(No Model.)

J. A. SOUTHMAYD.

DISINTEGRATING VEGETABLE TISSUES.

No. 304,675. Patented Sept. 2, 1884.

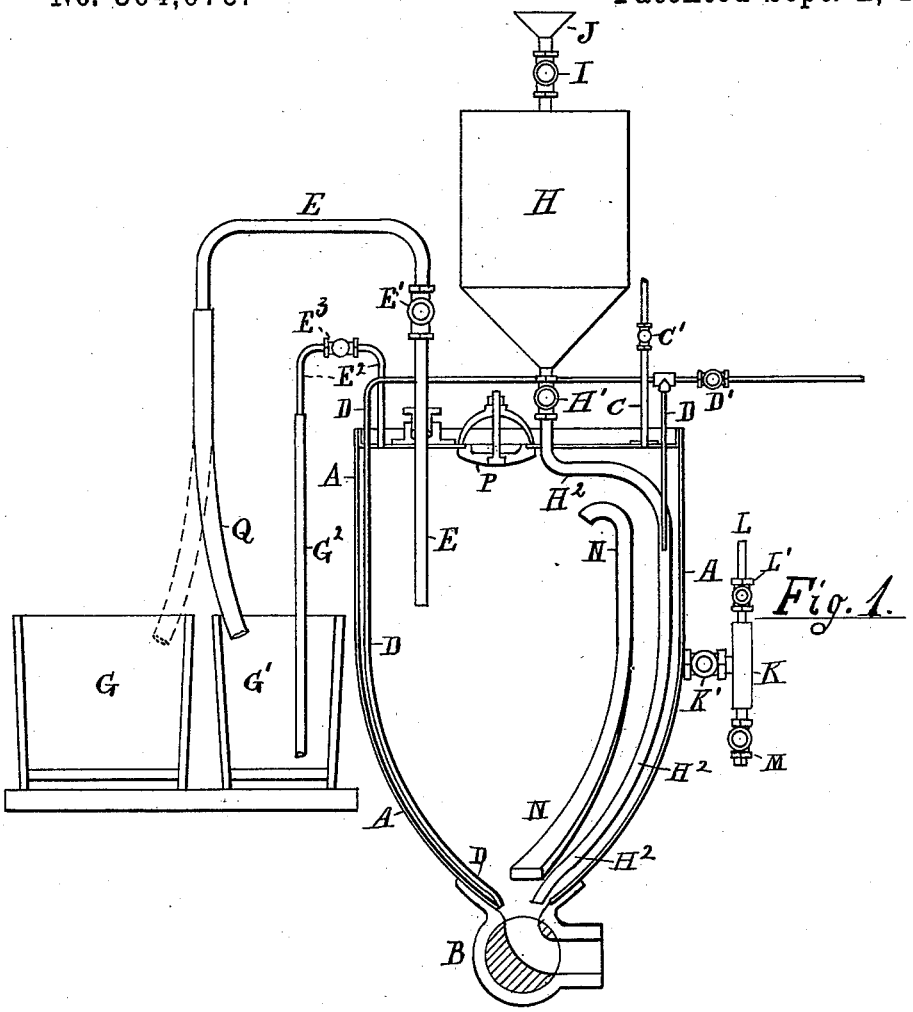

Fig. 1.

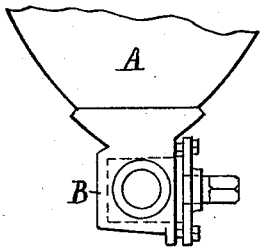

Fig. 2.

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UNITED STATES PATENT OFFICE.

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DISINTEGRATING VEGETABLE TISSUES.

SPECIFICATION forming part of Letters Patent No. 304,675, dated September 2, 1884.

Application filed February 20, 1884. (No model.)

To all whom it may concern:

Be it known that I, J. A. SOUTHMAYD, a citizen of the United States, residing in Elizabeth, Union county, New Jersey, have invented certain new and useful Improvements in Disintegrating Vegetable Tissues, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to certain improvements in the processes of and apparatus for disintegrating vegetable tissues, for which I have recently filed three patent applications; and it consists, first, in the disintegration of the tissues with chlorine under steam heat and pressure, after boiling the fibers in alkali; secondly, in a method of and means for reclaiming such part of the chlorine as is not destroyed in performing its work; and, thirdly, in an improved construction for the outlet-pipe of the charging-vessel, whereby the fluids are injected into the boiler contents by a current of steam.

It also consists in a special construction for the outlet-cock of the boiler, whereby a boiler tapering toward the bottom can be used to discharge sidewise.

My improved construction will be understood by reference to the annexed drawings, in which Figure 1 is a central vertical section of a boiler embodying the same, and Fig. 2 is an external view of the outlet-cock, viewed at right angles to the sectional view.

Using the letters that apply to the same parts in my former applications, A is the boiler, formed of tapering shape toward the bottom, to discharge the mass with facility. B is the discharge-cock. C is a vent-pipe; C′, a cock in the same; D D, steam-inlet pipes; D′, a cock in the same; E, a fluid-discharge pipe inserted into the top of the boiler through a stuffing-box, F, and provided with a cock, E′. G is a tank to receive the alkaline solution. H is a charging-vessel, situated above the boiler and connected with its upper part by a cock, H′, and provided at the top with a funnel, J, and cock I. N is a circulating-pipe, any number of which may be secured inside the boiler to conduct the fluids which are admitted at the bottom to the upper part of the boiler during the operation of the same; and P is a man-hole for entering the boiler or charging it with crude material. These parts are all shown and claimed in my former application No. 114,180, filed December 11, 1883; and my present improvements consist, first, in extending the pipe from the charging-vessel down toward the bottom of the boiler; secondly, in the insertion in such pipe of a nozzle connected with a steam-boiler, so that a jet of steam under pressure may be forced from the outlet or mouth of such charging-pipe at pleasure; thirdly, in providing a tank for the reception of chlorine liquor, and an outlet-pipe for conducting chlorine gas from the top of the boiler to such tank; fourthly, in combining with the discharge-pipe E a connection to such chlorine-liquor tank; and, fifthly, in constructing the boiler-discharge with an angle cock, so that the contents may pass from the bottom of the boiler and be projected sidewise.

H^2 is the charging-pipe from the vessel H, inserted through the top of the boiler and extended inside the latter nearly to the bottom, so that the liquids introduced through the charging-vessel may be mingled thoroughly with the steam introduced by the pipes D at the same point. One of the pipes D is shown inserted through the side of the pipe H^2 and extended along its center toward the discharging end, so as to throw a current of steam in the same direction as the inflowing charge, and to thus facilitate the rapid influx of the charge of chemicals, as well as to mingle the steam with them as they enter the boiler.

E^2 is a gas-outlet pipe, similar to C, but provided with means for conducting the gas to the bottom of the chlorine-tank, (shown at G′,) a rubber pipe, G^2, being attached thereto, and a cock, E^3, being inserted in the pipe, as at C′.

The liquid-discharge pipe E is also shown provided with a rubber pipe, Q, by which the flow can be directed into the tank G when discharging alkaline solution and into the tank G′ when discharging chlorine liquor, only one of the same being present in the boiler at the same time. The pipe E is movable in the stuffing-box F, so that its inner end may be set to a level with the mass of fiber at the close of the boiling operations, and the supernatant fluid discharged by the steam-pressure in the boiler.

The construction shown is intended to effect the disintegration of vegetable tissues under steam heat and pressure, and while the same may be used with various chemical agents I will describe the process, herein, of effecting the desired results by a novel process with baths of alkali and chlorine. Such a method of disintegrating is performed as follows: I place a suitable charge of the raw material—as rattans, grasses, wood-chips, &c.—in the boiler, and mix therewith a suitable solution of alkali, using for the harder tissues about 6° Baumé, and for the softer ones about 3° to 4° Baumé. Having closed all the outlets, steam is admitted to the boiler by the pipes D D and enters the bottom of the charge, whence it is mingled through the whole mass by its condensation and by the radiation of heat externally.

The circulating-tubes N also serve as upward channels for the moist hot vapor and for the hotter parts of the contained liquid, the colder fluid percolating downward through the charge to maintain the circulation. The upper ends of the circulating-pipes are extended close to the top of the boiler and their tops bent over, so as to mingle the wet steam and liquids effectually with the gases contained in the top of the boiler, such gases being thereby dissolved or absorbed with great rapidity and carried downward throughout the whole charge. This action of the circulating-pipes greatly facilitates the distribution of gaseous agents through the tissues and considerably shortens the time required for the disintegrating process. To determine when the charge is fit for the action of the chlorine liquor, I employ the test-chamber K, closing the tap M and opening the cock K′. The pulpy matter then passes into the chamber, a vent being afforded, when necessary, by opening the cock L′, and the cock K′ being closed when the chamber is sufficiently filled, and the sample being then drawn off through the tap M. Such samples are tested from time to time to discover when all the resinous matter in hard tissues or grease and foreign substances in rags have been thoroughly softened, so that the chlorine liquor will act powerfully upon the same in the conditions of heat and steam pressure existing in the boiler. In the case of rattan, spruce, &c., I boil the crude tissue until about one-third of the fiber is actually disintegrated and the gum in the remainder is entirely softened, while soft tissues are prepared to the required degree with a much shorter treatment. When properly prepared I introduce the chlorine liquor into the boiler, preferably drawing off the alkaline liquor first to avoid the dilution of the chlorine liquor. Such alkaline liquor may be removed, in my construction, by opening the cock E′ in the outlet-pipe E, which is shown fitted into the top of the boiler through a stuffing-box and bent at the outer end to discharge the lye into the tank G. The liquor, when thus drawn off, may be strengthened to the required point and used to reduce another charge, and the resin contained in it be extracted and utilized. The movement of the pipe E in the stuffing-box enables the operator to draw or siphon off the liquor to the desired level. While drawing off the alkaline liquor a charge of clean water is preferably introduced through the vessel H and pipe H^2. Such fluid enters the boiling mass at the bottom, thus raising the gummy and resinous matters extracted from the fiber to the surface of the mass while the alkaline fluid is being withdrawn, thus discharging these matters effectually from the interior of the boiler. I then introduce chlorine liquor through the charging-vessel H and pipe H^2, preferably in such quantity as to fill the boiler quite full, for the purpose of floating the fibers loosely in the solution and securing the most rapid and perfect contact of the chlorine with the softened tissues. It is obvious that heat would drive all the chlorine gas out of the tissues were an unfilled space left at the top of the boiler, and its effect under heat and pressure would thus be largely lost. By filling the boiler full the gas is kept in the solution and is forced by the pressure into the closest contact with the softened gums and fibers. I have discovered that under these conditions of heat and pressure a very small quantity of chlorine, less than half of that required when it is used for bleaching purposes with cold solutions, operates as a disintegrating agent upon the softened gums in the tissues and effects a further disintegration by destroying and removing a part of such gums. The extent to which this disintegration proceeds can be determined from time to time by the use of the testing-chamber K, and the process arrested when the maximum effect is attained without any destruction of the fiber itself. The chlorine liquor is introduced by opening the upper cock, I, on the reservoir H and pouring in through the funnel J. The upper cock can then be closed and the fluid discharged into the boiler by opening the lower cock, H′, the steam-jet inside the charging-pipe H^2 operating like an injector to drive the charge forcibly into the boiler in a heated condition.

As is well known, a slight elevation of temperature tends to discharge chlorine gas from an aqueous solution, and I have discovered that this principle may be used to discharge the gas from the tissues, and thus avoid the washings that are commonly required to free the fibers from this agent. To effect this result, I draw off sufficient of the chlorine liquor by the pipe E to form an empty space in the top of the boiler, discharging the liquor preferably into cold water in the tank G′, so as to retain the gas in the solution to utilize it again. I then boil the tissues to drive out all the gas contained in the boiler, the gas accumulating in the upper part of the boiler and being drawn off by the pipe E^2 and preferably discharged into cold water to preserve it for future use.

The boiling is then continued until proper tests show that the chlorine is removed, when the remainder of the liquor and the contained tissues may be simultaneously discharged from the boiler and finally disintegrated by a violent expulsion through the cock B, or by any other method or means. By the action of the alkaline liquor about one-third of the gums is thus entirely removed, and the remaining proportion is still further reduced by the acrid action of the heated chlorine; but the softened gum remaining is so separated by the treatment employed that it can be washed out, if desired, or be retained in the tissue by coagulating it with cold water, to increase the weight of the paper-stock produced therefrom. If discharged in a heated condition from the cock B, to effect the final disintegration, such proportion of the gum remains combined with the pulp, and is effective in increasing its weight as paper-stock.

It will be seen from the above description that although certain parts of my process are old by themselves—as the use of alkali for disintegration and the boiling of the tissue under steam heat and pressure—yet I am enabled, by the peculiar treatment of the tissues during those very operations, as well as by the peculiar method of applying, using, and discharging the chlorine from the tissues, to accomplish in a single operation what has heretofore required much more time and the employment of several different machines to effect. Thus the chlorine has heretofore been removed from the pulp by protracted washings in cold water in rag engines or washers, either of which consumes a great deal of power and a large supply of water, all of which is saved by my method of disintegration, as well as the large percentage of vegetable fiber commonly destroyed when the tissues are treated solely with caustic alkalies under heat and pressure. After the chlorine, for further disintegrating the softened gums, is used and the chlorine gas is expelled by heat, the tests may show a minute proportion of the chlorine still remaining in the fibers, in which case any antichlorine—as bisulphite of soda—can be used for removing any traces of chlorine that may be thus found and which the heat may not have expelled. The fibers may then be washed with warm water, in the manner stated above, by vessel H.

It is obvious that although the apparatus shown herein has been described in connection with my improved process of disintegrating by the use of chlorine, it may be applied to any other processes to which the construction is adapted.

The chamber H may be made of wood, and there may be several of them, if desired, each provided with its own outlet-cock H′, and a pipe connected with the boiler to facilitate the various operations for which the boiler may be used.

As alkali, acids, and various chemicals may be used in treating vegetable tissue or fiber it is obvious that it would be preferable to use separate charging-vessels for the alkalies and acids, as well as for various bleaching agents which may be used in my improved boiler.

The quantity both of alkali and chlorine, &c., to be used on any kind of tissue can be readily ascertained from time to time by those skilled in the art by samples drawn from the testing-chamber, the harder woods or tissues requiring stronger liquor and the weaker fibers or tissues a lower proportion of the same agents. By this means nearly the exact quantity of alkali or chemicals of any nature can be used without loss, and in practice I find that the disintegrating process I have described and claimed herein can be performed in much less than one-half the time usually employed in reducing the tissue entirely by alkaline solutions with a saving of a very great proportion of the useful fiber.

The pipe E may be used in place of the pipe E^2 to discharge the chlorine gas when collected in the top of the boiler as the former pipe may be drawn up sufficiently to connect with the highest part in which such gas collects. When the pipe E is used to draw off and discharge different liquors into separate tanks, as described herein, other connections may be used to divert the flow than the rubber pipe Q; but as the construction of such pipe-connections is well known to mechanics I have not shown them herein, the rubber pipe being preferable in any case.

It is obvious that the charging-pipe H^2 may be used with other means for supplying the required solutions than the vessel H, and I have therefore claimed the construction and arrangement of the same in combination with the pipes D independently of the vessel H.

Having shown and claimed the parts lettered from A to N in my previous application No. 114,180, I do not claim herein anything that may be allowed to me in said application.

Having thus set forth the nature of my improvements and distinguished them from previous modes of operating, I claim herein as follows:

1. The combination, with a boiler constructed with the steam-pipes D D, of the charging-pipe H^2, inserted in the boiler at or near the top, and extended to or near the bottom, substantially as and for the purpose set forth.

2. The combination, with a boiler constructed with a charging-pipe, H^2, extending into the boiler to or near the bottom, of the steam-jet inserted inside the charging-pipe, and operated substantially as herein shown and described.

3. The combination, with a boiler constructed with the steam-pipes D D, operating to inject steam inside the boiler at or near the bottom, of a charging-pipe, H^2, constructed to deliver the fluid from a charging-vessel or the steam from one of the pipes D, or from both, substantially as and for the purpose set forth.

4. The combination, with a boiler for treating vegetable tissues chemically, of the stuff-

ing-box F, pipe E, constructed to slide therein as described, and means, substantially as set forth, for diverting the fluid from the pipe into two or more tanks, as and for the purpose set forth.

5. The method herein shown and described of disintegrating vegetable tissues in a closed boiler, consisting, first, in boiling the tissues with an alkaline solution; secondly, in drawing off the alkaline solution and filling the boiler full of chlorine liquor, leaving no appreciable space for the disengagement of the chlorine gas; thirdly, in discharging a part of the fluid to form a space for the disengagement of the gas; fourthly, in disengaging the gas by the application of heat; and, lastly, in drawing off the chlorine liquor and washing the tissues with water, substantially as herein set forth.

6. The process herein shown and described of reclaiming the unspent chlorine gas in a closed boiler, consisting in driving off such gas from the boiler by heat and discharging the same into water sufficiently cold to absorb and retain the gas, substantially as shown and described.

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

JOHN A. SOUTHMAYD.

Witnesses:
THOS. S. CRANE,
C. C. HERRICK.