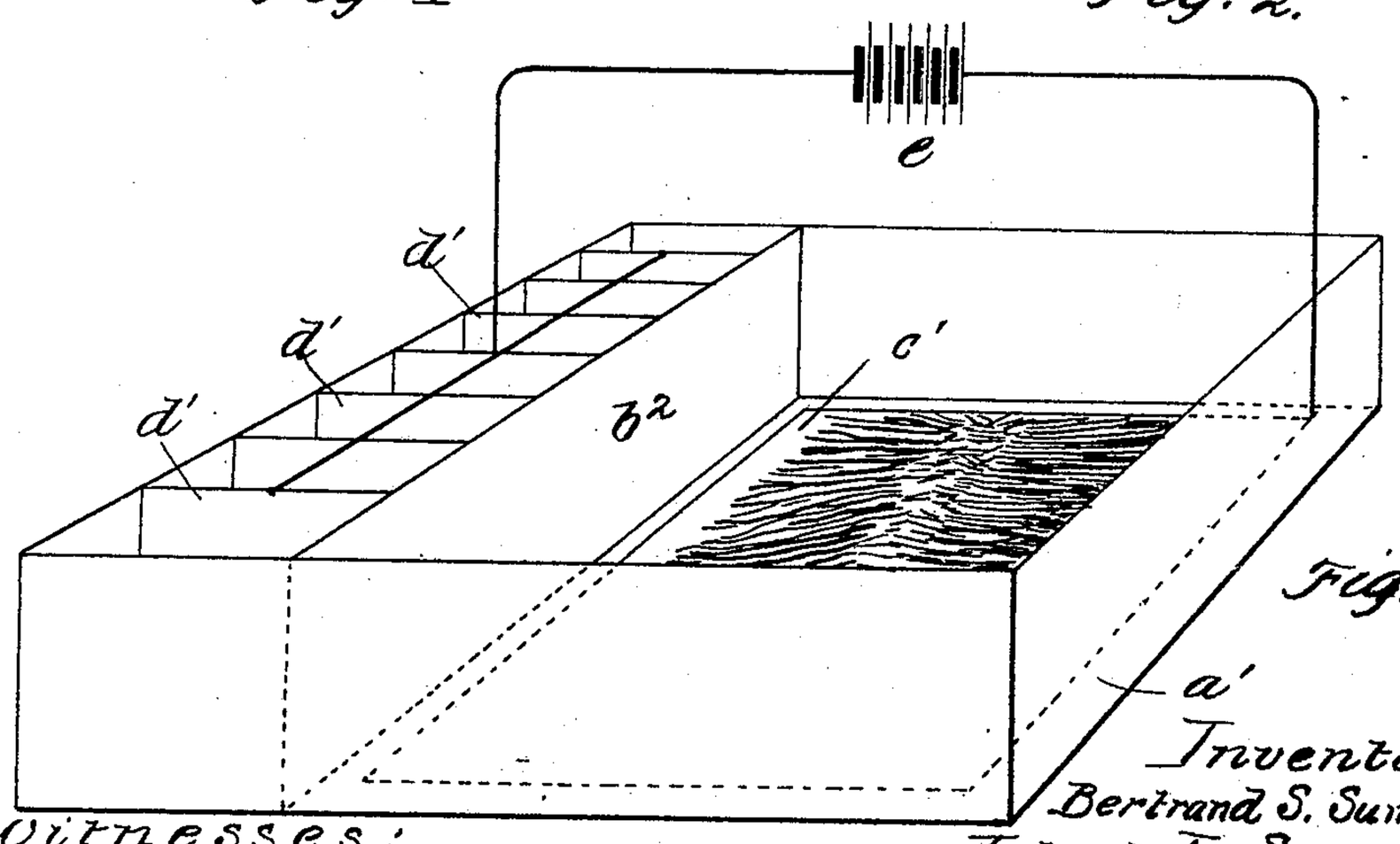

Fig. 3.

Witnesses:
H. C. Fennel.
W. Clyde Jones.

Inventors:
Bertrand S. Summers,
Leland L. Summers,
By Barton & Brown
Attorneys.

UNITED STATES PATENT OFFICE.

BERTRAND S. SUMMERS AND LELAND L. SUMMERS, OF CHICAGO, ILLINOIS.

ELECTROLYTIC PROCESS OF BLEACHING AND REFINING.

SPECIFICATION forming part of Letters Patent No. 569,680, dated October 20, 1896.

Application filed November 29, 1895. Serial No. 570,394. (No specimens.)

To all whom it may concern:

Be it known that we, BERTRAND S. SUMMERS and LELAND L. SUMMERS, 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 Bleaching and Refining Processes, (Case No. 2,) 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 an electrolytic bleaching and refining process, the object of our invention being to provide an improved method of bleaching and refining various fibers and materials employed in the arts without impairing the strength of the materials, and, furthermore, to provide an improved process of degumming, bleaching, and refining the vegetable fiber known in the arts as "ramie" or "china-grass."

Various substances have been chemically employed heretofore for bleaching purposes, most notably chlorin, sulfur, and the caustics; but these processes of bleaching are not satisfactory, as the bleaching agents thereof are so active that unless certain precautionary measures be adopted, entailing time and labor, the action is such as to affect the strength of many fibers or materials, either by producing immediate disintegration or by so impairing the strength that after a short lapse of time the fibers fall to pieces.

We have discovered that certain chemical agents, such as the commercial hydrates, will, when electrolyzed, yield bleaching agents at the positive pole in a solution giving an alkaline reaction at the positive pole. The presence of the alkaline solution at the positive pole results in a very effective bleaching action, which, however, with certain fibers may produce a destructive action, and to prevent this certain agents may be used, which, however, may cause the production of a reaction at the positive pole neutral or even acid in character, as, for instance, when a fluoride is added to the bath. We have employed sodium fluoride, potassium fluoride, and cryolite. By varying the strength of the current a reaction, resulting in either an acid or an alkaline solution at the positive pole, may be produced, and this result is obtained even when the quantity of fluoride is small as compared with the quantity of hydrate. In practice the quantity of each and the strength of the current are so proportioned as to maintain the acid reaction at the positive pole.

We have successfully employed various of the alkaline hydrates for bleaching purposes after the manner of our invention, but in practice preferably employ sodium hydrate (NaOH) on account of its cheapness.

We have employed commercial hydrates in practice and find that the resulting reactions produce agents having a destructive effect upon the material to be bleached, and to prevent this we add a fluoride to the bath, as above described.

The solution of the hydrate is placed in the electrolytic cell and the positive and negative electrodes are immersed in the solution, the material to be bleached being immersed in the solution in the vicinity of the positive pole. A porous partition or diaphragm is interposed between the two electrodes, which for best results should be non-permeable to diffusive action, while readily pervious to the electrolytic action. The solutions resulting from the electrolytic action are thus confined to their respective poles, and the solution present at the negative pole is thus prevented from coming in contact with the material to be bleached, and thereby diminishing the desired electrochemical action upon the material to be bleached, which is immersed in the solution at the positive pole. The bleaching process as thus practiced is very active, and the time during which the material is subjected to the bleaching process must be carefully determined, as too long a subjection to the bleaching process may affect the material. We have discovered, however, that if a fluoride solution be added to the hydrate bath the tendency to affect the strength of the material on extended or continued subjection of the material to the bleaching process is removed, the fluoride possessing the property of counteracting the destructive effect of the bleaching agents. The quantity of the fluoride need not be great and may be determined for the particular material to be bleached by experiment.

The process, as above described, is adapted for the bleaching of any of the materials, such

as pulps, cloths, the animal and vegetable fibers, and, in fact, any of the substances that are usually bleached in the arts, and is particularly applicable to those materials the fibers of which are easily attacked and are either destroyed or impaired by such bleaching agents as are commonly used in the arts.

We are aware that caustic potash and caustic soda have been employed for chemically bleaching materials, the bleaching being due to the direct chemical action of the hydrate on the coloring-matter; but by the present electrolytic process it is not the hydrate in itself that effects the bleaching process, but the products liberated therefrom by the electrolytic action, and we find that the same hydrates have a very different effect when employed for electrolytic bleaching from that which they have when employed for chemical bleaching.

We find our process particularly adapted to the preparation of the fibers of ramie or china-grass, which possess a remarkable strength when properly prepared, but which are very susceptible to the action of bleaching agents and are readily weakened thereby. Some bleaching agents have the effect of immediately destroying the fibers, while others so impair them in strength that after the lapse of a short time they disintegrate and fall to pieces.

In an application filed by Bertrand S. Summers and Charles O. Boring November 4, 1895, Serial No. 567,847, an electrolytic process of removing the gums and cementing material from the fibers of ramie and other vegetable fibers is described, according to which process the fibers are subjected to the action of a fluoride bath.

We find that by the employment of the bleaching process of the present invention in connection with the degumming process of the above-mentioned application a better product can be secured than by the employment of the said degumming process alone. In practicing the invention we may first subject the ramie fibers to the hydrate bath, which also has the property of removing a large proportion of the gum or cementing material, the fibers being thus separated and bleached. After the fibers have been subjected to the hydrate bath they may be removed and immersed in the fluoride bath and the process completed. It is preferable when the invention is thus practiced in separate baths to place a small quantity of the fluoride solution in the hydrate bath in order that the fibers may not be impaired in strength by the action of the bleaching agents.

When the fibers are removed from the hydrate bath, it will be found that they are somewhat harsh, and not soft and delicate, as is desirable. After placing in the fluoride bath, however, the harshness will be found to be completely removed, the fluoride bath, when employed with the hydrate bath, serving to refine the fibers, either by the further and complete removal of the gum or cementing material or by the removal of the silica or other substances which may remain in the fibers.

Instead of employing separate hydrate and fluoride baths the two may be combined, and instead of adding only sufficient fluoride solution to the hydrate bath to prevent the destruction of the fibers during the bleaching process a sufficient quantity of the fluoride may be added to effect the complete refining and softening of the fibers, the complete process of degumming, bleaching, and refining the fibers being thus effected in the single bath. We prefer, however, to employ separate hydrate and fluoride baths, as better results are obtained thereby.

We have illustrated the apparatus for practicing our invention in the accompanying drawings, in which—

Figure 1 is a view of an experimental apparatus which we have employed for bleaching purposes. Fig. 2 is a view of apparatus which we have employed for the refining process. Fig. 3 is a view of apparatus as designed for practical use.

Like letters refer to like parts in the several figures.

Within a jar or retaining vessel a is supported a porous cup b. Within the cup b, having an opening b^3 in the bottom to lower the electrical resistance of the bath and to maintain the level of the liquid the same upon the inside and the outside of the cup, is supported a partition b', beneath which is the positive electrode c, the negative electrode d being immersed in the solution upon the exterior of the porous cup. The positive and negative electrodes are connected with a source of electricity e, and the electrodes are immersed in the bleaching solution, in practice a solution of sodium hydrate. The material to be bleached is supported upon the shelf b' or maintained in an immersed position in any convenient manner in the solution within the porous cup. When current is passed through the cell, the bleaching agents are liberated at the positive pole, and thus come in contact with and act upon the material to be bleached.

In Fig. 2 we have illustrated a cell similar in all structural details to that illustrated in Fig. 1, and this cell may be employed for the refining process, a fluoride bath being provided in the cell, to the action of which the fibers are subjected.

In Fig. 3 we have illustrated a vat a', divided into two compartments by a porous partition b^2, the positive electrode c' being in the form of a large plate occupying a horizontal position, upon which the material to be bleached may be laid or in the vicinity of which it may be suspended. A number of negative electrodes d' d' are provided upon the opposite side of the partition b^2, the electrodes being connected in circuit with the source of electricity e.

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

1. The herein-described method of bleaching, which consists in immersing the material to be bleached in the region of the positive pole in an electrolytic bath containing a hydrate and a fluoride, passing a current of electricity through said bath, and isolating the chemical agents passing to the positive pole which come in contact with the material to be bleached from the agents passing to the negative pole, substantially as described.

2. The herein-described method of bleaching by which the deleterious effects of the bleaching agent are prevented, which consists in immersing the material to be bleached in an electrolytic bath containing a fluoride and a material yielding a bleaching agent when electrolyzed, and passing a current of electricity through said bath, whereby the fluoride acts to prevent deleterious action upon the material being bleached, substantially as described.

3. The herein-described process of degumming, bleaching and refining vegetable fibers which consists in first subjecting the same to the influence of a combined hydrate and fluoride bath, passing a current of electricity through said bath, and then subjecting said fibers to the influence of a fluoride bath, and passing a current of electricity through said fluoride bath; substantially as described.

4. The herein-described process of degumming, bleaching and refining vegetable fibers which consists in subjecting the same to the influence of a bath containing sodium hydrate and a small quantity of a fluoride, passing a current of electricity through said bath, and then subjecting the fibers to the influence of a fluoride bath, and passing a current of electricity through said bath; substantially as described.

In witness whereof we hereunto subscribe our names this 22d day of November, A. D. 1895.

BERTRAND S. SUMMERS.
LELAND L. SUMMERS.

Witnesses:
W. CLYDE JONES,
GEORGE L. CRAGG.