

UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN PROCESSES OF REDUCING WOOD TO PAPER-PULP.

Specification forming part of Letters Patent No. **150,111**, dated April 21, 1874; application filed
October 31, 1873.

To all whom it may concern:

Be it known that we, HEINRICH VOELTER, of Heidenheim on the Brenz, Kingdom of Württemberg, Germany, and OSWALD MEYH, of Zwickau, Kingdom of Saxony, Germany, paper manufacturers, do hereby declare that we have made an invention of a new method of or process for preparing wood, or various other fibrous materials of like nature, so as to render such useful in the manufacture of paper-pulp, or for various other purposes, of which the following is a specification:

The main features of our process are described as follows: We take pieces of wood of the same shape, size, and condition in which they are fed into the grinding apparatus in the well-known so-called wood-grinding mills, and expose them in a close vessel made of suitable material and strength, during one or many hours, to the action of saturated steam of a tension of forty-five to sixty pounds per square inch pressure, and to the action of the temperatures corresponding to these pressures. After such treatment and renewal of the acid by alkaline matter or matters, as hereinafter described, we grind the pieces of wood into pulp, as is usually done.

By the steam penetrating through all the pores of the wood, many of those substances contained in it, which are generally called incrustating substances, are dissolved, whereby it gets opened out, and a considerable loosening of its structure is effected, so much so that, after grinding it and passing the ground stuff through a good refiner and sorting apparatus, a surprisingly tough, but rather more or less brownish-looking, paper-pulp is obtained, of great felting capability, out of which, particularly when fir-wood has been used, paper of good quality, and boards, can be manufactured without the addition of any rag-pulp. For the production of this pulp very much less driving-power is required than for the production of an equal quantity of pulp from wood which has not passed the preliminary steaming operation. The vessel for steaming can be made of any convenient shape and size. It must, however, be of sufficient strength to stand the necessary pressure of steam. It may also be fitted on a suitable part of it with

one or more man-holes, for the purpose of filling and emptying it of the material to be treated; and it may be fitted on some convenient place of it with a pipe connecting it with the steam-generating apparatus or steam-boiler, from which, by means of a cock fitted to this pipe, the necessary steam can be passed into it or shut off, as required. It may be joined, if possible, on its lowest place, with another pipe provided with a cock to enable a person to draw the waste-water off, which results from the condensation of the steam inside the vessel during the steaming operation. This water will be found to contain extractive substances; and, lastly, if the steaming-vessel is of weaker construction than the steam-generating vessel, it should be fitted with a steam-gage and safety-valve. In some cases it will be necessary to fit a so-called false perforated bottom into the steaming-vessel, above the waste-water pipe. Should the materials to be steamed be in small pieces this must be done.

As mentioned above, the steaming-vessel, fitted up with the generally well-known mountings enumerated before, can be made of any convenient shape, and of any capacity, as may be required for working, but it must be constructed of sufficient strength to stand the pressure of steam. It may be made (to use the expressions in vogue among steam-boiler makers) horizontal or vertical, or generally like a rag-boiler heated by steam, as they are used in various forms in paper manufactories. In case a rotating steam-boiler is used as steaming-vessel, or a so-called "Donkin rag-boiler," which is fitted inside with a perforated rotating drum, into which the wood to be steamed is put, and where the outside shell is stationary during the rotations of the drum, the boiler may or may not be made to rotate during the steaming operation, as required. In some cases rotation will be found to act injuriously on the material to be steamed, on account of its preventing the extractive matter from being blown off when necessary.

Should it be desirable to do so, the steaming-vessel and the steam-generating vessel may be constructed, so to speak, of one piece. In this case the steaming-vessel has to be sufficiently high, and fitted with an intermediate

bottom about twenty inches above the intended highest water-level; also, fitted with a false bottom at some distance above the other bottom, both compartments to communicate by a pipe through which the steam is admitted to the steaming-compartment. The admission of steam should be regulated by a cock placed outside the vessel and fitted to this pipe. After blowing off the steam, on the steaming operation being finished, either into another vessel or into the atmosphere, it will be found to be necessary to carry off the acid vapors left in the steaming-vessel, which have been generated during the steaming operation, as these would condense on the cooling, but still hot, sides of the vessel, and, as it is generally made of iron, would corrode it, and color or do injury to the wood. Furthermore, by getting rid of the acid vapors less alkali will be subsequently required in the process.

For this purpose apertures of larger or smaller size, as may be required, ought to be constructed on opposite sides of the vessel, such apertures being shut tight during the steaming operation, but opened afterward for the purpose of creating a draft of air to carry the acid vapors off.

After a great part of the incrustations of the wood have been thus dissolved by the vigorous action of the steam, we next subject the steamed wood in the vessel to the action of one or more weak solutions of caustic soda or caustic potash, or only milk of lime, which exercise an important influence on the incrustations still remaining on the cellulose of the wood. These lyes act by imparting to the wood in a heightened degree those qualities which have been mentioned before as being essential to a good paper-pulp. By this further treatment a superior pulp is obtained from wood than is obtained by steaming alone, although it is more costly to produce.

We will further mention here that, according to our experience, wood, be it in large or small pieces, after its structure has been loosened by the steaming operation, can be converted easily, by subsequent treatment with other dissolving agents, into bleachable cellulose. The manner of effecting this is described in the following paragraph. It can also be applied to wood which it is not required to bleach.

The effect of steaming the wood with high-pressure steam is not only to loosen its structure to a considerable degree, but also to expel the air contained in the steaming-vessel and in the pores of the wood. This state of absence of air can be used to bring the dissolving-liquid—for instance, caustic-soda lye of proper construction—in unfailing contact with the innermost portions of the wood. This is done by shutting, after the steaming operation is finished, the steam-admission cock and the waste-water cock; then opening a third cock, which, by a pipe, communicates with a vessel of somewhat larger cubic contents than the steaming apparatus is, and

which is filled with hot or cold caustic-soda lye. As the outward atmosphere is gradually cooling the steaming-vessel, the volume of the steam inside of it is reduced, and in consequence of this the caustic-soda lye flows over into the steaming-vessel, where it effects the condensation of the steam and produces a vacuum, which is filled up as soon as formed by more lye flowing over. Directly the temperature of the soda-lye sinks below the boiling-point, the remaining steam becomes totally condensed, and through the vacuum obtained thereby the liquid is drawn into the innermost pores of the wood, which, by steaming, had been very much loosened in structure beforehand. For the purpose of increasing the dissolving powers of the caustic-soda lye, or other similar liquids, they may be heated by the admission of steam under a pressure of several atmospheres. After the wood has been thus left in contact with the hot lye sufficient time, the steam is to be shut off. The lye, which can be used repeatedly again for the same purpose, is run out, and by ventilation of the steaming-vessel, as described before, by means of a draft of air, the remaining vapors contained in the steaming-vessel are removed. The wood will be found now to be thoroughly impregnated with lye, and as it is heated above 100° , according to the steam-pressure employed, the ventilation effects a considerable concentration of the lye still adhering to it, which is of great advantage, as thereby the lyeing operation can be carried out from the beginning with very diluted lyes and with a smaller quantity of caustic soda. The pieces of wood saturated, as they are, with caustic soda-lye, or other kinds of lye used, are now either to be removed out of the vessel, to be converted into wood pulp by the grinding machinery and simultaneous washing, or else they are to be steamed again, as described before. By steaming intermittently the washing of the wood is effected of itself, and the resulting produce is a brown-colored cellulose, which can now be bleached by chlorine, &c.

The wood, which has been thus freed of its incrustating substances, may be exposed in large or small pieces to the action of bleaching-agents, which can be applied either as vapors or gases by charging high-pressed steam with chlorine or in the liquid form as solution of bleaching-powder. Should it be chiefly required to free the wood from these substances which impart to the wood-pulp the property to darken after in light, we recommend that it should be treated (without previous steaming, by which more particularly wood from coniferous trees is rendered of a brown color) with the vapors of alcohol, ether, sulphide of carbon, benzine, spirits of turpentine, &c., whereby those substances are extracted, and a pulp of the original natural color of the wood is produced.

Having now described and particularly ascertained the nature, utility, and peculiarity

of the said invention, and the manner in which the same is or may be used, or carried into practical effect, we would remark, in conclusion, that we do not claim simply subjecting wood to the action of steam or steaming it before grinding it; but

What we claim as our invention is—

The process, substantially as described, it consisting in subjecting the wood to the action of steam, as explained, and next separating from it, and the vessel containing it, the acid or acid vapors generated by the steaming op-

eration, and next treating the steamed wood with alkali, and finally grinding or reducing the wood, all as set forth.

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