No. 655,239. Patented Aug. 7, 1900.

T. JESPERSEN.

PROCESS OF BLEACHING BY ELECTROLYTIC CHLORIN WATER.

(Application filed May 29, 1899.)

(No Model.)

Fig. 1.

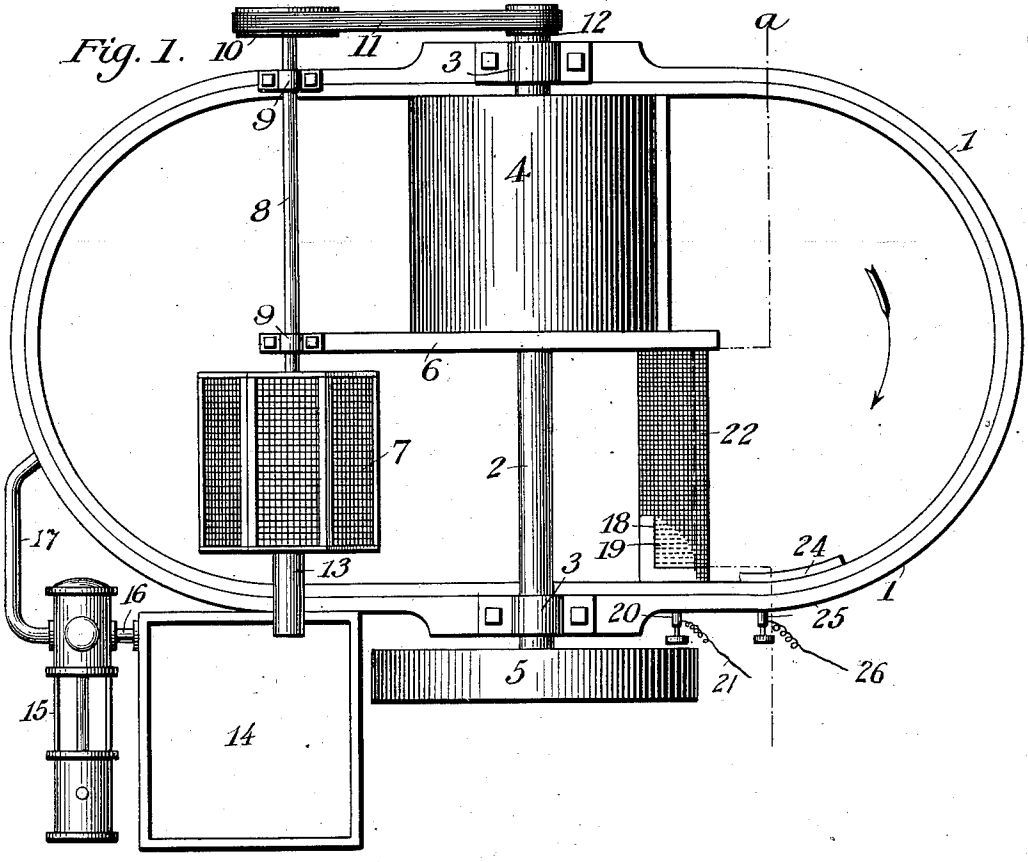
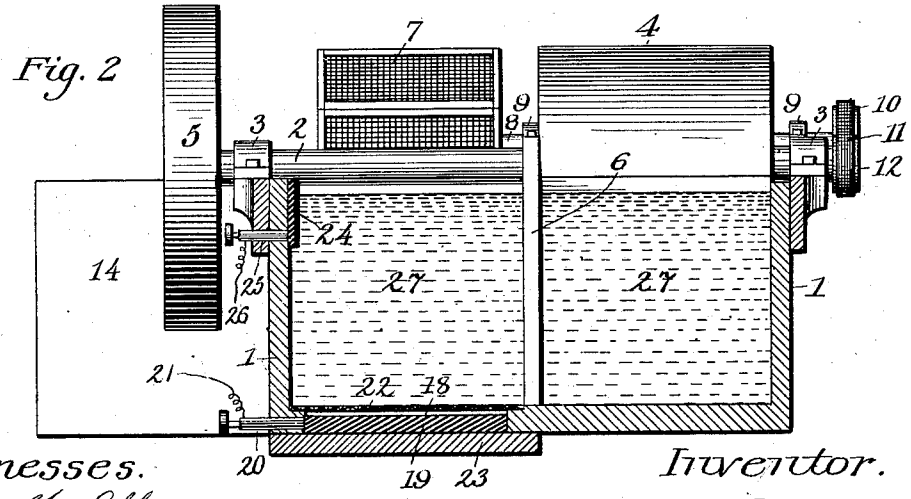


Fig. 2



Witnesses.

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PROCESS OF BLEACHING BY ELECTROLYTIC CHLORIN WATER.

SPECIFICATION forming part of Letters Patent No. 655,239, dated August 7, 1900.

Application filed May 29, 1899. Serial No. 718,679. (No specimens.)

To all whom it may concern:

Be it known that I, THOMAS JESPERSEN, a citizen of the United States, and a resident of Neenah, in the county of Winnebago and State of Wisconsin, have invented certain new and useful Improvements in Processes of Bleaching by Electrolytic Chlorin Water, of which the following is a specification.

In bleaching vegetable fiber—such as paper-pulp, cotton, or linen goods—by my process electricity is used to decompose a dilute watery solution of hydrochloric acid in such a way that the chlorin gas evolved at the immersed anode is absorbed by the water of the surrounding watery solution of the electrolyte, forming thereby chlorin water. Thus the watery solution serves as an electrolyte and as a carrier of chlorin simultaneously. The material to be bleached is also held suspended in this solution and may be agitated in a convenient manner to facilitate the uniform saturation of the contents of the tank in which the material to be bleached is held. The bleaching now proceeds in the usual manner by the decomposition of the water by the absorbed chlorin, yielding nascent oxygen and hydrochloric acid. Thus chlorin, while combining with the hydrogen of the water, is constantly reproducing an electrolyte, (hydrochloric acid,) which can again be subjected to the action of the electric current, yielding at the anode chlorin, which, as before, will be absorbed by the water, decomposing it to form oxygen and hydrochloric acid, as before, and at the cathode hydrogen, which is allowed to escape. Thus the chlorin may be used over and over in the same manner indefinitely, thereby cheapening the process of bleaching by saving material.

In using hydrochloric acid as an electrolyte in bleaching fibrous substances there are two distinct features for which I claim originality and superior usefulness over other processes heretofore used: first, the direct formation of chlorin water without the use of a porous partition and without the intermediate formation of a hypochlorite, and, second, the automatic reconversion of free chlorin into hydrochloric acid by the decomposition of water. To this aqueous solution of hydrochloric acid may be added one or more soluble chlorids, which, however, will not change the chemical reaction nor the ultimate result.

In order to carry out my process, it is essential that a suitable tank is provided for holding the necessary solution, the material to be bleached, and the electrolyzing apparatus.

If the material to be bleached is paper-stock, the usual washer or beater-engine tank is preferable, (the washer and beater-engine being substantially the same in construction,) the revolutions of the beater-knife cylinder serving to agitate the paper-stock while being acted upon by the electrolyzed solution and its pulp-washer serving to remove the watery solution from the paper-stock after it has acted upon one charge, that it can be returned to the beater-tank for action upon the succeeding charge of material.

In bleaching textile fabrics or other material any suitable tank having the anode and cathode arranged in it substantially as they are herein shown as being applied to the beater-engine tank may be used, and the various operations of agitating the solution and material to be bleached or of removing the liquid from the tank can be performed by manual labor or by any suitable means which is available.

In the drawings, Figure 1 shows a plan of a beater-engine tank and represents the manner in which I propose to apply my process for bleaching paper-stock. Fig. 2 is a vertical section of the tank on the line *a a* of Fig. 1.

Similar numerals indicate like parts in both views.

1 indicates the washer or beater-engine tank; 2, the shaft which carries the beater-knives; 3, the journal-boxes in which the shaft revolves; 4, the beater-knife cylinder-cover; 5, its driving-pulleys; 6, a partition dividing the tank into sections along its line of greatest length for a part of its central portion; 7, the pulp-washer; 8, the washer-shaft; 9, journal-boxes supporting said shaft; 10, a pulley by which the washer may be revolved by means of the belt 11 from the pulley 12 upon the end of the shaft 2; 13, a spout lead-

ing from the washer for discharging the water which the washer dips up in its revolutions outside of the tank; 14, a storage-tank for holding said water until it is required to be returned to the tank for bleaching another charge of paper-stock; 15, a pump for the return of the water to the tank; 16, a pipe connecting the pump and storage-tank; 17, a pipe from the pump to the beater-engine tank; 18, a recess in the bottom of the tank for holding the anode; 19, the anode; 20, a binding-screw connecting with the anode and by means of the wire 21 connecting the anode with a supply of electricity; 22, a perforated screen which separates the pulp to be bleached from direct contact with the anode. This screen may be of wood or metal perforated, or it may be of wire-cloth, which is preferable, as it will permit the free contact of the liquid without allowing the pulpy material of the paper-stock to come in contact with the anode. If of metal, it may be entirely covered with an insulating coating for preventing its acting as a bipolar electrode, should such be its tendency.

23 is a supplemental bottom piece under the usual bottom of the tank; 24, the cathode; 25, a binding-screw for connecting the cathode with a supply of electricity by means of the wire 26; 27, the watery solution in the beater-engine tank (containing the paper-stock) to be acted upon by the electrolytic current.

The arrow in the tank indicates the direction of movement of the liquid and paper-stock in its passage over the anode to be saturated with chlorin.

In the drawings, 1 represents a container serving both as a bleaching and electrolyzing tank. The anode 19 is recessed into the bottom of the tank and screened by means of a perforated screen of some suitable material in order to allow the chlorin gas to be absorbed most effectually by the superincumbent stratum of watery solution of the electrolyte mixed with the material to be bleached without allowing said material to come in contact with the anode. This screen may be made of brass wire-cloth, but other forms of a suitable material may be used, or other material which will not be affected injuriously by the chemicals used. A carbon anode at which chlorin is liberated in the nascent state will be slowly corroded by that gas, causing minute particles of carbon to be dislodged constantly from that anode. These minute particles of carbon, if not in some way prevented from mixing with the material to be bleached, will impart a blackish discoloration to the material, thus defeating the object of the process. Friction between the anode and the material will materially increase the amount of carbon dislodged. To overcome this objection, I have arranged the anode in the above-stated manner. The cathode is placed at a point or line corresponding with the surface-level of the solution, dipping into it slightly, as in Fig. 2, to make contact in such a way as to allow easy escape of the hydrogen liberated by the electrical current. The material to be bleached is placed in the tank with a solution of the electrolyte, which consists of dilute hydrochloric acid. In the electrolysis of hydrochloric acid chlorin gas is evolved at the anode. This gas is readily absorbed by the surrounding water, forming chlorin water, which in the act of bleaching will reproduce hydrochloric acid. This hydrochloric acid remaining in solution is again subjected to electrolysis, with the same result as before. Thus the process is rendered continuous. At the cathode hydrogen gas is evolved, which will rise to the surface of the solution. It is not desirable to have this free hydrogen pass through the body of the electrolyte charged with free chlorin on account of the affinity existing between the gases, which in combining would lessen the amount of available free chlorin. To overcome this objection, the cathode may be placed as near the surface of the solution as possible, thus reducing the objection to a minimum.

After the bleaching operation has been completed the bleached material is to be separated from the solution, which solution is now ready to receive a new charge of material to be bleached. This separation may be made in any convenient manner. In the present case it is being done by means of the washer 7, which is continually delivering the liquid contents of the tank 1 to the storage-tank 14, from whence it can be returned to the tank 1 by means of the pump 15 for the succeeding charge of paper-stock.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process of bleaching, consisting of electrolyzing a dilute watery solution of hydrochloric acid, allowing the chlorin gas liberated at the immersed anode to dissolve in the water of said watery solution, bleaching with the resulting chlorin water, and by the act of bleaching restoring hydrochloric acid to the solution and again electrolyzing as before, all of the processes being performed simultaneously and continuously in the same tank or container, substantially as described.

2. The process of bleaching, consisting of electrolyzing an aqueous solution containing hydrochloric acid, allowing the chlorin gas liberated at the immersed anode to dissolve in the said aqueous solution, bleaching with the resulting chlorin water, and by the act of bleaching restoring hydrochloric acid to the solution and again electrolyzing as before, all of the processes being performed simultaneously and continuously in the same tank or container, substantially as described.

3. The process of bleaching, consisting of electrolyzing an aqueous solution of one or

more chlorids containing hydrochloric acid, allowing the chlorin gas liberated at the immersed anode to dissolve in said aqueous solution, bleaching with the resulting chlorin water, and by the act of bleaching restoring hydrochloric acid to the solution and again electrolyzing as before, all of the processes being performed simultaneously and continuously in the same tank or retainer, substantially as described.

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Witnesses:
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