A. ROCK.

Process and Apparatus for Separating and Collecting Tufted Fiber from Cotton-Seed Hulls.

Patented Feb. 2, 1875.

No. 159,455.

Fig. 1.

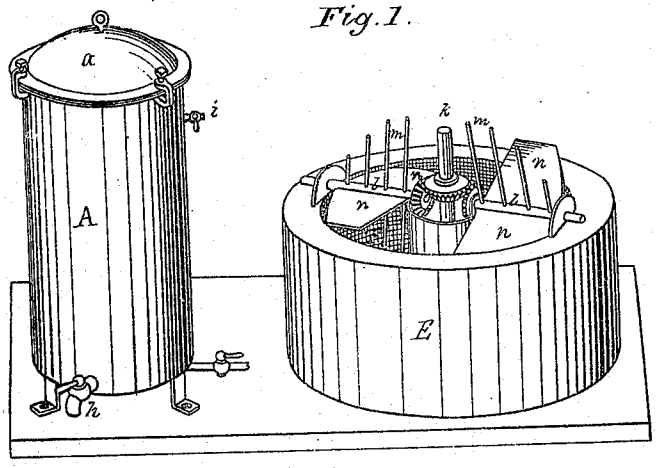
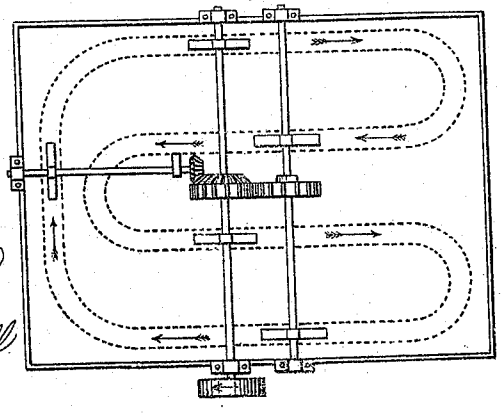


Fig. 4.

Fig: 2

Fig. 3.



Witnesses.

Philip A. Garner

A. B. Cauldwell

Inventor.

Adolphe Rock,

By Munn & Co

Attorney.

UNITED STATES PATENT OFFICE.

ADOLPHE ROCK, OF NEW ORLEANS, LOUISIANA.

IMPROVEMENT IN PROCESSES AND APPARATUS FOR SEPARATING AND COLLECTING TUFTED FIBER FROM COTTON-SEED HULLS.

Specification forming part of Letters Patent No. **159,455**, dated February 2, 1875; application filed January 4, 1875.

To all whom it may concern:

Be it known that I, ADOLPHE ROCK, of the city of New Orleans, in the parish of Orleans and State of Louisiana, have invented a certain new and useful Process and Apparatus for Separating the Tufted Fiber from the Hulls of Cotton-Coated Seeds of the Cotton-Plant, whereby a novel product is attained; and I do hereby declare that the following specification, taken in connection with the drawings herewith, forming a part of the same, is a clear, true, and accurate description of the several features of my invention.

It is well known that ever since the practical application of processes and apparatus for removing from fiber coated cotton-seed its oil-yielding components there has been a waste product in the hulls of the seed. The hulls of the cotton-coated seeds have been variously heretofore treated for the purpose of separating therefrom the fiber not previously removed by ginning and other analogous mechanical means. Numerous attempts have heretofore been made to separate the fiber adhering to the hull by the application of the general principles of trituration. That all attempts in this direction have thus far been practically futile will be readily comprehended when it is remembered that the hull has greater strength, weight, and bulk than the mass of fiber, and that all mechanical attacks on the hull must, if the hull be disintegrated, obviously result, also, in a corresponding disintegration of the fiber. The minute disintegration of both fiber and hull, attendant upon such operations, render the fiber of little value for paper-stock, and practically worthless for use in the textile arts. When employed in paper-stock the fiber is found to possess but little, if any, staple, and the presence of the fine particles of hull break the continuity of the laid pulp in the paper. For entirely separating the fiber from the hulls a variety of processes have heretofore been proposed, and to some extent employed, involving the use of water (cold and hot) for dissolving the simpler resinous gums, and also alkaline solutions (both hot and cold) for attacking those gums and resins, which are not soluble in water. So far as I have been able to learn, no process has ever been proposed or practiced prior to my invention which could, by any possibility, preserve the fiber, practically, intact, and maintain in it the tufted characteristics originally possessed by it when on the fragment of hull. In other words, certain mechanical operations incident to and forming a part of all processes heretofore known to me in this connection have necessarily resulted in injury to the fiber.

The mechanical operations to which I refer, without naming all of them, will be readily comprehended when I cite as instances thereof the "Oval Troughs of Paper-Mills," the "Beaters in Pulping-Machines," and rapidly-revolving drums inducing triturative currents of water, all of which introduce the element of mechanical force for detaching the fiber from the hull, and in proportion to the degree of this force employed the fibers are more or less injured. The mere retention of the tufted characteristics of the fiber has a value in that it is evidence that (other desirable conditions having been filled) the fiber is intact, and possesses the same staple that it had on the hulls after leaving the gin. It has a more practical value (the strength of the fiber not having been impaired) in that it is in a favorable condition for treatment by operations analogous to carding, whereby that portion of the fiber which is of value in the textile arts may be subsequently separated from that greater portion which has value mainly in the art of paper-making. The retention of the tufted characteristics of the cotton has also great practical value, in that, were it not for practically maintaining the tufted form, a good proportion of the aggregate weight of the fiber would be lost, because a good proportion thereof, being very light and short, would necessarily be uncontrollable during the several operations, and would pass away beyond recovery. Moreover, the tufted mass of fiber may be readily matted, and therefore be capable of being presented to an opener or breaker in a lap-like form, which would be practically impossible if the fibers were detached one from the other, and themselves disintegrated during the process by which the disintegration of the hulls was effected.

With this brief recital of the state of the art, as understood by me, I will state that the object of my invention is to effect a complete separation of the fiber from the hull without materially impairing the integrity of the fiber, and to present it for market in a tufted form never before attained, as I believe; and my invention partially consists in a novel process the several steps in which consist, first, in subjecting the coated hulls, while confined and incapable of motion, to the filtering or percolating effects of boiling water and steam pressure; second, after said treatment, in subjecting the same, when so confined, to percolative contact with a weak alkaline solution; third, in washing the same, when unconfined, in water, to which motion is given to a degree which will simply overcome the gravitating tendencies of the tufts of fiber while permitting the particles of hull to precipitate. My invention further consists in a novel apparatus for treating the coated hulls, in which the essential elements are, first, an inclosing-vessel with a false perforated bottom and a steam-tight detachable head; second, an interior basket having inner and outer perforated sides, between which an annular space is formed for the reception of the hulls; third, a vomiting-tube located within the interior space surrounded by the inner wall of said basket; and, fourth, steam-pipes for inducing ebullition. These four elements combined constitute as a whole the best embodiment known to me of this portion of my invention for chemically treating the coated hulls, and which apparatus I term a "digester." In this apparatus, as a special novel element, my invention further consists in providing the vomiting-tube with a steam-pipe which extends from the bottom to its top, thence, by a bend on itself, returns downward to a point near the bottom, at which point it emits steam into the digester, whereby a great heating-surface is afforded, the movement of the vomiting stream greatly accelerated, and a desired volume attained. The combination, with a tank and vomiting-tube, of a removable basket for containing the hulls also constitutes, as I believe, a novel feature of my invention, and it has a special value in that it admits of placing the hulls into the tank or digester, and removing them without subjecting them to any manipulation which would tend to destroy the tufted characteristics of the fiber.

That portion of my invention which relates to the apparatus further consists in the combination, with an exterior water-tank, of an interior stationary receiver having finely-perforated walls, and mechanical apparatus for keeping the water within the receiver in motion, whereby the particles of hull on leaving the tufts of fiber are precipitated or flowed from the receiver through the perforated bottom and side walls into the tank wherein, by reason of the absence of agitation, they may be speedily precipitated.

To further describe my invention, I will refer to the drawings, in which—

Figure 1 represents, in perspective, an apparatus embodying my invention. Fig. 2 represents the same in lateral vertical section. Fig. 3 represents a modification of the washing apparatus. Fig. 4 represents a partially matted mass of the tufted short fiber produced under my process.

In each instance, A denotes the digesting-tank. It is similar in its general aspects to tanks long employed in connection with the art of bleaching cotton and its fabrics. It is provided with a detachable cover, *a*, capable of closing the tank with a steam-tight joint. The false bottom at *b* is perforated, as in ordinary vomiting-tanks. The basket B is composed of the inner wall *c* and outer wall *d*, both composed of wire-cloth or perforated sheet metal, and both cylindrical in form, the annular space between the two constituting the receptacle for the fiber-coated hulls. The upper end at *e* is also perforated, and may be detachable or otherwise. I prefer that the bottom at *f* be detachable, in order that, when the basket is taken out, by means of hoisting-tackle and the bail *g*, the contents may be readily discharged by removing the bottom. For filling it with fresh seed-hulls it may be placed on its upper end, closed by attaching the pin-clamp at the lower end, and placed in position by means of the tackle referred to. The dimensions of the tank and basket may be varied, with capacity for containing from one hundred to one thousand pounds of the coated hulls. The central vomiting-tube C is in itself like others heretofore employed. The novel feature in this connection is the steam-pipe D, which extends from the bottom to the top of the tube, or slightly above it, and then by a bend upon itself is returned to a point near the bottom. The downward pipe D terminates in, and communicates with, a star pipe, horizontally located in the water-space below the perforated false bottom of the tank, and steam is constantly discharged therefrom at various points, either at open ends of the several branches of the star-pipe, or through perforations provided for that purpose.

As heretofore constructed, the pressure induced by heating the water below the false bottom causes the vomiting stream to continuously move upward in the vomiting-tube. This is effected with but little difficulty when the space on all sides of the tube, between it and the inner walls of the tank, is filled with cloth or other matter to be operated upon. In this instance a free lateral, as well as vertical, percolation is sought, and therefore water-spaces are essential between the outer walls of the basket and the inner walls of the tank, and also between the inner wall of the basket and the outside of the tube, and to effect a complete circulation of water I produce a downward current in said water-spaces, and an upward current in the vomiting-tube. This

result could not be attained if a uniform pressure upon the water beneath the false bottom were relied on, for the water would then have a tendency to rise at all points of the unobstructed water-space. To accomplish this upward current in the water-space within the tube, I provide the vomiting-tube with the steam-pipe D, which presents an extensive heating-surface at the center of the tube by reason of its double length, and it maintains the water in the tube at a higher temperature than it is elsewhere, securing thereby, when operating in conjunction with the steam discharged from the pipe at the bottom of the digester, a copious upward flow, necessarily inducing downward currents in both water-spaces.

The novel characteristic feature of the operation of my percolator, considered as a whole, consists in an upwardly-driven central current, and one or more downward currents, all of which traverse unobstructed water-spaces, which have a common communication with a water-space below the false bottom.

At the bottom of the tank A a flush-pipe is provided, as at *h*, whereby the fluids may be withdrawn from time to time. Suitable try-cocks, as at *i*, are provided for determining the quantity of fluid in the tank during the operation. A tank for treating, say, one thousand pounds of hulls, should have a capacity of not less than, say, five hundred gallons. The vomiting-tube should have a diameter of not less than three inches. The outer annular water-space between the outer walls of the basket and the inner walls of the tank should be about three inches on each side. The inner annular water-space between the outside of the vomiting-tube and the inner wall of the basket should be about two inches on each side. The basket at its upper end may profitably be provided with vertical annular flanges at its inner wall and periphery, in order that a portion of the volume of water from the tube may fall between them, and be thereby directed downward, through the perforations, upon the contents of the basket.

The washing apparatus E consists of an exterior cylindrical tank for holding water, and a stationary interior receiver, F, for containing the treated hulls to be washed. The bottom and sides of the receiver are composed of wire-cloth, or perforated sheet metal, preferably of wire-cloth, with about one hundred meshes to the square inch. Within the tank and receiver is a vertical shaft, as at *k*, which, being driven at slow speed by suitable power, communicates motion by means of bevel-gears to the two horizontal shafts, as at *l*. These horizontal shafts are each provided with a double series of stirrers, *m*, and a two-armed float, as at *n*. The outer edge of each float is curved, so that when it is in a horizontal position it closely corresponds in its outer line with the circular sides of the receiver. In operation the stirrers and floats are slowly revolved in opposite directions, which causes the contents of the receiver to travel continuously in a circle, and the centrifugal action of the current, slight as it is, in practice causes the hulls to pass outward through the meshes into the still water of the tank, where they may readily gravitate to the bottom. Meanwhile particles of hulls pass through the meshes at the bottom of the receiver.

Considered as a complete organization of mechanism, my washing apparatus differs from any analogous apparatus known to me, in that the receiver is stationary, has finely-perforated side walls and bottom, and is inclosed by a water-space, with which an open communication is afforded from the receiver, at bottom and all sides. Rag-engines, and engines intended to operate on cotton-coated seed-hulls, have been made with the well-known sand-trap or its equivalent, located at the bottom of the receiver, and separated therefrom by wire-cloth or perforated sheet metal. Into this trap all heavy matters of necessity gravitate.

I am also aware that machines have heretofore been employed for washing vegetables, in which there were embodied exterior tanks, interior stationary receivers, and devices for keeping the contents thereof in motion. So far as I am aware none of these have ever been adapted by reason of their construction and arrangement for practical use in this connection.

I am also aware that in connection with the art of paper-making, revolving perforated cylinders immersed in water-tanks, and provided with interior revolving stirrers, have been employed for cleaning rags, &c. Such an apparatus would necessarily keep the water in the tank which was outside the receiver in a state of constant perturbation by reason of the revolving motion of the receiver. As already described, I seek specially to prevent all movement of the water in the tank in order that even the lightest particles of refuse matter may gravitate readily to the bottom of the water-tank.

Sand or gravel with the heavier particles of hull will naturally pass into the trap and remain there. In operating upon the hulls of cotton-coated seed, however, a large proportion of the fragments of hulls are of so little specific gravity that when the water is agitated to any substantial degree they cannot gravitate, and for that reason the perforated side walls (the novel feature herein) have a peculiar value, as these lighter particles are floated outward into the still waters of the tank, where they are free to gravitate. Below the shafts *l* I sometimes place a few vertical pins in the bottom of the receiver, as shown, but they are not essential. They, however, assist the stirrers *m* in separating masses of tufts.

In Fig. 3 I show a modification of my washing apparatus. Instead of being circular in

form the water-tank is rectangular, and the receiver, instead of being round, is a long open trough, bent upon itself in vertical planes extending from end to end, as shown. Like the receiver F the bottom and side walls of the trough-receiver are composed of wire-cloth or perforated sheet metal, and like that it is provided with mechanical means for inducing a continuous current within it. In turning each time at the ends of the trough a similar centrifugal effect is attained as in the other receiver. Any gentle current within the receiver, however induced, will approximately produce desired results.

The bottom of the water-tank may be depressed at the center, and provided with a large aperture properly controlled by a gate through which precipitated matter may be discharged from time to time by flushing without drawing off all of the water in the tank.

A receiver of a capacity for treating at one time, say, one thousand pounds, should be considerably larger than the tank, and so formed as to be comparatively shallow. A receiver of capacity named should have internal dimensions equal to the cubic measurement of from seven hundred and fifty to one thousand gallons, and the water-tank should be sufficiently larger than the receiver to afford a free open water-space on all sides between outer walls of receiver and inner wall of tank of at least six inches. The water-space below the receiver should not be less than twelve inches, and might with propriety be still deeper, especially at the center.

Having thus described this novel apparatus embodying, as I believe, the best mechanical features of my invention, and adapted to manipulate cotton-coated seed-hulls, with a view to the removal of the tufted fiber in accordance with the principles of my novel process, I will now describe the mode of procedure therewith.

In treating, say, one thousand pounds, of cotton-coated hulls I place them in the basket, (which is removed for the purpose.) and close the lower end, then hoist and lower it into position; then nearly fill the tank with water, so as preferably to wholly submerge the basket. Secure the head to the tank, and render it steam-tight; turn on steam at, say, twenty pounds pressure. The water then is driven upward in the vomiting-tube, and a portion of it falls upon the basket, another portion into the outer and inner water-spaces, down which it passes through the perforated bottom, and so on as long as a proper degree of heat is maintained. By these opposite currents of water a lateral as well as vertical percolation is constantly occurring through the hulls. At the end of the two hours the water is withdrawn, and the tank filled with any alkaline solution, caustic potash or soda, for instance, of a strength of form 4° to 6° Twaddle, and this fluid is moved as before in upward and downward currents, by heat, and under substantially the same steam-pressure for about four hours. The solution is then drawn off, the basket withdrawn, the hulls removed therefrom, and subjected to pressure for discharging the alkaline fluids therefrom. The result of the water treatment, heat, and pressure, is the practical removal of a large proportion of the resinous gums in the hulls, on which water can act as a solvent. The alkaline solution, heat, and pressure complete the removal of a large proportion of those resins and gum not soluble in water, but leaves particles of various sizes of partially carbonaceous but principally silicious matter, as a residuum of the hulls. Although it has thoroughly disintegrated the weak alkaline solution has not materially attacked said silicious matter, but has only removed those resins and gums by means of which the silicious particles were united in the original hull.

Having discharged the alkaline solution as far as practicable by compression, as aforesaid, the fiber, with the remaining particles of hull, is then thrown into the washing apparatus. The stirrers *m* do not perform the function of beaters, as the shaft to which they are united revolves at a rate of speed not greater than, say, eight or ten times a minute, but their function is to effect a separation of tuft from tuft without tearing apart the fibers composing the tufts. The floats *n*, while inducing by their slow motion a circular current of the mass, also at each sweep serve to gently direct the hulls and tufts against the sides of the receiver, through the perforations in the wall of which the tufts cannot pass, while the small particles of hull in their altered condition are free to pass through said perforations into the still water of the tank, and once there are wholly incapable of returning. This operation requires but from thirty to forty-five minutes for each charge, and therefore one washer of the size given will serve to operate on hulls which are previously treated by the employment of several digesting-tanks. After leaving the washer the tufts are found to be freed from the hull, and may be dried by compression, by a centrifugal drier, or any other suitable and well-known means.

The tufts of fiber, after this operation, are of a grayish color, and are ready for the market. Paper-makers may bleach the product to suit the requirements incident to intended use. When a portion of the longest fibers is to be employed in the textile arts, the fibers, being intact, have sufficient strength to enable them to safely undergo operations analogous to opening and carding, and therefore it is advisable that such operations be performed prior to bleaching. Mechanism for separating long fibers from the short is well-known. Instead of providing in such apparatus for the removal of grit and sand, however, it will only be necessary to provide for

the proper recovery of the short fiber and fibrous dust, it being already free from dirt and ready for preliminary operations in preparing it for paper-stock.

By the exercise of care and skill in accordance with well-known bleachers' formulas the tufts may be bleached before the separation of the longest fibers without materially impairing their strength.

For economizing in the practice of my process I can frequently employ the alkaline solution at least on two charges of hulls. After once using said solution I test it with muriatic acid, and if it be found to contain considerable carbonic acid I add thereto a quantity of caustic lime, say, about one-half the weight of the alkali originally in solution. A portion of the carbonic acid unites with the lime and a portion of the fatty matters held by the solution is thrown down, thereby fitting the solution for further use.

From this description it will be seen that throughout the operation nothing has occurred which in any manner could separate the fibers in each tuft, and that the said tufts maintain practically the same character which they possessed when they were attached to the fragments of hulls. From this fact it will also be seen that the fibers in each tuft are absolutely intact, because, having been subjected to no action which could separate fiber from fiber in the tuft, they have obviously, therefore, not been subjected to any mechanical action which could by any possibility have injured the fiber itself. Therefore, the fiber produced by my process, instead of being a homogeneous mass of short broken disintegrated fiber, is a tufted mass of fiber, each tuft, as before stated, containing substantially the same long and short fibers which each fragment of the hull possessed prior to treatment, and it can readily be distinguished from all fiber products heretofore produced by reason of its tufted characteristics. Fig. 4 gives a fair representation of an adhering mass of tufts.

Having thus described my invention, I claim as new and desire to secure by these Letters Patent—

1. The process herein described of separating the fibers in tufts from cotton-coated fragments of seed-hulls, which consists of the following operations, to wit: the digesting of said coated fragments of hulls while immovably confined in a suitable receptacle, by means of water applied in a percolating apparatus and steam under pressure; a continuance of the same digesting operation, in a similar receptacle and under like conditions, by means of water and an alkali, also applied in the percolating apparatus, and the subsequent washing of said tufts in water, which is agitated sufficiently to enable it to hold said tufts of fiber and the lighter particles of hull in suspension, substantially as described, whereby the original tufted characteristics of the fiber on the hull are retained, and the separation of the hull effected without injury to the fiber, as set forth.

2. The digester, composed of a steam-tight tank, a vomiting-tube, and a movable basket surrounding the tube for containing the matter to be digested, in combination, substantially as described, whereby said basket may may be readily removed from the tank and discharged or filled, as set forth.

3. The combination, with the digesting-tank of the vomiting-tube and the central steam-pipe, which is located within the tube and discharges steam at the bottom of the tank, substantially as described, whereby the fluid in the vomiting-tube is maintained at a high degree of temperature, and a rapid and voluminous discharge effected, as set forth.

4. The combination, with a steam-tight tank, a perforated false bottom, a vomiting-tube, a central steam-pipe within said tube, and a detachable basket, of one or more free vertical water-spaces communicating with the water-space beneath the false bottom, substantially as described, whereby an upward current is induced in the vomiting-tube and free downward currents induced in said water space or spaces, as set forth.

5. The washing-apparatus, composed of an exterior water-tank, a stationary interior receiver surrounded by an open water-space in the tank, and having its side walls and bottom finely perforated, and provided with paddles which mechanically induce a continuous gentle current within the receiver, substantially as and for the purposes herein described.

6. As a new article of manufacture, tufted cotton fiber detached from fragments of cotton-coated seed-hulls, and having the tufted characteristics it possessed before being detached from said fragments, substantially as described.

ADOLPHE ROCK.

Witnesses:
WM. C. WOOD,
PHILIP F. LARNER.