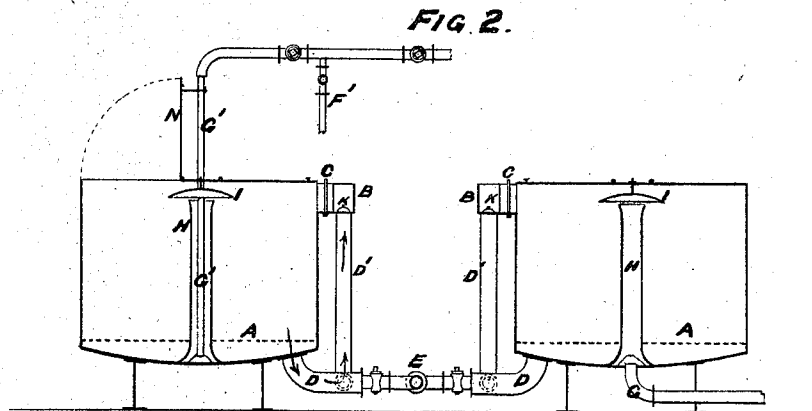
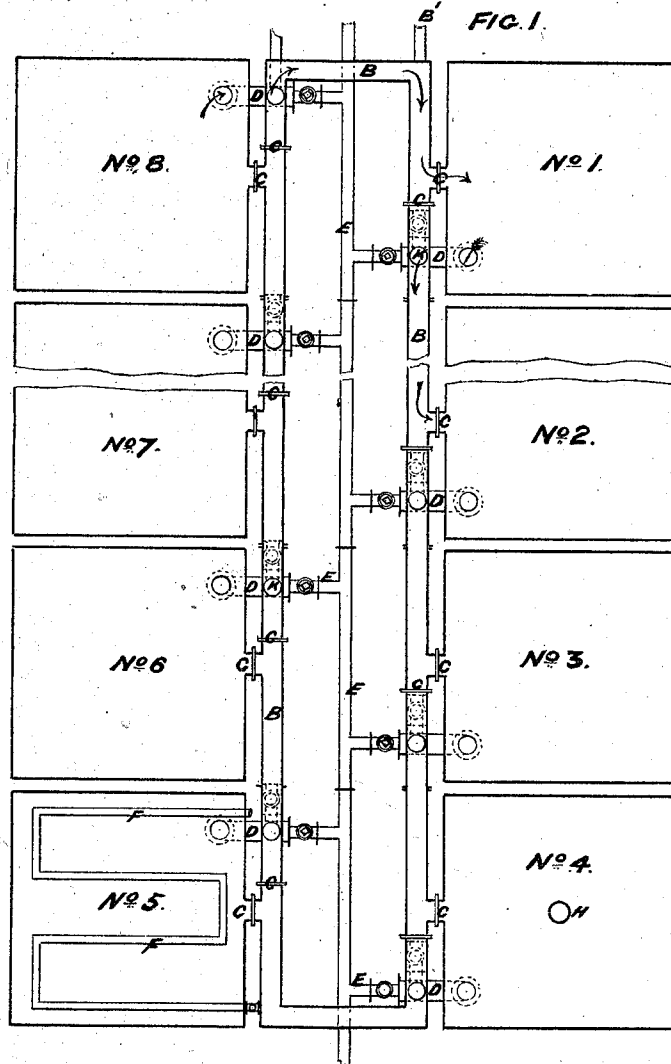


T. ROUTLEDGE.
Modes of Treating Fibrous Substances in the
Manufacture of Paper Stock.
 No. 141,016. Patented July 22, 1873.



Witnesses:

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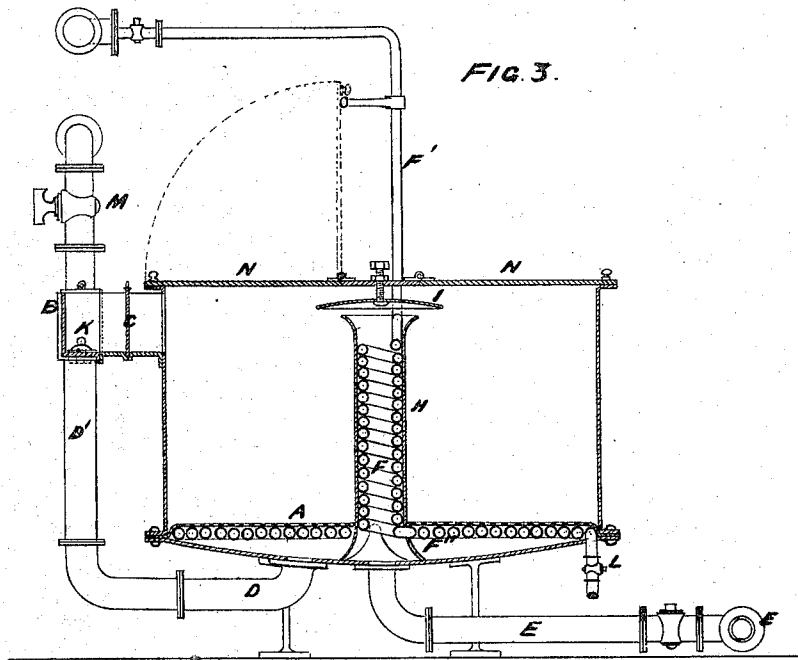
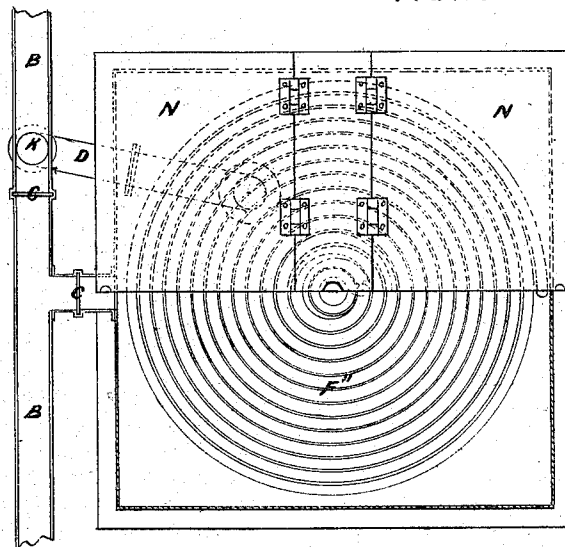


FIG. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

THOMAS ROUTLEDGE, OF FORD WORKS NEAR SUNDERLAND, ENGLAND.

IMPROVEMENT IN THE MODES OF TREATING FIBROUS SUBSTANCES IN THE MANUFACTURE OF PAPER-STOCK.

Specification forming part of Letters Patent No. **141,016**, dated July 22, 1873; application filed August 31, 1872.

To all whom it may concern:

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

My present invention relates to the treatment of vegetable fibrous substances in order to reduce them into a fibrous condition suitable for textile purposes and for paper-stock. In a pending application, I have described a mode of preparing crude "paper-stock" by subjecting the vegetable fibrous substances first to an alkaline steep, and subsequently to a fermentative steep. The stock thus prepared 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 leys. My invention relates to this boiling process, and its object is to render the process more effective, rapid, and economical than has heretofore been practicable; and to this end the invention may be stated to consist in a continuous system of boiling in an alkaline ley and subsequent washing with water in a series of vessels connected together, substantially as hereinafter described. I wish it to be understood that my system of boiling is applicable and fitted, not only for crude paper-stock, prepared as above described, but also for fibers or fibrous materials to which the preliminary steeping processes before referred to are not applicable, and which have otherwise been suitably prepared for the boiling process.

I shall now proceed to describe the manner in which I prefer to carry my system into effect.

I employ for the said boiling and subsequent washing processes, a series of eight or more vessels shown on Sheet 1 of the drawings, so connected together that I can employ the alkaline ley for boiling again and again, until the free alkali therein is completely neutralized, by which I effect a great saving, not only in the original relative percentage quan-

tity of alkali employed, but I save fuel, and enormously reduce the quantity of water required by the ordinary process as now followed, besides producing the desired effect upon the fibrous material under treatment with the minimum of waste or loss to such material. The plant or series of tanks or vessels may be constructed, of any convenient form, 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 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 Sheet 1 of the drawings in plan and section, Figs. 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. These vessels should be water-tight, 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 last vessel of the series (in the 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 boiling process may thus be proceeded with continuously, and each vessel may be emptied, as desired, through the pipe E from under the false bottom.

The vessels may be heated in any convenient manner by injection of either low or high pressure, or superheated steam; or by blind pipes F, with steam or water circulating therein. I

prefer employing the bowking or vomiting system, as it is desirable that circulation of the alkaline leys be from time to time kept up during the boiling process, the same being also necessary to maintain the requisite temperature of the leys. This is most conveniently effected by injecting steam into the kier or vessel by means of the pipe G, Fig. 2, Sheet 1, immediately under the ordinary vomiting-pipe H, which is fixed in the center of the kier, and attached to the false bottom thereof; or by injecting steam from above the vomiting-pipe H by means of the pipe G², in Fig. 2, this system being applicable with either low or high pressure steam, and to either an open or a closed vessel or boiling-pan. It is desirable the bonnet I, superimposed over the vomiting-pipe, should be adjustable, to control the flow and circulation of the vomited leys; and where fuel is costly, I prefer the special arrangement of blind-pipes for producing boiling and circulation, hereinafter described and shown on Sheet 2 of drawings.

In commencing the boiling process, one of the vessels of the series—say, No. 1—being filled with the fibrous materials to be treated, I run thereon the boiling ley supplied by the pipe B¹, filling the vessel above the level of the pipe or channel B, connecting it with and to the next vessel of the series, which vessel, being charged with the fibrous material, I again run a charge of ley into the first vessel, which (the valve of communication K being there opened from under the false bottom of the first vessel) an equivalent quantity of ley is forced by gravitation from it into No. 2 vessel, by which time No. 3 vessel is charged, and so on, progressively and continuously, so that, assuming ten hours would, by the ordinary system, be employed for boiling with one charge during such period, by my system five successive charges would be run on, over, and through the fibers in No. 1 vessel, which would then be found to be sufficiently boiled. I then 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. No. 2 having received its final charge of ley is then disconnected from No. 3, which, in its turn becomes as it were No. 1, and No. 2 are connected again with No. 1, and a fresh charge of washing water, being run into No. 1, forces over a corresponding quantity into No. 2. By this system it will be seen that both the leys and the succeeding rinsing or washing waters will be used again and again. By the time the first ley introduced has reached No. 5 or No. 6 vessel, it will be found to have become neutralized by the gummoresinous coloring and extractive matters, and may then be run off to waste, or evaporated to recover the alkali therefrom, and when the succeeding washing waters have been run progressively in the same manner from vessel to vessel, it will be found that they will ultimately have attained nearly the same strength

as the original ley. The fibrous material in No. 1 being perfectly cleansed, and, if desired, cooled by a final rinsing water, may then be removed from the pan or vessel and is ready for bleaching.

By this means I am enabled to employ concentrated leys, thus saving at least two-thirds the quantity of water usually employed, thereby insuring economy of the fuel required for maintaining the necessary temperature during the boiling process, reducing also the quantity of water to be subsequently evaporated, and thus effecting a further saving, if it is desired to recover the alkali employed; moreover, as each fresh charge of alkali removes, and so to speak, pushes forward the proteine and coloring matters, every successive charge acts on fresh surfaces, and the ultimate cleansing and purification of the fibers are insured, with a saving of thirty per cent. and upward of the alkali now employed, and, as previously remarked, with less injurious action upon the fibrous materials under treatment. For instance, with esparto, the present practice is to use not less than eight per cent., and frequently ten per cent. and upward of soda to the ton of fiber under treatment. By the foregoing system I find from about five to seven per cent. sufficient, or even less, and I also am enabled to recover a larger proportion of the effete alkali after it has been used in the boiling-process, and from the washing and rinsing waters, which are also, by being thus used again and again, concentrated to nearly an equal strength of contained soda to the original leys employed.

In the ordinary process of boiling now practiced in single or detached keirs or other vessels, the charge of alkaline ley requisite to treat a ton of fibrous material, such as esparto, is from about nine hundred to one thousand gallons, such alkaline ley being constituted by from about eight per cent. to ten per cent. of soda to the fiber treated.

By my continuous system, as hereinbefore described, I am enabled to use the ley in a far more concentrated form, the quantity of liquor being reduced to about three hundred to four hundred gallons, and its relative percentage strength of soda to the fiber treated to about six per cent. to seven per cent., thus saving about three per cent. of alkali, and more than half the water to be boiled, and ultimately evaporated if the soda is intended to be recovered.

The special arrangement of blind pipes hereinbefore referred to, as shown on Sheet 2 of drawings, Figs. 3 and 4, for boiling is as follows, the same letters of reference indicating corresponding parts to those shown on Sheet 1 of drawings: I take wrought-iron tubing, say, of one to two inches diameter, and bend the same into a helix or coil, F, proportioned in height to the size of the vessel in which the materials are boiled, the internal diameter of the said helix being kept from about five to eight inches, and its exterior surrounded with thin

sheet iron, when it forms, as it were, the vomit-pipe H. I connect the bottom of the said helix F with a coil of pipe formed into a flattened worm or volute, F'', corresponding with the diameter, and placed underneath the false bottom of the pan or boiling-vessel, the extremity of said worm or volute being protruded through the bottom of the pan and furnished with a tap, L, so that steam being admitted into the upper portion of the helix by the pipe F' passes through the whole coil of pipe, the tap L being so regulated as merely to allow the condensed steam, as water, to escape. The pipe and cock M, Fig. 3, Sheet 2, is for supplying water for washing. N N are lids or covers.

I do not limit myself to the special construction of apparatus herein shown, which has been described in order to illustrate the manner in

which my invention may be carried into effect; but

What I claim is—

The continuous system of boiling in an alkaline ley and subsequent washing with water, in a series of vessels connected together, substantially as and for the purpose hereinbefore described.

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

THOS. ROUTLEDGE.

Witnesses:

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47 *Lincoln's Inn Fields, London.*

WM. L. WOOD,
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