

A. UNGERER.
Processes of Treating Fibrous Substances for
Paper Pulp.
 No. 143,546. *Fig: 2* Patented Oct. 7, 1873.

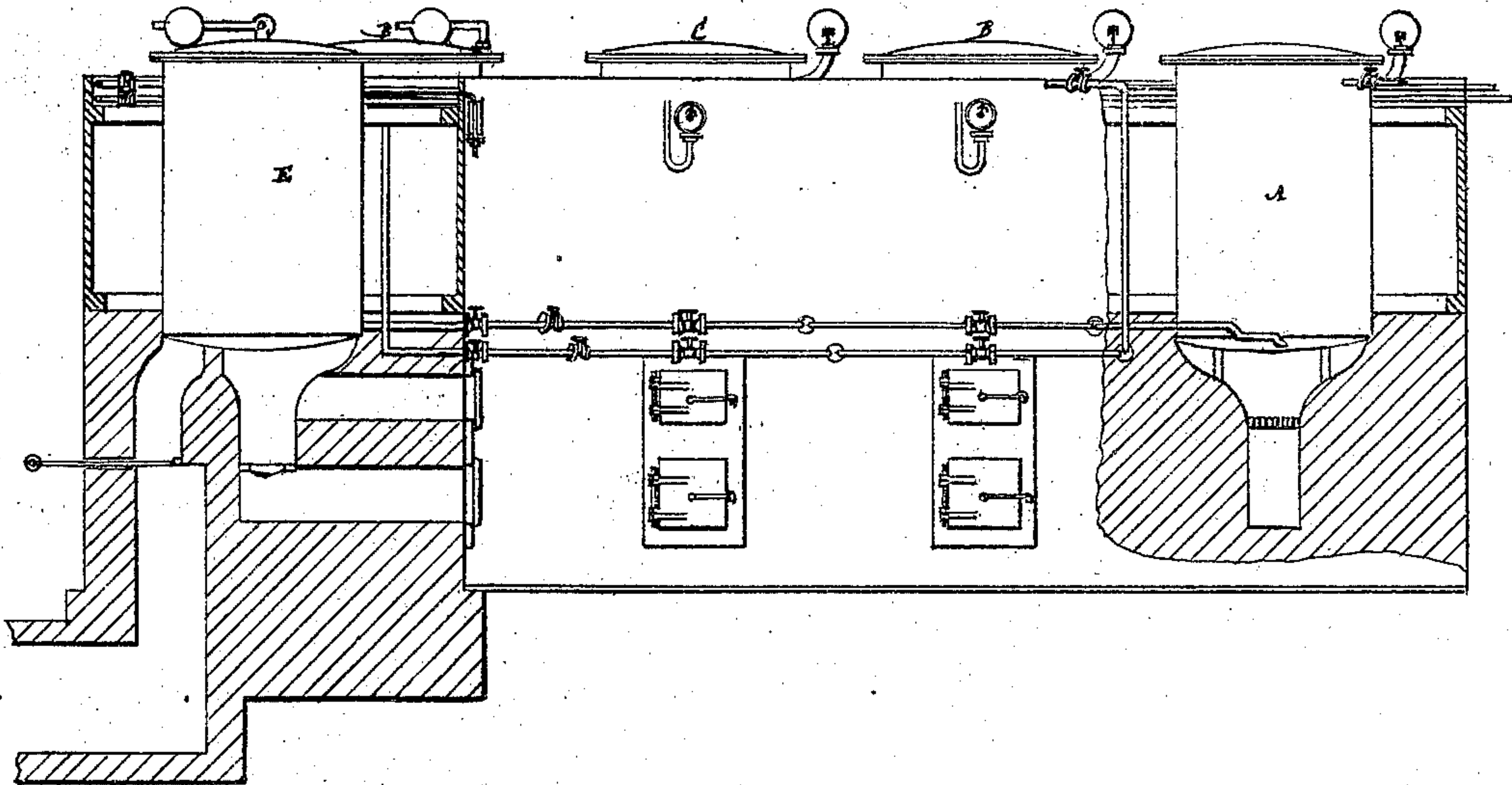
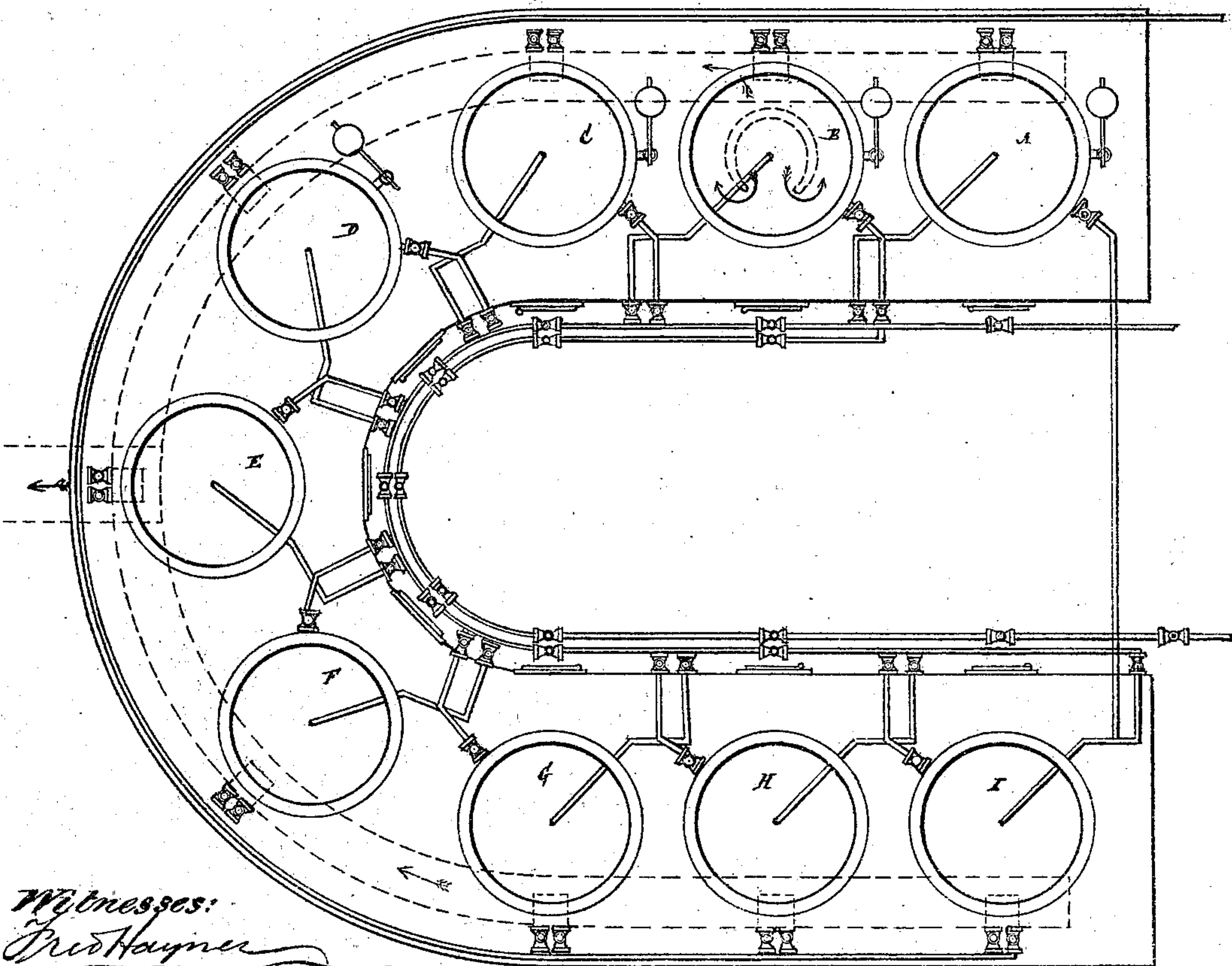


Fig: 1



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ALBERT UNGERER, OF PFORZHEIM, GERMANY.

IMPROVEMENT IN PROCESSES OF TREATING FIBROUS SUBSTANCES FOR PAPER-PULP.

Specification forming part of Letters Patent No. **143,546**, dated October 7, 1873; application filed October 1, 1872.

To all whom it may concern:

Be it known that I, ALBERT UNGERER, of Pforzheim, in the Grand Duchy of Baden, Empire of Germany, but now residing at Simmering, in the Empire of Austria, have invented a novel Process of Treating Woody or Vegetable Matter for the Production of Paper-Pulp and other purposes, of which the following is a specification:

This invention consists in a new and peculiar process for isolating the cells of plants without injuring their integrity, and for freeing them completely from the substances known as incrustating substances, whereby they are also decolorized to a great extent.

Although my process can be employed for isolating the cells of plants generally, whenever such is desirable for different purposes, I consider it particularly useful for the purpose of manufacturing pulp, for the use of paper-makers, from wood or from the fibers of plants, and the description of the invention will here be restricted to such application of it.

The main features of my process are as follows: I put the wood, after cutting it up in small pieces, (preferably as dye-woods are prepared or separated,) into closed vessels, in which it is treated at a gradually-increasing pressure, and at a temperature corresponding to the same, with a caustic-soda lye several times renewed and heated beforehand. After being thus treated said woody matter is also thoroughly washed in the same vessels. This deprives the wood or vegetable matter of incrustating substances, and the connections between the single cells is severed.

My process is based upon a discovery which I have made, viz: That some substances contained in the wood, which in the commencement of the action are dissolved at a comparatively low heat, are precipitated again at a higher temperature as insoluble matter of a humus-like nature. This induced me to act upon the wood with a previously-heated lye, and at a gradually-increasing temperature. By the constant change of lye that takes place those substances which once have entered into solution are carried away by the lye sooner than the separation of humus-like matter from them can take place, in consequence of the rise in temperature. The wood is accordingly

acted upon evenly and partly decolorized, so that it becomes fit for the manufacture of a high class of paper. I find that the wood is the more evenly disintegrated and bleached the oftener the lye is changed, and it is therefore a particular advantage of the apparatus hereinafter described, that in it a continuous change of the lye takes place.

The pressure, the duration of the action, and the concentration of the lye must be regulated according to the particular kind of wood, and the degree of bleaching required. For wood from trees, with deciduous leaves, it is sufficient to use a lye containing two or three per cent. of an hydrous caustic soda, the pressure of which rises at the close to three or four atmospheres, and the action ought to last five or six hours. Wood, however, which is derived from conifers requires for the same time a pressure up to six atmospheres, and a lye containing three or four per cent. of an hydrous caustic soda. Within certain limits an increase of the pressure, or of the time of action, or of the concentration of the lye, can be substituted for a decrease in either of the two other conditions; consequently these proportions and figures need not be strictly adhered to. Freshly-cut wood is more easily worked than old wood.

My process will be more clearly understood from a description of the apparatus which I propose to use, and which fulfills in a high degree the condition of making wood into a fine even pulp with the least possible expense.

Figure 1 in the accompanying drawing represents a plan, and Fig. 2 a longitudinal sectional elevation of the apparatus.

Said apparatus consists of a larger or smaller number of closed vessels capable of resisting the required pressure and chemical action, and therefore most suitably made of iron, which vessels are connected with one another in such a manner that liquids can pass from one vessel to the other, and penetrate in regular order through the contents of the whole range of vessels, either downward or upward, under controllable conditions of temperature and pressure, and the liquid ultimately be run off. The size and arrangement of the apparatus depends, on the one hand, upon the special kind of wood used, and, on the other hand,

upon the special kind of pulp to be manufactured. Thus, if either the raw material is wood from deciduous trees, or if unbleached pulp is required, there are fewer vessels wanted than for working with wood from conifers, or for stuff intended to be bleached to a white color.

A to I represent the closed vessels in which the wood is treated, there being nine in all, although this number may be changed. Each vessel is surrounded with some non-conducting material to keep its contents at a high temperature, and is also provided with a separate fire-place in order to correct any accidental cooling; also, with a man-hole, safety-valves, steam-gages, water-gages, and the other usual mountings of boilers, and a system of upper and lower pipes, which allow of the introduction of water and lye separately into each vessel, and from one vessel to the other. A further important part of the apparatus is a boiler, hereinafter called the lye-boiler, provided with a fire-place for heating the soda-lye, and for bringing it up to the required degree of pressure; also, a force-pump with an air-vessel or regulator for filling the vessels with cold water, as required.

The following is a description of the way in which the above-described apparatus is worked; but it is, of course, allowable to vary the manipulation, according to special circumstances, in points of minor importance: First, the whole of the vessels are filled with cut-up wood; then the communication between the lye-boiler and the first vessel A is opened, and the latter is filled with hot lye, as well as the five following ones by the lye flowing from one to the other in succession through the communications provided for the purpose. The pressure naturally decreases in each successive boiler, and ought to be regulated in such a manner that the lye enters the first vessel A with a pressure of six atmospheres, but stands in the sixth vessel F only under a pressure of one atmosphere, or half of one.

When all six vessels, A to F, are filled with lye the outlet-cock of F is opened, and as much lye is run off as would fill one of the vessels. This drawn-off lye passes to a recovery apparatus, where it is evaporated to dryness, calcined, and remade into caustic soda. At the same time the liquid contents of the first five vessels are forced forward by means of cold water out of the regulator of the force-pump, which communicates with each of the vessels A to F by means of pipes or cocks. The pressure in the regulator is strong enough to force the cold water into A and push the liquid forward, so that in the end A is filled with water and B to F with lye, each containing that lye which has just been in the vessel immediately preceding. Now the cold water is shut off again, the communication between A and B is stopped, and fresh lye is forced from the lye-boiler into the vessel B, while at the same time the outlet-cock of F is shut and the communication be-

tween F and G is opened. This causes the liquid to be forced forward again, and when G is filled the running of fresh lye into B is stopped. At this stage A stands filled with water, and B to G with lye. Now the communication between A and B is opened again, cold water is forced into A, and the outlet-cock of G is opened till a vessel full of lye has run off. A now stands filled with fresh water, B with water previously passed through A, C with the lye just before in B, and so on. Next the outlet-cock of G and the communication between B and C are stopped, but the connection between G and H is opened and fresh lye is forced into C, pushing forward the liquid contents of the next vessels till H is filled as well. Now B and C are connected, a vessel full of lye is drawn out of H, and at the same time cold water is forced the third time into A. After this the vessels A B and C will be full of water, and D to H with lye. The connection between C and D and the outlet of H are now stopped, and H and I are connected and fresh lye is forced into D till it has forced on enough lye to fill I. The liquid contents of A, which has now had three waters, are run off, and the solid contents, viz., the wood, now thoroughly lixiviated and washed, is taken out. The vessel A is filled with fresh wood, and connection established between the several vessels from A to F. The water in C, which has already passed through three vessels, is not used any further for washing, and is not forced from C to D, but is run off, while fresh water is forced into B. The liquid running off from C is dilute lye, and can be used in preparing fresh lye, or otherwise. When C is filled with the water from B, and B with fresh water, C and D are connected, more cold water is forced into C, and a vessel full of lye is run off from F, so that now B C D are full of water and E and F full of lye. Now D and E are disconnected, F and the freshly-charged vessel A are put into communication with each other, and fresh lye is forced in E till E F G H I and A are all full. The stuff in B, which has had three waters, is sufficiently treated and is taken out, after running off the water, and B refilled with wood.

Thus the manipulation is continued without interruption, always five or six vessels being filled with lye and two or three with water, and occasionally one being either emptied or recharged with wood. When the operation is fairly going on, it will be evident that each vessel full of cut wood receives first five vessels full of lye previously passed through wood, then one vessel full of fresh lye, and then three vessels full of water, the first two of which have served for previously washing. The pressure is an increasing one in each vessel, counting backward from the vessel last filled, and reaches its highest degree in the first vessel filled with lye at the moment when fresh lye is being forced into it from the lye-boiler.

When first filling a vessel charged with fresh

wood the lye should enter it from below, but when it is full and closed up the cocks should be reversed, and the subsequent fillings should be from the top downward. The running off and on is so regulated that for each vessel full of wood a quantity of lye is employed just sufficient to cover the wood, which will be about two and one-half or three times the weight of the wood. The wood should be subjected, all in all, to the action of the lye for six or seven hours. The exact time cannot be stated, however, as the treatment has to be varied according to the nature of the wood. The lye, after passing through five or six vessels, is boiled down, and the residue calcined and dissolved in water, and again employed for making caustic lye. The water, which has passed through three vessels, is used as weak lye, either in bleaching or in making fresh lye.

The lye-boiler, in which the caustic lye is kept, is continually being fed with fresh lye, and its contents are there heated under the necessary pressure, and the lye discharged by the pressure on it, as required, to act upon the wood in the closed vessels. The water for washing is not heated, but is forced cold into a regulator or air-vessel, and from this into the vessels A to F, as required. As it has to pass through two vessels previously to coming in contact with hot lye, it is heated in advance to some extent at the same time the pulp is cooled, which is of great importance, as the process is thereby greatly expedited. When

the third water has been drained from the mass, the latter is put, along with water, into a poacher, and is beaten up therein in order to separate the fibers of the wood, which fall asunder almost by themselves, and thus the wood is converted into proper half-stuff.

Only very little power is required for this operation, since the mass need not be cut up, as is done by the ordinary poacher or beating-engine, but only disintegrated and stirred up among the water.

I am aware of the United States patent of Thos. Routledge, No. 141,016, and of his English patent for the same invention, in which he makes no pretensions to subjecting the material to a gradually-increasing pressure, and temperature consequent thereto. I therefore disclaim anything described or claimed by him.

What is here claimed, and desired to be secured by Letters Patent, is—

The process, herein described, of cooking, lixiviating, and washing wood and other vegetable fibrous materials, by exposing the same in a cut or separated state, within a close vessel or vessels, to the action of hot caustic-soda lye at a gradually-increasing pressure and temperature, several times repeated, substantially as specified.

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Witnesses:

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