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PROCESS AND APPARATUS FOR DIGESTING OR COOKING FIBROUS MATERIAL Original Filed July 14, 1925

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## UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR DIGESTING OR COOKING FIBROUS MATERIAL.

Application flied July 14, 1925, Serial No. 43,597. Renewed May 24, 1927.

This invention relates to a process and screen (not shown) prevents the fibrous apparatus for digesting or cooking fibrous material and more particularly to the circulation of the cooking liquor used in the  $\boldsymbol{s}$  treatment of the fibrous material in the manufacture of pulp.

Such materials are now treated with various cooking liquors for the purpose of removing the substances which encrust the fibre "

- to in a manner well known in the art, and in processes known to me much time is consumed in the accomplishment of the desired
- keeping it in motion, which causes a mix- raise the temperature to the desired point. ing of the reagent employed and the extrac- I have found that improved results are ob-
- 20 cook and materially improves the product. It is thus an object of this invention to provide a process and apparatus in which tion of liquor in the heater 5 and then forethe cooking liquor is brought into contact ing it into the lower conical portion of the with the material under treatment in an
- 25 effective manner in order to make full use of the digesting properties of the liquor in digester through the pipe 10. This treatment not only raises the tem-
- A further object of the invention is the provision of a process and apparatus for so regulating the temperature of the digesting of material which brings the heated liquor liquor without the addition of excess steam to the digester or exposing the liquor to the atmosphere.
- provision of a simple process and apparatus for circulating the liquor and causing it to effectively enter the material being treated. The objects and advantages will appear
- from the detailed description in the specifi-40 cation and will be particularly pointed out in the claims.
  - For a clear understanding of the invention, reference is made to the accompanying drawing, which illustrates one form of ap-
- 45 paratus for carrying out the process. In the drawings 1 illustrates a digester in which the fibrous material in the desired form is treated. A pipe 2 having therein a valve 3 connects the pump 4 to the lower 50 end of the digester. A heater 5 of any desired type, is connected to the pump by means of a pipe 6 and to the discharge end of the heater is secured a pipe 7 having a valve 8. This pipe 7 discharges into the

material from entering the pipe 2 and the pipe 7 is provided with a perforated nozzle 9. A further pipe 10 having a valve 11 60 connects the heater with the top portion of the digester above the level of the charge therein.

In the cooking of such materials it is very desirable that the cooking liquor come into 65 intimate contact with the particles of the material in order that the desired reactions result. I have found that the most effective the usual cooking processes it is customary application of the cooking liquor is obtained to innuerse the material in the cooking 70 may take place in a minimum of time. Th 16 by circulating the liquor, or in other words liquor and admit steam to the digester to tives liberated from the material being tained by periodically or continuously with-treated, which reduces the period of the drawing a portion of the liquor from the 75 cook and materially improves the product. bottom of the digester by means of the pump 4, raising the temperature of this pordirector in a tangential manner, or part of 80 the liquor may be returned to the top of the

perature of the cooking liquor but causes a circulation and agitation within the charge 85 into more intimate contact with the cells of the material and permits the more ready extraction of the resinous and gummy sub-Another object of the invention is the stances from the fibres of the material. It 90 will be apparent that by forcing the heated liquor into the conical portion of the digester in the manner specified, a swirling upward circulation of the liquor and charge will be effected in the onter portion of the digester 95 with a downward flow at the centre. This circulation and agitation of the liquor and charge tends to hasten the cook and to give more uniform results throughout the entire charge. In addition, the temperature is 100 raised as desired without undue dilution of the treating liquor.

Moreover, I have found that an effective circulation of liquor may be effected in the digester, without the use of the pump. 105 When the liquor flows into the heater its temperature is quickly raised and this rise in temperature causes the liquor to flow through the ontlet of the heater to the digester, thus causing circulation of the liquor 110 56 lower end of the digester at a tangent to as well as securing the required temperature the conical surface thereof. A suitable without dilution of the liquor.

Furthermore, by closing the valves 8 and immersed therein in order to hasten the cook, 11 without operating the pump, the heater will become filled with liquor and when the pressure in the heater, due to the rise in temperature of the liquor therein, is sufficient, liquor will be forced back into the bottom of the digester with the result of keeping the liquor, consequently the material being treated, in movement, which greatly 10 assists in causing thorough mixing of the retained gases and solvents with the extractives liberated from the material under treatment.

I claim:

1: A process of digesting fibrous material 15 which consists in treating the material with a cooking liquor in a digester, withdrawing a portion of the liquor from the bottom of

the digester, raising the temperature of the withdrawn portion of liquor and returning 20 it to the lower conical part of the digester,

and there releasing it in a manner to cause agitation without any substantial compacting of the charge.

2. A process of digesting fibrous material which consists in cooking the material in a 25 digester with a liquor, withdrawing from the bottom of the digester a portion of the liquor, passing it through a heater to raise its temperature and forcing the heated liquor

30 into the lower conical part of the digester to cause effective agitation and penetration into the charge of material.

3. A process as defined in claim 2 wherein the heated withdrawn portion of liquor is given a swirling upward circulation in the 35 bottom portion of the digester.

4. In a process of digesting fibrous material circulating cooking liquor from the bottom of the digester through a heater and back to the lower part of the digester to

40 cause a movement of the liquor and material

the circulation being such as to affect substantially the whole charge.

5. In a process of digesting fibrous ma- 45 terial the step which consists in producing in the lower conical portion of the digester a swirling movement of the liquor.

6. In a process of digesting fibrous ma-terial in a digester the steps which consist 50 in permitting liquor to flow from the bottom of the digester to a heater and rapidly raising the temperature of the liquor in the heater to create pressure therein to force the heated liquor back to the bottom of the 55 digester.

7. An apparatus for digesting fibrous matorial which consists of a digester, a pump connected to the lower end of the digester, a heater connected to the discharge end of 60 the said pump and a pipe connecting said heater to the lower conical portion of the digester in a tangential manner.

8. An apparatus for digesting fibrous material having in combination a digester and 65 a heater, so connected to the digester as to be adapted to cause a circulation of liquor from the bottom of the digester back to the lower conical portion of the digester in a 70 tangential manner.

9. A digester for cooking fibrous material having in combination means for admitting fluid to the lower conical portion of the said digester, said means being connected to the digester in a tangential manner.

10. An apparatus as defined in claim 9 having means for circulating a portion of the heated liquor to the top of the digester substantially as described.

In testimony whereof I affix my signature.

## FREDERICK K. FISH, JR.