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[54] **METHOD OF PERFORMING A SURGE-BOIL STEP DURING THE HEATING PERIOD OF A LIGNO-CELLULOSIC MATERIAL COOKING STAGE**

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[51] **Int. Cl.** **D21c 7/12**

[58] **Field of Search** 162/61, 42

[56] **References Cited**

UNITED STATES PATENTS

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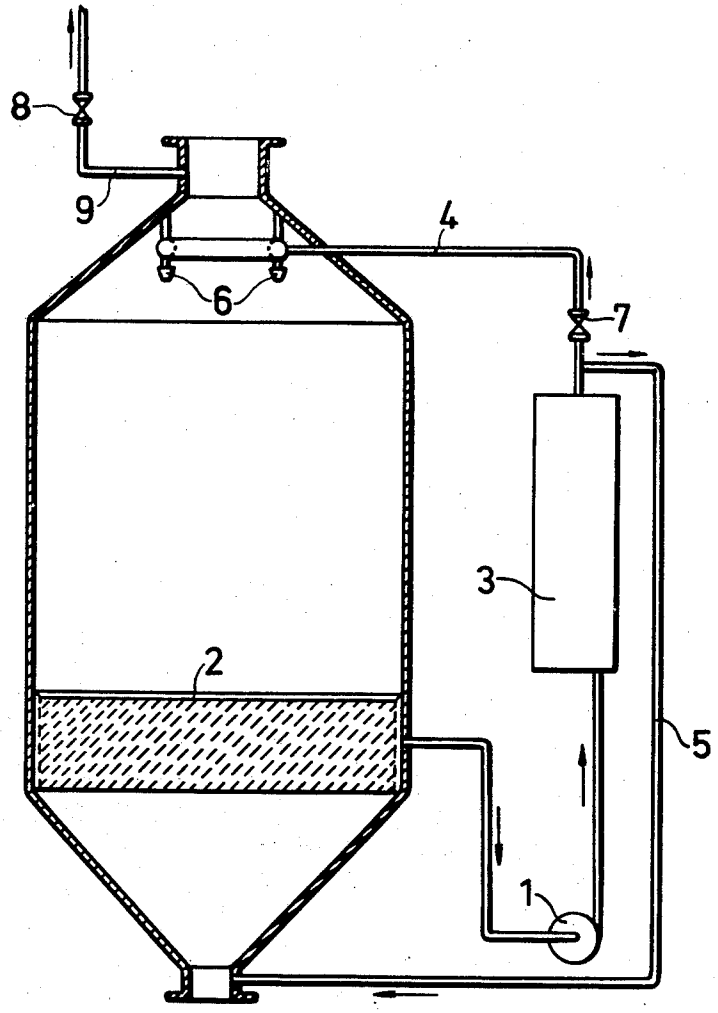
[57] **ABSTRACT**

A surge-boil step is performed during the heating period of a pulp cooking stage at a point of time when the chlorine number of the pulp is 20 to 30, said surge-boil step being created by causing a pressure drop in the digester by removing gas from or supplying cooling liquid to the top of the digester.

2 Claims, 1 Drawing Figure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METHOD OF PERFORMING A SURGE-BOIL STEP DURING THE HEATING PERIOD OF A LIGNO-CELLULOSIC MATERIAL COOKING STAGE

The present invention relates to a method of obtaining a uniformly cooked pulp in discontinuous lignocellulosic material cooking processes in which there is used a digester of the type having a circulation system constructed in a manner to permit cooking liquor to be drawn from the digester via a strainer unit, heated in a calorisator and returned to the top and the bottom of the digester.

A uniformly cooked pulp is of great importance with all pulp manufacturing processes, both with respect to economy and to the quality of the pulp. The reasons for uniformly cooked pulp vary with the type of process applied. In the case of periodic pulp cooking processes, however, the following factors can be considered fairly general with respect to pulp quality.

1. The quality of wood chips used.
2. The extent to which cooking liquor is able to penetrate the wood chips.
3. Cooking liquor circulation.
4. The rate at which the digester content is heated.
5. The pattern of the cooking process applied.
6. The chemical charge made to the system.
7. The wood to liquor ratio.

Although all of the above parameters are of relative importance in obtaining the homogeneous pulp, the present invention is mainly concerned with the circulation of the cooking liquor through the system, which in most cases is the most dominating of the above mentioned factors.

Digester circulation systems are generally of similar constructions for all digesters. The digesters are normally provided with a strainer unit, which may be located at varying positions of heights in the digester, ranging from a position at which approx. 5 percent of the digester volume is located beneath the strainer to a position at which the digester volume beneath the strainer is approx. 50 percent. The liquor circulation system is arranged so that liquor is drawn out from the strainer unit by means of a pump and, subsequent to passing through a heat exchanger, is distributed in specific proportions to the top and the bottom of the digester. The purpose of the system is to distribute chemicals and heat uniformly over the whole content of the digester when heating said content.

A long series of tests carried out on a factory scale has shown that serious difficulty is experienced in obtaining a uniformly cooked pulp when applying conventional cooking techniques. The main reason for this is found to be uneven temperature distribution in the digester. One of the reasons for uneven temperature distribution is poor distribution of cooking liquor at the top of the digester, another is channelling, i.e., the formation of channels in the chip content of the digester by the cooking liquor during the cooking process. In addition to poor temperature distribution, uneven dispersion of cooking liquor in the top of the digester can also lead to uneven alkali distribution to the wood chips located therein. Swedish Pat. No. 303,425 proposes the use of centrifugal pressure sprays as a solution to this problem. It has been found that even spray devices of low efficiency can give a relatively good result in this connection, provided that the level of cooking liquor in

relation to the chips in the digester is favourable (the level of the liquor rises to above that of the chips at an early stage of the cooking process), which in turn is correlated with, inter alia, the wood liquor ratio, the compactness of the chips in the digester, the circulation conditions and the rate at which the digester contents are heated, or in other words most of the conditions under which the cooking process is effected. Thus, poor distribution of the cooking liquor at the top of the digester limits the production rate of the digester and restricts the digester to certain specific cooking conditions, which are seldom optimal. Good distribution of the cooking liquor to the top of the digester is thus a basic condition for acceptable operation of a circulation system of the type envisaged.

The second reason for uneven temperature distribution in the digester, i.e., channelling, or generally unfavourable circulation geometry in the digester, is mainly due to the fact that the quality of the chips relating (essentially to the saw dust content of the charge) and the setting conditions (wood: cooking liquor ratio, circulation flow, circulation ratio of digester top, digester bottom, cooking liquor distribution in the digester top, etc.).

The present invention is also concerned with a method of preventing channelling and of supplying heat to poorly heated zones in the digester. This latter is achieved by the fact that a number of so-called surge-boils are effected during the heating stage and that the first of the surge-boils is carried out at a point in the process where delignification of the wood has just progressed to some significant extent, but prior to any substantial delignification of the wood; i.e., when the chlorine number is 35–10, suitably 32–15 and preferably 30–20. Depending on the length of time taken to heat the digester contents, the cooking temperature will vary during the surge-boil periods between 140° and 180° in the case of a sulphate cook. Corresponding temperatures for acid sulphite cooking processes are 110°–150°C, and for bisulphite cooking processes 130°–170°C.

The duration of the surge-boil periods may vary, but is normally from 10 seconds – 20 minutes. A suitable length of time in this respect is from 1 – 10 minutes, although a period of from 2–5 minutes is preferred.

In accordance with the invention, the surge-boils can be effected either by de-gassing the top portion of the digester for suitable lengths of time, or by introducing suitable quantities of cooling liquor to the digester. The introduction of cooling liquid causes condensation in the digester with accompanying drop in pressure. The extent to which the digester is de-gassed or to which cooling liquor is charged to the digester depends upon the degree of intensity required with respect to the surge-boil. De-gassing and charging of cooling liquor, however, are usually effected in a manner such that a drop in pressure of 0.1 – 8 atm is obtained in the digester, suitably 0.5 – 3 atm, but preferably 0.8 – 2 atm.

It will readily be understood that the number of surge-boil periods applied will vary according to the pattern of cooking process in question. Consequently, in accordance with one aspect of the invention the number of surge-boils applied and the time intervals therebetween are adjusted to suit the particular cooking process performed in a manner to obtain uniform distribution of heat over the digester contents during

the whole cooking process while delignification is taking place.

De-gassing of the digester to bring the surge-boil periods into effect, or the introduction of cooling liquid, such as water or cool cooking liquor for example, to the digester, can be effected by any suitable means. For example, valves which are opened and closed at pre-set intervals by clock mechanisms, can be installed in the cooking liquor circulation line serving the top portion of the digester and in the cooking liquor inlet lines. Obviously, such valves need not be actuated by clock mechanisms, but may be equally well served by temperature sensing devices adapted to send opening and closing signals to the valves upon detecting a certain predetermined temperature.

One important aspect of the valve used for de-gassing the upper portion of the digester is that while it should be capable of de-gassing to the aforementioned extent with which the desired drop in pressure is obtained, its outlet port should not be of such magnitude as to permit excessive quantities of cooking liquor to be entrained with the gas leaving the digester during the de-gassing period.

In accordance with the present invention, prior to carrying out a surge-boil step the flow of cooking liquor to the top of the digester is either stopped completely or decreased. This is preferably effected by means of a valve means installed in the cooking liquor inlet line, although any other suitable means for interrupting or diminishing the flow of cooking liquor will also suffice. In this respect, the supply of cooking liquor to the top portion of the digester is cut off, or partially throttled, at a point of line in the region of from 1 to 120 seconds before opening the de-gassing means, e.g., the de-gassing valve. A suitable point of time in this respect is 5 – 60 seconds prior to opening the de-gassing means, although a time of 10–30 seconds is preferred.

Since deposits are liable to occur on the calorisator during the surge-boil periods unless the supply of steam thereto is interrupted during these periods, means should be provided for closing the steam inlet line at predetermined intervals. As with the de-gassing means and cooking liquor supply control means, the steam inlet control means may also be actuated automatically by pre-set devices, although of course all adjustments to any of the aforementioned control means, including the de-gassing means, may be activated by manually operated mechanical devices.

The present invention will now be illustrated by means of an example, describing the manner in which surge-boil periods were effected when carrying out a sulphate cooking process. The accompanying single drawing illustrates a periodic sulphate digester used when carrying out the process described in the following example.

Although the following description is given with respect to a sulphate cooking process, it will be understood that the invention can also be applied with sulphite and bisulphite cooking processes.

Example

Wood chips were cooked in a periodic sulphate digester having a volume of 125 m^3. The digester was charged with approximately 23 tons calculated as absolutely dry wood chips packed by means of liquor circulation. White liquor and black liquor were charged in quantities such that the alkali charge was 200 kg active alkali (NaOH) calculated per ton of absolutely dry wood and the wood:liquor ratio was 1:3.5. The circulation pump **1** of the illustrated sulphate digester was started up while the chips were being charged to the digester and was operative to remove liquor from the digester through a strainer unit **2.** The liquor was passed through a calorisator **3** and then distributed in a manner such that approximately 80 percent of the liquor passed through a circulation conduit **4** serving the top portion of the digester and the remaining 20 percent passed through a circulation conduit **5** serving the bottom of the digester.

The liquor circulating to the top of the digester was distributed over the chips by means of centrifugal pressure sprays **6.** The digester contents were heated to 170°C by indirect heating with steam in the calorisator **3,** the time taken to heat the digester contents being 150 minutes. When the temperature in the conduit **4** during heating of the digester contents had reached 153°C, the first surge-boil was carried out. This was effected by a valve **7** which was arranged to be automatically closed by a clock mechanism, which was started at the same time as the cooking process.

Thirty seconds after closing the valve **7,** a de-gassing valve **8** was opened and de-gassing of the digester was effected through a conduit **9.** The digester was degassed for 5 minutes, whereupon the pressure in the digester fell by approximately 0.8 atm. In connection herewith a surge-boil took place in the digester, the intensity of which was increased by supplying heat via the circulation system serving the bottom portion of the digester, the flow of circulating liquor being particularly intensive when the valve **7** was closed. After the aforementioned 5 minute digester de-gassing period, the valve **8** was closed and the valve **7** opened and heating of the digester contents was effected in the normal manner. The same surge-boil step was repeated at 160° and 165°C and immediately after reaching the maximum temperature of 170°C. The cook was held at the maximum temperature of 170°C for 20 minutes. Subsequent to this, a pressure decreasing period, 45 minutes in length, was applied, during which the temperature was decreased from 170°C to approximately 165°C. The digester was blown subsequent to taking in approximately 10 m^3 cool cooking liquor. The blowing time was 30 minutes.

The chlorine number of a pulp cooked according to the aforegoing was 6.0 and the shive content when screening an average sample from the digester in a Wennberg strainer having a slut size of 0.20 mm was 1.8 percent. The shive content of a pulp removed from a digester at a chlorine number of 6.0 with which the surge-boil technique of the present invention was not applied was 5.5 percent.

As mentioned before, the surge-boil principle can, alternatively, be effected by supplying cooling liquid, for example cooking liquor or water, to the top of the digester instead of the aforementioned de-gassing step.

I claim:

1. A method of uniformly cooking pulp in periodic lignocellulosic material cooking processes in which there is used a digester of the type having a cooking liquor circulation system constructed in a manner to permit cooking liquor to be drawn from the digester via a strainer unit, heated in a calorisator and returned to the top and to the bottom of the digester, wherein at least

one surge-boil step is carried out during the heating period of the cooking stage at a point of time when the chlorine number of the pulp is 30–20, said at least one surge-boil step being effected by causing a drop in pressure in the digester to take place for at least 10 seconds, said drop in pressure being obtained by carrying out at least one of the steps of (a) removing gas from the top of the digester and (b) supplying cooling liquid to the top of the digester, the flow of cooking liquor to the top of the digester being restricted during said at least one surge-boil step prior to creating the drop in pressure in the digester.

2. A method according to claim **1** wherein the flow of cooking liquor to the top of the digester is at least partially decreased at a point 1–120 seconds prior to causing the drop in pressure in the digester.

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