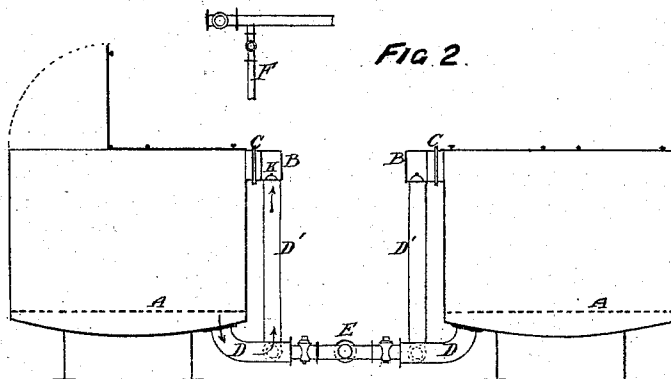


Process of Treating Fibrous Substances for Paper Stock.

Patented April 1, 1873.



Witnesses:
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IMPROVEMENT IN PROCESSES OF TREATING FIBROUS SUBSTANCES FOR PAPER-STOCK.

Specification forming part of Letters Patent No. **137,484**, dated April 1, 1873; application filed February 28, 1873.

CASE A.

To all whom it may concern:

Be it known that I, THOMAS ROUTLEDGE, of Ford Works, near Sunderland, in the Kingdom of England, paper manufacturer, have invented Improvements in Treating Fibrous Substances for Textile Purposes and for the Manufacture of Paper-Stock, of which the following is a specification:

The objects of this invention are the preliminary preparation and the subsequent treatment of raw vegetable fibrous substances in order to reduce them into a fibrous condition suitable for textile purposes and for paper-stock. The said preliminary preparation consists in a process or series of processes whereby the gluten, starch, and other amylaceous, gummo-resinous, and extractive compounds, which more or less constitute a large proportion of the bulk and considerable percentage of the weight of all raw vegetable fibrous substances, are decomposed, or partially decomposed, so far that the ultimate fibers may be separated or eliminated wholly or partially therefrom, thus constituting paper-stock; or the said ultimate fibers so preliminarily prepared may be further disintegrated by hackling, willowing, carding, or other analogous process, so as to be adapted for spinning and various other textile purposes, the residuary amylaceous and proteine compounds being, if desired, collected and utilized.

It is well known that most fibers employed in textile manufactures, with the exception perhaps of silk and cotton, are separated, or prepared for separation, from the attaching stalk or parenchyma with which, during their growth, they are naturally combined, by a process of steeping or retting in water, which induces a species of fermentation whereby the parenchymous, amylaceous, or gummo-resinous compounds or matters are so decomposed, or partially decomposed, that by the further mechanical processes of rolling, breaking or beating, scutching, and hackling the ultimate fibers are separated therefrom; such steeping or retting processes, however, as now practiced, occupy a very considerable time, and require to be very carefully conducted and watched.

I have discovered that when a certain class of raw vegetable fibrous substances are sub-

jected to a preliminary alkaline steep, and from that transferred to a fermentative steep produced artificially, as hereinafter described, the time necessary for such steeping is very much reduced; and, further, by adjusting the temperature of such steeping operations, the desired decomposition, or partial decomposition, and subsequent separation and elimination of such parenchymous and other extraneous substances or compounds combined with ultimate fibers is materially expedited and promoted, and at the same time readily controlled.

The class of fibrous substances to which I have found the above preliminary system of treatment more especially applicable are those combined with or containing a large proportion of gluten, starch, and similar amylaceous and gummo-resinous compounds, such as bagasse or sugar-cane refuse, maize straw and leaves, rice straw. It is also applicable to the treatment of flax, hemp, jute, rhea fiber, and similar fibrous substances, used more especially for textile purposes.

According to my said invention the preliminary or first steep is composed of water charged with lime or other alkali. I immerse the fibrous substances to be treated in a tank or one of a series of tanks or vessels, hereinafter described, filled with the alkaline steep liquor, taking care that they shall be submerged or covered, and allow them to remain therein from about twenty-four to thirty-six hours; if at the ordinary temperature of the water where such fibrous substances are produced—say from about 50° to 70° Fahrenheit—by the action of such alkaline steep the parenchymous covering and amylaceous and proteine compounds combined with the fibers will be so far attacked or affected as to admit of and facilitate the action of the following or fermentative steep, which (the lime or other alkaline steep liquor being drained or pumped off) may be conducted in the same, but by preference in one or more of another adjacent series of tanks or vessels, the fibrous substances being placed therein and ferment liquor added thereto, so as to cover the fibrous substances. The time required for this second or ferment steep will be from thirty-six to seventy hours, according to the atmospheric temperature. Such ferment

steep is composed of water, to which has been added a portion of the ferment resulting from a previous ferment steep; or fermentation may be induced by adding yeast or other fermenting substance thereto, the natural previously-created ferment being preferable; and such ferment in the first instance may be created by allowing a certain portion of the fibrous substances previously treated by an alkaline steep to remain under steep until fermentation has been naturally induced, when, by using the ferment thus created, the process of steeping may thereafter be conducted continuously from one steep-vessel to another through the series of vessels, with fresh charges indefinitely.

It will be remarked that both the alkaline and fermentative steeps may be effected by using water at the natural temperature; but in order to expedite both the said steeping process and economize the plant or apparatus required, I prefer the application of heat, as, according to the elevation of temperature of the steep liquors, the time required for steeping is materially reduced or abridged, and more readily controlled. For example, the best results are obtained by alkaline steeping from about 110° to 120° for about ten to twelve hours, sufficient decomposition of the extraneous compounds, without injurious action on the ultimate fibers, being thereby attained with most convenient and regular working of the steeping plant or apparatus and succeeding processes.

I have now to add that when fuel is not an object of economy a material reduction in the time required for the said preliminary preparation of the fibrous materials, and a consequent saving of the plant or apparatus employed therein, may be effected by elevating the temperature of the lime or other alkaline steep to from about 160° to 180° , or even to a boiling temperature, and continuing the same from about eight to ten hours, the warmth mellowing, softening, and swelling the fibrous substances, so that the covering silicious coating and their pores are more readily permeated and acted upon, the parenchyma and proteine compounds being thereby sufficiently decomposed to allow of their being readily removed by a washing process, preferentially in the apparatus for which I am applying for Letters Patent contemporaneously herewith.

It is desirable, when subjecting bagasse or similar harsh ligneous fibers to the above treatment, to increase the quantity of lime present in the steep liquors, not, however, exceeding from about fifteen to twenty-five per cent. of the fiber treated; but in treating maize and similar fibers of a more delicate texture the lime or other alkaline steep liquor should be clear or nearly clear, especially when it is desired to utilize the by-products.

The plant or series of tanks or vessels in which the aforesaid steeping processes are to be performed may be of any convenient form, and constructed of wood, masonry, concrete,

or metal sunk into or placed on the surface of the ground; but, as crude or raw vegetable substances in their normal condition are generally extremely bulky, for economical considerations, especially when mere steeping alone is desired, it will be found most convenient to construct them in the ground, and of capacity sufficient to contain a ton, or thereabout, of the fibrous substances to be treated. The vessels are shown in the drawing in plan and section, Figures 1 and 2, respectively. Fig. 1 is broken across to indicate that any number of vessels may constitute the series, sixteen being adopted by preference. The vessels should be water-tight and furnished with perforated false bottoms A, and connected together by pipes or channels B, fitted with the necessary cocks or valves C, in order to connect or disconnect each vessel, as desired, in such manner that the warm steep or other liquor being run into the top of the first vessel of the series, (charged with the material to be treated,) which is connected by a pipe, D, or otherwise, from under the false bottom, and by the pipe D' and pipe B to the upper portion of the second vessel of the series through its valve C by hydrostatic pressure is forced or gravitated downward and then upward successively and continuously through eight, ten, or more vessels constituting the series, the eighth or last vessel of the series (in this case No. 8) being connected through the pipes D D' and B or other channel and valve C with the first or No. 1 vessel of the series, as shown by the arrows, so that the steeping process may thus be proceeded with continuously. The liquor may be emptied, as desired, through the pipe E from under the false bottom. By this system the steep may be used again and again until it has become inoperative or surcharged with extractive matter, meanwhile, however, utilizing the heat, if heat be employed, and thus economizing fuel and water; or the whole or a certain portion of the liquors in either case may be run off to waste, or otherwise utilized, and fresh added to supplement the portion thus run off; or the steep may be pumped or siphoned from one vessel to another, as may be desired; but I have found the continuous system, as described, most convenient in practice. The temperature of the steep liquors is maintained by blind-pipes F, shown in vessel No. 5, Fig. 1, laid under the false bottoms of the vessels heated by steam supplied by the pipe F', Fig. 2; or water or naked steam may be employed for such purpose.

It will be known when the effect desired has been attained by taking a portion of the fibrous substances which have been treated in the hand, when, if they are found to have lost their natural harshness and to have become soft, viscous, or greasy, and the fibers readily separate or detach from the parenchyma and from each other by rubbing, they may be removed from the steep, and subjected to pressure in any convenient manner, or without

pressure trodden on a paved floor, passed through stampers or rollers, or otherwise treated, to complete the disintegration resulting from the steeping processes previously described, and then washed with water, when the glutinous and other compounds or substances will separate freely therefrom. The comparatively clean fiber or fibrous material may be pressed into cakes, in any convenient manner, and dried artificially or otherwise; or by preference, especially if the cost of carriage is an object, the fibers may be reduced materially in bulk, and still further be deprived of extraneous matter, after being pressed to extract the excess of moisture, by passing them, when dried or partially dried, through a willow or carding machine, by which they will be converted into a fibrous or tow-like condition, when they may be baled, forming in this condition crude "paper-stock." The glutinous proteine or other compounds left diffused in the washing-waters will deposit, and may be collected and utilized. If the fibers are desired only for textile purposes, neither the alkaline nor the ferment steeping processes should be carried so far as when the fibers are desired for paper-stock; partial decomposition of the parenchyma and proteine compounds having been sufficiently effected, further disintegration of the fibers should be produced by greater mechanical manipulation of the rolling and washing processes, and by subsequent scutching, hackling, &c.

The crude paper-stock prepared as described is suitable for conversion into brown, wrapping, and other common papers; but when it is desired to manufacture therefrom printing, writing, or other bleached papers, such paper-stock must be subjected to a process of boiling in alkaline lyes, as ordinarily practiced, or to a continuous process of boiling in alkaline lyes, followed by washing, conducted in a plant or series of vessels, substantially such as herein shown. To this, however, no claim is here made, as I have made it the subject of a separate application for Letters Patent.

When it is desired to bleach paper-stock or fibrous substances resulting either from the beforementioned processes, or otherwise, I prefer to employ the continuous system, by hydrostatic percolation (with or without intermediate or finishing souring by mineral or vegetable acid as desired,) in a series of ves-

sels, as shown on the drawing, so connected together that I can repeatedly employ the bleaching-liquor, until the bleach is completely exhausted, by which I effect a great saving.

The vessels may be heated in any convenient manner, by injection of either low or high pressure or superheated steam.

In commencing the bleaching process, one of the vessels of the series, say No. 1, being filled with the fibrous materials to be treated, I run thereon the bleach-liquor supplied by the pipe B', filling the vessel above the level of the pipe or channel B, connecting it with and to the next vessel of the series; which second vessel being charged with the fibrous material, I again run a charge of bleaching-liquor into the first vessel, which, the valve of communication K being then opened from under the false bottom of the first vessel, an equivalent quantity of bleach-liquor is forced by gravitation from it into No. 2 vessel, by which time No. 3 vessel is charged, and so on progressively and continuously. After the bleaching process has been effected, I disconnect No. 1 by closing the connection between it and No. 2 vessel, thus constituting No. 2 for the time being No. 1 vessel, and run water into No. 1 for washing; such wash-water may then be utilized for making up fresh stock-liquor.

Claims.

1. The preliminary preparation of raw vegetable fibrous substances, in order to reduce them into a fibrous condition suitable for textile purposes, and for paper-stock, by steeping the same in an alkaline bath, and subsequently subjecting them to a fermentative steeping, substantially as hereinbefore described.

2. The continuous system of bleaching vegetable fibrous substances, by hydrostatic percolation in a series of vessels connected together, substantially as hereinbefore described.

In witness whereof I have signed my name to this specification in the presence of two subscribing witnesses.

Witnesses: THOS. ROUTLEDGE.

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