

# UNITED STATES PATENT OFFICE.

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## PROCESS OF MANUFACTURING CHEMICAL PULP FOR PAPER.

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*To all whom it may concern:*

Be it known that I, ROBERT ROE, JR., a citizen of the United States, residing in Amberg township, in the county of Marinette and State of Wisconsin, have invented certain new and useful Improvements in Processes of Manufacture of Chemical Pulp for Paper, of which the following is a specification.

My invention relates to processes of making fiber or pulp for the manufacture of paper from wood, such as spruce, hemlock, or poplar. In these processes the wood is cut into small pieces or chips and treated in closed vessels, commonly called "digesters," being reduced therein to fiber by the action of suitable chemicals, such as caustic soda, or the sulfites of lime and magnesia, aided by the application of heat usually applied in the form of steam; which is introduced either directly into the digester itself or into a jacket inclosing or surrounding the digester.

The object of my invention is to provide a method by which the digesting of the wood may be accomplished in a shorter time and in a more economical manner than hitherto.

In the so-called "sulfite" process of the manufacture of wood paper pulp or fiber the wood-chips are digested by a cooking liquor, which consists of sulfurous acid combined in certain proportions with a suitable base or bases, such as lime and magnesia employed in the form of dolomite. This cooking liquor has commonly been prepared of the strength required for the digesting process modified, however, in some instances by forcing into the acid already prepared and stored for use that portion of the sulfurous-acid gas which is set free by the action of the heat in the digester and which accumulates in the upper part of said digester and produces gas-pressure. This gas-pressure is relieved by blowing out in order to allow free admission of steam at the bottom of the digester. This blowing of gas from a digester (in which the cooking process is going on) into another receptacle which contains the stored liquor is called "reclaiming" the gas.

In my improved process the cooking liquor

is preferably made of a strength greater than is actually required for the cooking of the wood and afterward as it is being introduced into the digester it is diluted to the degree which is actually required for that purpose by means of water previously heated, as I will now describe. For the purpose of heating this water I prefer to use either a tank (of wood or other suitable material) or a closed vessel in which the water may be heated under pressure to the desired temperature. Heat is applied in any suitable manner, preferably by the introduction of steam. The steam which serves this purpose has heretofore been blown out into the external atmosphere as waste or exhaust steam after the cooking process has been completed; but as the contents of the digester are discharged into the receptacle provided for that purpose, commonly called the "blow-pit," I introduce a portion of this surplus steam into a vessel which contains water and utilize to this extent the exhaust-steam to heat the water. This vessel is connected by a pipe with the digester at any convenient point near the top thereof or with some of the digester attachments.

In my improved process the digester is charged with the chips or small pieces of wood in the usual manner; but instead of running the cooking liquor into the digester at the top, as is commonly done, I prefer to introduce said liquor into the digester at the bottom, together with water, (heated as above described or in any other suitable manner,) or as close as convenient to the place where said water is introduced. The rate of the flow of the cooking liquor and of said heated water is regulated so that the quantity of hot water required for diluting the liquor to the proper degree of strength is run into the digester in about the same length of time as is required to run in the liquor itself. If the water is heated in an open vessel, its temperature of course will not exceed 212° Fahrenheit; but if heated in a closed vessel capable of sustaining steam-pressure the temperature of the water may be greatly increased and prefer-

ably should be raised to such a degree that when the cooking liquor and water have been introduced into the digester the temperature of the contents of the digester is about 212° Fahrenheit. As a considerable time is required to reach this temperature in the present processes, the introduction of heated water, as I have already described as a part of my improved method, greatly reduces the length of time for the digesting operation and in consequence materially increases the per diem product of the digesting apparatus. When the digesting process is nearly completed, I begin to blow steam from the digester through the pipe into the water-heating vessel and continue to do so until there is only a sufficient steam-pressure remaining in the digester to effect the discharge of the contents thereof into the blow-pit. The water thus heated by the steam blown into it, as above described, is used both to heat and dilute the cooking liquor, being mixed or mingled therewith as the liquor is introduced into the digester, as before explained.

When the cooking liquor contains uncombined gas in solution, such as sulfurous-acid gas in the free state, it cannot be heated to a very high temperature without loss of gas, except in a closed vessel; but this difficulty is overcome by my method of heating said liquor, because the hot water is admitted at or about the same time and practically at the same place as the liquor is introduced into the digester, and the gas which volatilizes is still contained within the digester without any loss whatever and may be reclaimed, as hitherto, to strengthen the liquor by being discharged from the top of the digester into the receptacle wherein the cooking liquor is stored. The cooking liquor having been made of a strength exceeding that which is actually required for the digesting process is by the introduction of said hot water not only heated, but is diluted to the exact strength which is required for the digesting process.

I am aware that in reclaiming the sulfurous-acid gas set free by the action of heat in the digesting process, as already mentioned, some steam is blown over into the liquor with the gas and that thereby the temperature of the liquor is somewhat raised, but only slightly, however, and, indeed, it is usual to pass this gas through a cooling device for the very purpose of preventing the overheating of the liquor and the consequent liberation of the gas.

It is a characteristic feature of my said improved process that the cooking liquor is introduced into the digester at its normal temperature at or about the same time of the introduction into the digester of hot water, thereby serving the two purposes, first, of quickly raising the temperature of said liquor to such a degree that the digesting process promptly begins instead of losing the time, as heretofore necessary, to raise the cooking liquor to

the required temperature by heat afterward applied, and, secondly, of diluting the cooking liquor from its previous excessive strength to that strength at which it is commonly used. Therefore I do not wish to confine myself to the use of water for these purposes which has been previously heated in a separate vessel; but I may with equally good results use cold water with steam blown into it as it is introduced in the digester, or I may use mingled water and steam or any other method of heating the water as it is introduced into the digester, or I may use steam alone, admitting it into the digester while the cooking liquor is being admitted at or near the place where the cooking liquor is admitted to heat and mingle with the same, the strength of the liquor, however, always being regulated to suit the conditions. Yet I prefer to heat the water in a separate vessel, as described, because it most conveniently reclaims and utilizes the steam which in the old method is waste.

When the liquor is heated as it is introduced, the temperature of the contents of the digester may be sufficiently high by the time the liquor is all in to avoid the necessity of blowing off much gas at the top of the digester, and therefore the cooking liquor may under those circumstances possess as great strength as it ought to have at the time the digesting process actually begins, even though it has been made of usual strength and considerably diluted in its introduction.

In the so-called "soda" process, "sulfate" process, and other similar processes in this art the cooking liquor may itself be heated before it runs into the digester, or it may be heated by any of the methods above described.

I claim as a novel and useful invention and desire to secure by Letters Patent—

1. In the manufacture of chemical pulp or fiber for making paper, the process herein described of introducing into the digester the cooking liquor at an excessive strength and diluting it to the proper strength by introducing and mingling with it at the same time a suitable quantity of hot water, substantially as specified.

2. In said manufacture, the process herein described of introducing into the digester the cooking liquor at an excessive strength and diluting it to the proper strength by introducing with it mingled water and steam, substantially as specified.

3. In said manufacture, the process herein described of introducing into the digester the cooking liquor at an excessive strength and diluting it to the proper strength by introducing with it water mingled with the exhaust-steam from the digester, substantially as specified.

4. In said manufacture, the process herein described, of introducing into the digester the cooking liquor at an excessive strength and diluting it to the proper strength by water heat-

ed in a suitable vessel and discharged therefrom into the digester at the same time with said liquor, substantially as specified.

5 In said manufacture, the process herein described, consisting of the following steps: putting into a vat natural vegetable substance in small pieces: then introducing into said vat from another receptacle the cooking liquor at an excessive strength but at or about its normal temperature: and then introducing into 10 said vat from still another receptacle heated water for the purpose of diluting the cooking liquor to the proper strength and of raising the contents of said vat to the required temperature, substantially as specified. 15

6. In said manufacture, the process herein described of heating the cooking liquor in the digester by the introduction of steam while said liquor is being admitted, substantially as 20 specified.

7. In said manufacture, the process herein

described of heating the cooking liquor in the digester by the introduction of a heated fluid, discharged into the digester at the place where the cooking liquor is discharged therein, substantially as specified. 25

8. In said manufacture, the process herein described, consisting of the following steps: putting into a vat natural vegetable substance in small pieces: then introducing the cooking liquor into said vat at or near the top thereof: then introducing water into said vat at or near the bottom thereof: and introducing at the same time steam into said vat at or near the place where said water is introduced, substantially as specified. 30 35

In testimony whereof I affix my signature in presence of two witnesses.

ROBERT ROE, JR.

Witnesses:

CHAS. A. SOMMERS,  
JOHN E. DREYER.