UNITED STATES PATENT OFFICE.

MORRIS L. KEEN, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO HIMSELF AND SAMUEL A. WALSH, OF NEW YORK CITY.

IMPROVEMENT IN THE MANUFACTURE OF PAPER-STOCK.

Specification forming part of Letters Patent No. **108,487**, dated October 18, 1870.

To all whom it may concern:

Be it known that I, MORRIS L. KEEN, of Jersey City, in the State of New Jersey, have invented certain improvements in means or method of making paper-pulp from wood, straw, and analogous vegetable substances, and in the treatment of the materials used therein, of which the following is a description:

I will describe the invention as applied to the manufacture of pulp from poplar or analogous soft woods.

After wood has been reduced to fine chips by any suitable cutter or machine, the chips or shavings are put in a close strong boiler, one of an upright form preferred, fitted with a perforated false bottom inside, so that the stock under treatment can be drained off by means of a cock in the bottom of the boiler, communicating with space under the false bottom. A discharge-valve also is fitted to a passage through both bottoms, communicating with the interior of the boiler, so that the stock of pulp, when finished, can be discharged or blown out under pressure into a suitable receiver or tank for said purpose. The boiler is also provided with a top screen or perforated diaphragm, fitted across the inside of the top of the boiler, allowing a steam-space above the screen.

The boiler is charged either through a man-hole above or below the screen, a portion of the screen being removed in the former case to admit of charge. After the boiler is charged with the wood and the man-hole secured, steam is admitted to boiler from a separate generator, by means of pipes at the top of the boiler, and manipulated at pleasure. After steaming the stock for thirty minutes (more or less, according to the fineness of the shavings or chips) at a temperature of from 300° to 400° Fahrenheit, the drain-cock is opened at the bottom and the condensed water drawn off. Hot water is now injected, at a temperature of from 300° to 400° Fahrenheit, above the screen into the steam-space, and percolates freely through the stock under treatment, and washes out the interstitial matter.

By alternating the treatment from steam to water and water to steam every five or ten minutes for thirty minutes or more, according to the previous condition and kind of stock under treatment, it will be found that at least forty to fifty per cent. of the interstitial matter of straw or dry wood will have been removed and fifty to sixty per cent. of green wood will have been removed.

All dry stock may be steeped with advantage in hot or cold water as a preliminary process.

The charge is now ready for the alkaline treatment; but, if thought desirable, it can be drawn from the boiler and more thoroughly washed, and more of the interstitial matter thus removed, or it can, in this stage, be made into common brown paper.

The stock, as left in the boiler after the steam and hot-water percolation, may be transferred, with or without extra washing, to another boiler, or retained in or returned to the same in which it was originally steamed, and subjected to the action of alkali, either in a carbonate or caustic form, in solutions of the strengths and temperatures described below, and, as most of the interstitial matter has been previously removed, it is easily reduced to a pulp with about thirty-three per cent. of the alkali now used by any other of the present approved manufacture of wood or straw paper—that is to say, a good pulp can be produced by boiling the stock of wood or straw, &c., previously cleaned of much of the interstitial matter by the steaming and hot-water process, in solutions of caustic alkali of twenty to twenty-five per cent. of wood pulp produced, and in eight or ten per cent. of caustic alkali to straw pulp produced.

The strength of alkali preferred for wood is about 10° to 12° Baumé; that for straw 6° to 8°, though much weaker solutions will answer nearly as well.

The alkali is first charged for wood at the rate of one gallon at 8° Baumé to every pound of wood under treatment, and for straw one gallon at 5° Baumé to every pound of straw under treatment, and the heat raised in the boiler to a temperature indicated by ten to thirty pounds pressure on the steam-gage.

I have made good pulp at ten pounds pressure, and have also pulped the wood, straw, and similar materials, having been previously acted on, in the manner described, by steam and hot water in open vessels without any pressure whatever. It is, however, preferred

to treat the stock, under the pressure of thirty pounds, in a close boiler in caustic alkali of strength described, as the action desired is obtained under the heat indicated by that pressure in a shorter time than at a lower temperature. With most stock this should be continued about one hour. I do not, however, confine myself to the pressures or temperatures named, as higher pressure can be used to nearly equal advantage, and lower steaming will answer the purpose; but those named seem to be about the best for commercial use.

It is important that no considerable quantity of steam be allowed to condense in the boiler at this stage, as it would weaken the strength of the solution. I therefore prefer to maintain the temperature by the admission of steam, at a proper pressure, to an exterior jacket alone, or to a jacket and coils, or other provisions for heating the interior.

The construction of the boiler should, in this respect, depend much on its size. If the boiler is large, ample provision should be made for introducing heating-surfaces in its interior. If small, the heat may be maintained from the exterior sufficiently.

The alkali is now drawn off at the drain-cock in the bottom of the boiler, measure for measure—that is, the stock is now freed by percolation and a sudden injection of steam in the top of the boiler over the stock.

The stock is now steamed again under high pressure, indicated by from seventy to two hundred pounds by steam-gage, and hot water also injected at the temperatures corresponding to those pressures, to which treatment and which temperature the charge is kept fifteen or twenty minutes, and then drawn out or blown out into a proper receiving-tank, drained and washed by percolation, and assumes the condition of good gray pulp, ready for bleaching by any of the ordinary known methods.

The stock in a cleansed state, at this stage of process, prior to its discharge from the boiler, may be again subjected to percolation by steam and hot water, so as to remove a great part of the extraneous matter liberated by the last steaming and hot-water treatment, and a solution of weak chloride of soda, less than 1° Baumé, admitted to the boiler, which is raised to a temperature of 300° for ten or fifteen minutes, and the stock then blown out. This greatly improves the color of the stock.

The alkali drained off from the boiler is reserved and replenished for future use—that is, one-sixth of its original quantity is discarded and set aside for the recovery-furnace, and that quantity, by measure, at a strength of from 10° to 12° Baumé for wood, and of the straw-liquor the same quantity—one-sixth—is discarded, and a fresh charge or amount of one-sixth new liquor or caustic alkali is added at a strength of 6° to 8° Baumé, or such strength as to maintain the proper strength in the liquor; and this order is preserved of discarding one-sixth of alkali used in every boiling and replacing the same with new alkali.

The waste or discarded alkali can be recovered in suitable evaporating-furnaces at a loss of from ten to fifteen per cent. for recovery of said waste.

The boiler, in the alkaline treatment, may be heated by an auxiliary coil, through which the large amount of alkali freely circulates, and in which the bulk is retained during the discharge of waste alkali, or any other desirable method to economize time and heat.

The first steaming and hot-water treatment may be dispensed with, and good pulp produced from straw and very finely-reduced woods of non-resinous character by simply boiling the same in solutions of caustic alkali of strength indicated, with the subsequent percolations and steaming; but the renewal of liquor at subsequent boilings must, in such case, be increased from two to three fold, as the interstitial matter not removed by first steam and hot-water process has to be overcome by extra amount of caustic alkali.

Although I esteem the above process entire, and all the several novel parts thereof, more particularly valuable in its application to wood and straw, I believe it may be used with much benefit on various other, and, in short, nearly or quite all, paper material. The first portion of it—to wit, the extraction of most of the interstitial matter by the alternate steam and hot-water treatment at high temperatures—I propose particularly to employ in preparing paper-stock from hemp, flax, and tow of either or both.

I can use carbonate of soda or other alkaline carbonates instead of caustic alkalies.

I claim as my invention in the pulping of wood and analogous materials—

1. The process of treating the material by a succession of stages, pure steam and water and steam at a high temperature being employed at one stage and caustic alkali at a lower temperature at another stage.

2. The percolation of steam downward through the mass of partially-treated fiber, so as to hasten the removal of the chemical, as specified.

3. The triple treatment, first, with pure steam and water and steam at about two hundred pounds pressure per square inch; second, with caustic alkali at twenty or thirty pounds per square inch; and, third, with steam or water again at or near its previous high pressure, the several operations being combined and made to succeed each other in the manner and for the purposes herein set forth.

4. The process of treating wood and analogous material for making pulp by steam and water alternately, substantially in the manner described, and for the purpose set forth.

5. The process of treating the stock by high steam and hot water prior to discharging the same out of the boiler, so as to aid in perfectly cleaning the fibers of all coloring matter.

6. The caustic alkali in weak solutions, in the proportions of twenty to twenty-five per cent. for wood pulp produced and eight to ten per cent. of straw pulp produced, either at low or high temperatures, when used in connection with steam and hot-water process.

7. The process of treating wood or straw or analogous material in caustic alkali under pressure as named, as a first process, and subsequent treatment of the stock by steam and hot water, as described.

8. The process of treating wood or straw, &c., by steam and hot water at a high temperature, as described, then the process of treating the stock in open vessels in caustic alkali, as described, and the subsequent process of treating the same stock with hot water and steam, as described.

9. The process of treating the stock with chloride of soda, in the manner and at the stage of the treatment herein set forth.

In testimony whereof I have hereunto set my name in presence of two subscribing witnesses.

MORRIS L. KEEN.

Witnesses:
C. C. LIVINGS,
A. HOERMANN.