UNITED STATES PATENT OFFICE.

GEORGE ESCOL SELLERS, OF SELLERS' LANDING, ILLINOIS.

IMPROVEMENT IN PREPARING VEGETABLE FIBER FOR PAPER-STOCK.

Specification forming part of Letters Patent No. **41,101**, dated January 5, 1864.

To all whom it may concern:

Be it known that I, GEORGE ESCOL SELLERS, of Sellers' Landing, Hardin county, in the State of Illinois, have invented certain improvements in the mode of freeing disintegrated vegetable fiber from its adhering non-fibrous matter in preparation for white-paper stock; and I hereby declare the following to be a full and exact description thereof.

The object of my invention is the removal of such portions of non-fibrous matter as still adhere to or incrust vegetable fibers after they have been disintegrated or separated, and to prepare the fiber for making white paper in a cheaper, better, and more thorough manner than has heretofore been done.

The nature of my invention consists in loosening or changing the nature of the incrusting or adhering non-fibrous matter by fermentation, and then washing the same from the fiber, leaving it in a condition to be bleached with a less amount of chlorine than would have been required had not the fiber been first submitted to this fermenting and washing process, and in cases where the disintegration has been effected by so high a temperature as to have discolored and hardened the incrusting or adhering material in so great a degree as to render fermentation too tedious and expensive the use of chlorine and its resulting hydrocloric acid combined with heat as a solvent, and then washing previous to bleaching.

In order to render the process clear to any practical workman or paper-maker, I will describe the same and the manner I use it for the fiber of cane, (*Arundinaria macrosperma*,) the same being applicable to any other vegetable fiber.

I take the fiber of cane, as prepared by my process patented November 10, 1863, No. 40,576. After all the non-fibrous and gummy matters have been as thoroughly removed as they can be by that process there still remains attached to, enveloping, or incrusting the fibers small portions of the non-fibrous, resinous, or gummy coloring-matter of the plant. In this condition I place the fiber, taken wet from the washing-engine, into vats provided with loose or movable tops or covers, false bottoms, and the usual arrangement for draining. In these vats I steep the fiber in water of about 80° Fahrenheit, which temperature, or thereabout, is maintained by a coil of steam or hot-water pipes under the false bottoms, or, which I prefer, by a stream of heated air forced under the false bottom through jets or small holes arranged so as to distribute the air under the fiber in the vats. The air in escaping through the fiber not only maintains the heat, but furnishes oxygen, which greatly assists the fermentation. In from six to ten hours after the fiber has been placed in the vat, as above described, a natural fermentation commences, and large quantities of gas escape from the vats. During this fermentation the water or liquid in the vats becomes colored, varying from a light yellow to a dark brown, and gummy matter rises to the surface, which, if in large quantities, should be removed by skimming. If this gummy matter should be allowed to remain floating in the vats, a rapid growth of mold takes place thereon. If fermentation is continued for too long a time, putrefaction takes place, which in time would destroy the fibers or greatly waste them away. The object being to free the fibers from the non-fibrous adhering and coloring matter and preserve them in their utmost integrity, I take care not to allow the fermentation to proceed too far. These adhering matters are loosest and most easily removed at the time that gas is escaping in the greatest volume, or when it has reached its maximum and has begun to decrease. This is generally within twenty-four hours after fermentation has commenced. At this stage of the operation I draw off the liquor from the vats, and then wash from the fiber the non-fibrous coloring-matter that has now become loosened by means of copious showers of water thrown on the fiber in the vats, drawing off the fluid that percolates through the mass by pumps, which at the same time exhaust the air from under the false bottoms, greatly quickening the washing process. I then again fill the vats with water and repeat the operation.

There is an advantage and saving of time in starting the fermentation with yeast, such as is used by distillers, or by a small quantity of the expressed juice or sap of the cane, or other vegetable substance under treatment, in a state of fermentation when put into the vats.

I find that after every successive fermentation and washing fermentation is more tardy. I therefore resort to artificial means to quicken the operation, the best and cheapest that I

have used being a wort made from Indian corn. In practice I find that the wort from about fifty pounds of corn-meal is sufficient to wet down two thousand pounds of fiber. A second fermentation and washing remove so much of the non-fibrous matter that the fibers are bleached with a very low percentage of chlorine, and without the use of alkalies or other chemical solvents. The fibers are also preserved in greater integrity and strength than when powerful chemical solvents are used.

The action produced by fermentation and wasting not only removes from the fiber a considerable portion of the incrusting or attached non-fibrous matter, but produces such a change in what remains as to render it easily acted on by chlorine, and this often when producing but little change in the color of the fiber under treatment until it has been acted upon by chlorine, or has been exposed to the action of the sun, which readily bleaches it after being properly fermented and washed.

When cane has been overheated in the process of disintegration, or had become so dry before steam-washing and volatilizing the sappy portions, in the manner set forth in my patent of November 10, 1863, No. 40,576, as not to have derived the full benefit of the volatilization, the fermentations and washings required to remove the adhering non-fibrous portions may become too numerous or prolonged and consequently too expensive. In this case the process well known to all bleachers of boiling or bucking in a solution of caustic alkali can be used to great advantage in removing the non-fibrous matter that by heat has become colored, hardened, and more firmly incorporated with or attached to the fibers. When bucking or boiling in caustic alkali is resorted to it produces better results in open vats or boilers than when closed and under pressure, and with less waste or shrinkage of the material under treatment. This I attribute to certain principles in vegetable substances, which, when dissolved or softened by boiling with alkali, are volatilized and pass off in the steam, emitting a strong, pungent, and sickening odor.

I prefer, however, when this state of the material exists and the fermentation does not act with sufficient rapidity, to drain off the fermented liquid and replace it with a weak aqueous solution of chlorine. From $\frac{1}{4}^{\circ}$ to $\frac{1}{2}^{\circ}$ of Baumé is sufficient. Keeping the mass thoroughly agitated until the chlorine is spent, or nearly so, I then raise the temperature to the boiling-point without removing the resulting acid liquor, and allow it to boil for about one hour. I then draw off the liquor and wash out first with hot and afterward with cold water, and then bleach in the usual manner. Chlorine used in this manner is a better solvent for the incrusting or adhering non-fibrous matter than caustic alkali, and is less injurious to the texture of the fiber. All the non-fibrous matter that still adheres to the fibers after disintegration by my process, as per Patent No. 40,576, and the separation therefrom of the substance I have called "arundine" in said patent, may be successfully removed by this process of partial bleaching with chlorine, and then boiling and washing with hot water. The action of chlorine and its resultant acid converts this non-fibrous matter into a deliquescent substance, which may be easily removed by washing. The remaining bleaching is then effected with a smaller amount of chlorine than if the material were treated with chlorine without this intermediate washing, and the fibers are preserved with more firmness and consistency, and in a condition better adapted for making white paper. I never resort to this treatment, however, if the fiber and its incrusting or adhering non-fibrous material are in a condition to be acted upon, with sufficient economy as to time, with ferments, as fermentations and washings leave the fiber softer, more silk like, and altogether in a better condition for making strong, pliable paper than any other process.

It is evident that fermentation may be produced in various ways. I have described the above as the mode I prefer; but I do not limit myself to this. The same results may be produced without immersion in water. For instance, the disintegrated fibers may be placed on racks in a fermenting-chamber similar to the chamber or chest used for bleaching rags with chlorine gas, so arranged that a current of moist heated air may be made to pass under, through, and around the mass, maintaining a proper degree of heat and moisture. When such a chamber is used the first sensible phenomenon observed in the operation is a fine dew collected on all the points of the exposed fiber. This appears very shortly after closing the chamber if the fiber has been placed in it in a wet and warm state. Next there is a slight smell of fermentation, which is quickly followed by a delicate growth of white mold, starting from the specks of dew or moisture. The growth of this mold is very rapid, often reaching an inch in length in a few hours. The mold then falls into a more compact mass and passes through various changes of color until it becomes a dark green. Then commences a rapid production of animalculæ, which in time destroy the fiber, and the entire mass becomes converted into a brown mold similar to rotton wood.

The operation, as I have thus described it, is carried on to absolute destruction and through a period of several months, the object being to take advantage of the natural processes of decay, which appear to attack first the non-fibrous portions of vegetable substances. I have tried all the various stages, and find, the best practical results, everything being considered, to be obtained by washing out at that stage when the white mold on the outside of the fiber begins to mat into a solid mass and to show specks of a yellowish-brown color. At this time the mold through the mass has a yellowish tinge somewhat the color of the fiber under treatment. When taken at this stage I

find the incrusting or adhering matter is easily removed by washing, or has been so changed that bleaching is then effected with about the same amount of chlorine that is required when the fiber has been treated by the first process above described. I consider this state as analogous to that which is produced when the gas is passing off freely, as mentioned in said first process.

The process last described may be preferred by some, as only requiring one treatment and one washing. The heat never exceeding 110° Fahrenheit, the expenditure for that purpose is trifling. The time required is from forty-eight to seventy-two hours.

I am aware that there is no novelty in fermenting vegetable fibers for the purpose of disintegration, it being almost universally practiced to separate the fibers of hemp and flax from the woody stem or boon. It is also extensively used by the natives of Asia, Africa, and South and Central America in separating many vegetable fibers for textile purposes, and in their preparation for sun-bleaching. Fermentation or souring was and still is used in bleaching textile fabrics. Fermentation or rotting was formerly practiced to soften and prepare rags for being reduced to paper-pulp by pounding or beating in mortars; but I am not aware that the process has been either known or used for the purpose of loosening or separating the non-fibrous material that still incrusts or adheres to vegetable fiber that has been previously disintegrated and separated into its ultimate fibers by other processes, combined with washing, and then treating with chlorine, for the purpose of preparing such vegetable fiber for making white paper.

Chlorine and its compounds have been used in a great variety of ways; but I am not aware that it has ever been used as a solvent, combined with heat and washing, to remove the incrusting or adhering non-fibrous matter from the ultimate vegetable fibers that have been first separated by any process involving heat at so great a degree as to have discolored and hardened this non-fibrous matter.

Having thus described my invention as to its object, nature, and theory of operation, what I claim as new, and desire to secure by Letters Patent, is—

1. The preparation of disintegrated vegetable fiber for white-paper stock by the removal or change in the nature of the incrusting or adhering non-fibrous matter by fermentation and washings previous to bleaching with chlorine, substantially as described.

2. The use of chlorine as a solvent for the non-fibrous portions of vegetable substances that have become discolored and hardened by heat in the process of disintegration, combined with boiling and hot-water washing to remove them from the fiber previous to bleaching, substantially as described.

GEO. ESCOL SELLERS.

Witnesses:

PHILIP M. PRICE,

WILLIAMS OGLE.