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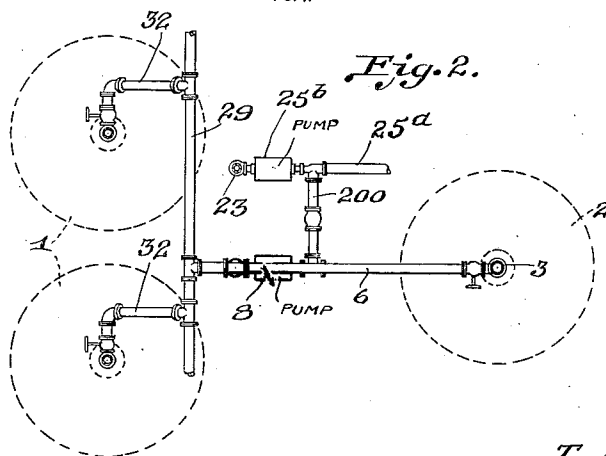
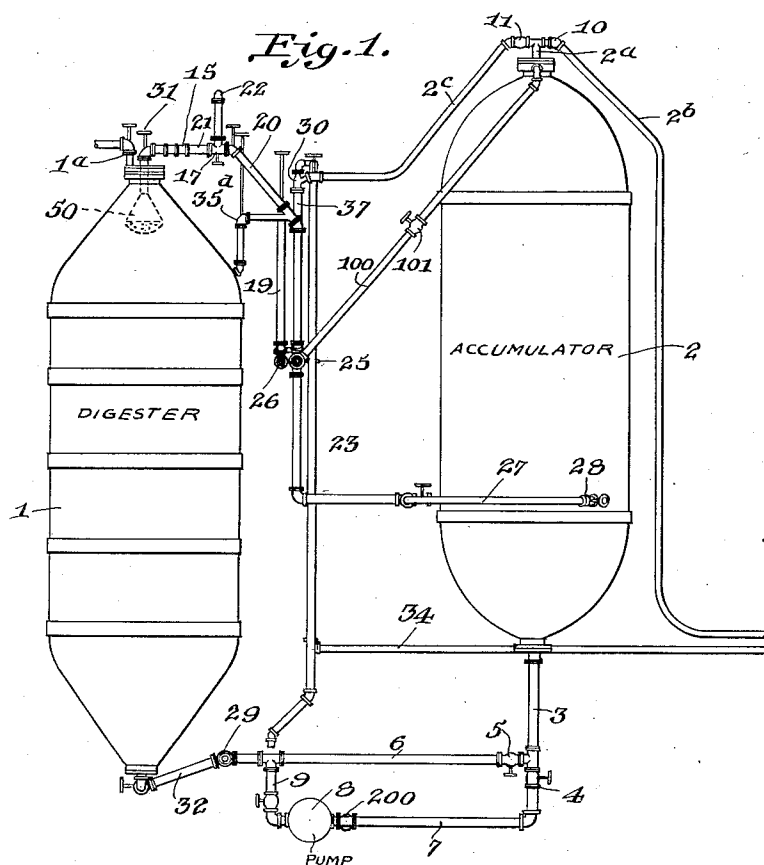
T. L. DUNBAR

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METHOD AND APPARATUS FOR DIGESTING FIBROUS MATERIAL

Filed May 17, 1930

3 Sheets-Sheet 1



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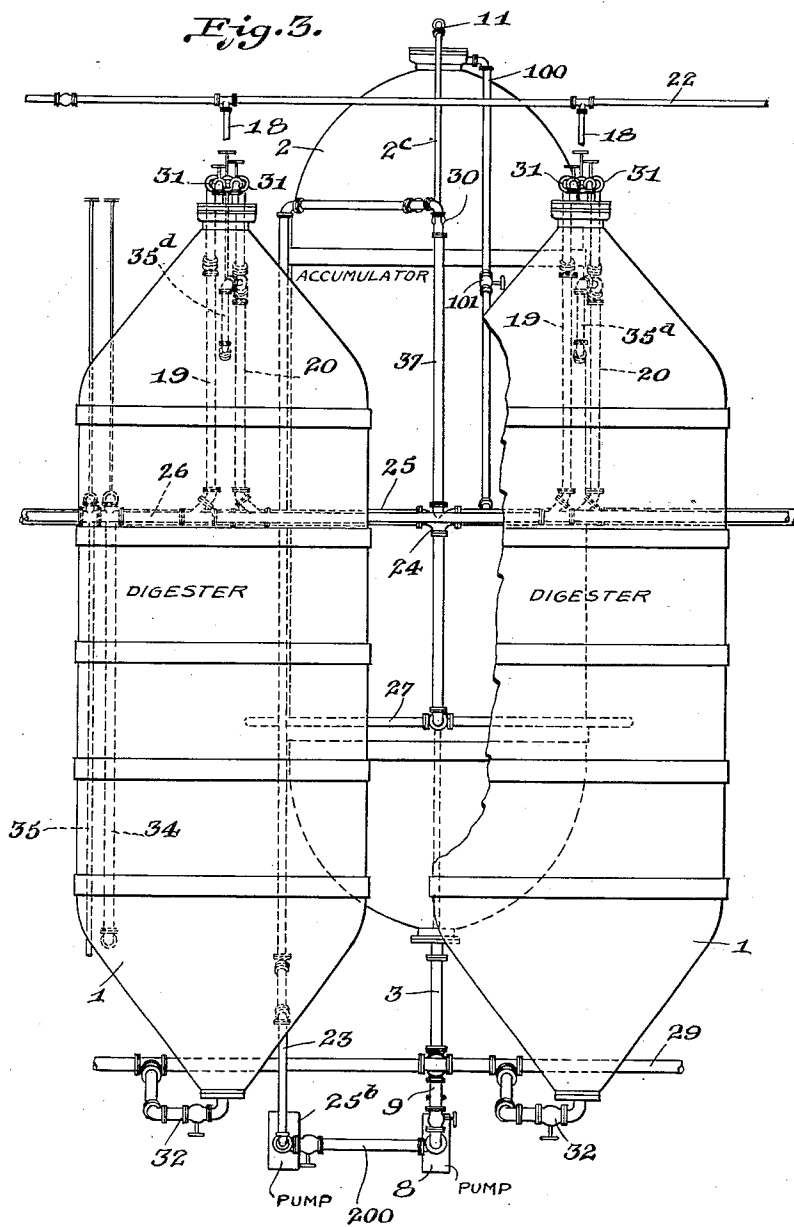
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METHOD AND APPARATUS FOR DIGESTING FIBROUS MATERIAL

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3 Sheets-Sheet 3

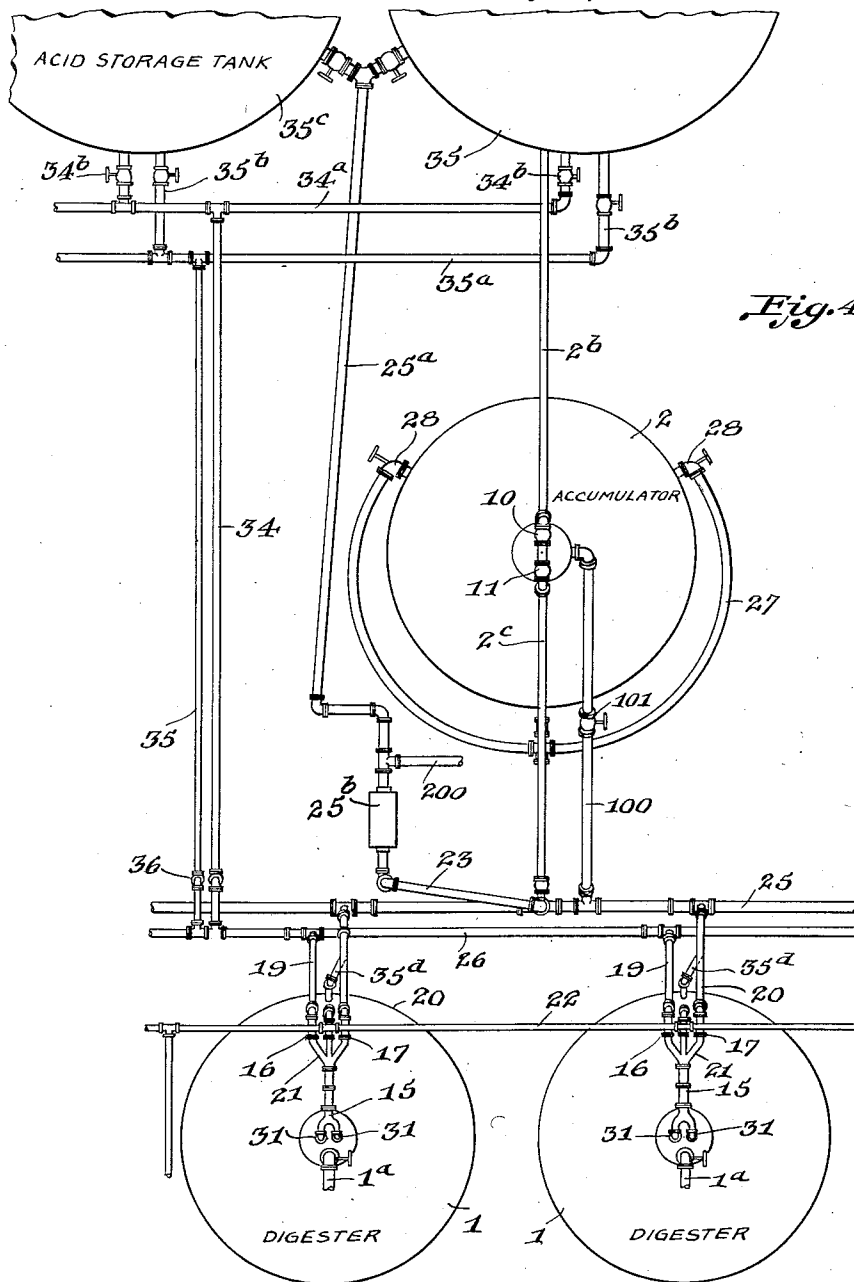


Fig. 4.

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR DIGESTING
FIBROUS MATERIAL

Thomas L. Dunbar, Watertown, N. Y.

Application May 17, 1930. Serial No. 453,255

24 Claims. (Cl. 92-7)

This invention pertains to the digestion of fibrous material, and is directed to improvements in systems of the character which recover the relief gas, vapor and liquid from the digesters and use the heat units impounded therein for heating fresh acid liquor in an accumulator maintained under pressure.

Heretofore, it has been proposed to pump the hot liquor from the accumulator into a digester that has just been charged with chips, and to utilize the pressure of the pump to build up a pressure in the digester. However, in such proposals, a cushion of air remaining in the digester during the filling with liquor, must be compressed, and this not only prevents the complete filling of the digester with the liquor, but the air has a deleterious effect on the material undergoing treatment.

Furthermore, the acid liquor pump must be kept running from the time that liquor starts into the digester, until a pressure has been pumped on the digester sufficient to open a relief valve at the top of the digester.

In accordance with my invention, the accumulator is elevated relatively to the digester. For example, assuming a digester and an accumulator to be of about the same height and capacity, the top of the accumulator will be elevated say about ten feet above the top of the digester, so that the pressure existing in the accumulator in conjunction with the static head of liquor therein will be sufficient to transfer the hot liquor from the accumulator into the chip charged digester, and then, after the completion of the filling of the digester with the acid liquor, a pump may be used for a short time to pump any desired pressure on the digester to cause the hot preconditioned liquor to penetrate the chips in the digester.

In this way, I save most of the power that was formerly expended in transferring the hot liquor from the accumulator to the digester.

Another object of the invention is to provide means to allow steam to be blown reversely through the relief branches of the digester for cleaning the strainers at the top of the latter.

A still further object is to provide improved means for contacting relief fluids from the digesters and accumulator, with acid liquor.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

Referring to the drawings,

Fig. 1 is an end elevation of a portion of my improved apparatus.

Fig. 2 is a top plan view of a portion of the same, with certain parts removed to facilitate illustration.

Fig. 3 is a side elevation showing a pair of the digesters, the accumulator and some of the pipes connecting these elements of the apparatus.

Fig. 4 is a top plan view of the apparatus.

In the drawings, 1 designates the digesters, and 2 an accumulator elevated relatively to the digester. It will be understood that as many digesters and accumulators may be used as the size of the plant dictates.

Hot acid liquor from the accumulator can be discharged by means of the pressure existing in the accumulator, and the static head therein, through a pipe 3 that leads from the bottom of the accumulator. Hand control valves 4 and 5 connect this pipe to a pump suction conduit 7, and an acid by-pass pipe 6. The latter communicates with a header 29, which is employed to feed the hot acid liquor to valved branches 32, leading to the bottoms of the digesters.

At this point, if we assume that a digester has just been charged with chips or other fibrous material, hot liquor from the accumulator can flow through 3, 5, 6, 29 and 32 to that digester for completely filling the latter with hot liquor.

After the digester has been filled in this way, valve 5 can be closed, and valve 4 opened, and then the pump 8 may be started to force the liquor from the accumulator through the valved branch 9, and into 6, 29 and 32, to build up the desired pressure in the digester.

This is one of the important features of the present invention, for by elevating the accumulator relatively to the digesters, gravity and the pressure and static head existing in the accumulator may be used to complete the filling of the digester after the latter has been charged with chips, and to build up a certain pressure in the digester. Then, if a higher pressure is desired in the digester, the pump 8 may be employed for this purpose.

While the hot liquor is flowing from the accumulator to the digester, a valved vent 1a at the top of the latter is opened, so that the air may escape to atmosphere. As soon, however, as gas commences to escape at this point, the valve of the vent is closed, and then either one or both of the valves 31 at the top of the digester is or are opened to allow the escape of the gas through the Y-connection 15. This connection is joined by a

low pressure branch 19 having a hand valve 16 interposed therein, to a low pressure header 26. The latter is connected by a pipe 35 having a valve 36, to a header 35a that is joined by valved branches 35b to the acid storage tanks 35c. By the use of such means, the cold vent gases may be led into the fresh acid liquor in the storage tanks to be absorbed by such liquor.

When liquor has completely filled the digester, the valve 16 is closed, as well as the valves 31, and then by means of the pump 8, the desired pressure can be pumped on the liquor in the digester. When this desired pressure is reached, the pump is halted and the valve in the acid liquor branch 32 at the bottom of the digester is closed.

Now as steam is introduced in the usual way, the valved side relief branch 35d of the digester is opened so that the excess hot liquor will flow into the high pressure relief header 25. This header is provided at 24 with an injector fitting through which acid liquor from the storage tanks 35c is pumped to the accumulator, so that the forced liquor will induce the flow of relief liquor from the digester to the accumulator. For this purpose, a pipe 25a leads from the storage tanks to a pump 25b which forces the liquor upwardly through a pipe 23 into a second injector fitting 30. From the latter, the liquor flows through the down pipe 37, into the injector fitting 24. The lower end of the latter is in communication with a header 27 that is connected by valved branches 28 with the lower portion of the accumulator, so that fresh liquor on its way to the accumulator, mixes with the relief liquor from the digester. After the required liquor has been released from the digester through the side relief branch 35d, the valve in that branch may be closed, and then one or more of the valves 31 at the top of the digester may be opened to allow high pressure gas to flow through the fitting 15, into a high pressure branch 20 that is provided with a valve 17. When that valve is opened, the high pressure relief gas will flow from pipe 20 into the high pressure header 25, and it will be sucked by the injector fitting 24, into that fitting, to be mixed with the fresh liquor on its way to the accumulator.

At the end of the cook, the valve 17 may be closed, and then the low pressure gases will escape from the digester through the low pressure branch 19 and be discharged into the low pressure relief header 26, and from the latter, these gases may flow through a valved pipe 34, into a header 34a that is connected by valved branches 34b to the storage tanks, so that the hot low pressure gases will be introduced into the fresh acid liquor in the storage tanks, to be absorbed by the fresh liquor, and of course, to impart their heat units to said liquor.

In the present invention, the top of each accumulator is provided with a gas outlet conduit 2a that is joined by a pipe 2b to one or more of the acid storage tanks. A pressure operated valve 10 in this pipe is set to allow the gas under excessive pressure, to flow from the accumulator, into the liquor in the storage tanks, to be absorbed by such liquor, and to impart its heat units to such liquor. Ordinarily, however, relief gases from the accumulator are discharged into a pipe 2c which leads from the conduit 2a to the injector fitting 30, whereby the acid liquor on its way from the storage tanks to the accumulator, sucks over this gas and mixes the same with the fresh liquor flowing to the accumulator. A pressure operated valve 11, interposed in the pipe 2c, func-

tions to maintain the desired pressure on the accumulator.

With regard to the pressure operated valves 10 and 11, it will be noted that during the cooking, the pressure is built up in the accumulator, and the pressure will rise until it equals the pressure existing in the digester, and for the purpose of preventing the pressure in the accumulator rising higher than that in the digester, the pressure relief valves 10 and 11 are provided.

It is well known that the relief branches at the top of a digester are provided on the interior of the latter with strainers 50 to prevent solids from escaping with the relief fluids, and as these strainers have a tendency to become clogged, I have provided novel means for freeing the same of accumulated solids. For this purpose, a steam header 22 is connected by valved branches 18 to the fittings 21, whereby when the valves 16 and 17 are closed, steam may flow reversely through the conduit 15, and into the digester, through the strainers in the latter, and act to blow any accumulation from the strainers.

To assist, if desirable or necessary, in discharging preheated and preconditioned cooking solution from the accumulator 2, the top of the accumulator may receive gas from the high pressure header 25. For this purpose, the header is connected to the top of the accumulator by means of a pipe 100 having a control valve 101.

A valved pipe 200 connects the pipes 25a and the pipe 7 adjacent to the inlets of the pumps 25b and 8, whereby liquor from the storage tanks or from the accumulator may be forced by either one of the pumps. This also allows liquor from the storage tanks and accumulator to be mixed before passing through either one of the pumps.

While I have disclosed what I now consider to be a preferred embodiment of the invention in such manner that the same may be readily understood by those skilled in the art, I am aware that changes may be made in the details disclosed, without departing from the spirit of the invention, as expressed in the claims.

What I claim and desire to be secured by Letters Patent is:

1. An improved process for filling digesters charged with fibrous material, consisting in flowing hot preconditioned sulphite liquor from an elevated pressure accumulator under the pressure and the static head existing in the accumulator, directly into said digester, said liquor being of such a concentration that it can be used immediately for the digesting operation.

2. An improved process for filling digesters charged with fibrous material, consisting in flowing hot preconditioned sulphite liquor from an elevated pressure accumulator under the pressure and the static head existing in the accumulator, directly into said digester, said liquor being of such a concentration that it can be used immediately for the digesting operation, and permitting any air in the digester to escape to the atmosphere while filling the latter with liquor.

3. An improved process for filling digesters charged with fibrous material, consisting in flowing hot preconditioned acid liquor from an elevated pressure accumulator under the pressure and the static head existing in the accumulator, into said digester, said liquor being of such a concentration that it can be used immediately for the digesting operation, permitting air to escape from the digester while filling the latter with liquor, and pumping hot liquor into the di-

gester after the latter has been filled, to build up a pressure within the digester.

4. In a process of the character described, passing hot relief fluids from a digester undergoing cooking, directly into acid liquor in an elevated pressure accumulator and thereby absorbing and mixing said fluids with the acid liquor in the accumulator and preheating said liquor, charging a digester with fibrous material, and then completing the filling of the digester with hot acid liquor from the accumulator by utilizing the pressure and static head existing in the latter, to flow the hot liquor from the accumulator into the last mentioned digester.

5. In a process of the character described, passing hot relief fluids from a digester undergoing cooking, directly into acid liquor in an elevated pressure accumulator and thereby absorbing and mixing said fluids with the acid liquor in the accumulator and preheating said liquor, charging a digester with fibrous material, then completing the filling of the digester with hot acid liquor from the accumulator by utilizing the pressure and static head existing in the latter, to flow the hot liquor from the accumulator into the last mentioned digester, and permitting air to escape from the last mentioned digester while the hot acid liquor is flowing into said digester.

6. In a process of the character described, utilizing hot relief fluids from the digester undergoing cooking, to preheat acid liquor in an elevated pressure accumulator and thereby absorbing and mixing said fluids with the acid liquor in the accumulator, charging a digester with fibrous material, then completing the filling of the digester with hot acid liquor from the accumulator by utilizing the pressure and static head existing in the latter, to flow the hot liquor from the accumulator into the last mentioned digester, allowing air to escape from the digester while filling the latter with hot acid liquor, and increasing the pressure in the digester after the latter has been filled with liquor, by pumping hot acid liquor into the digester while the latter is sealed.

7. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, a valved conduit connecting the bottom of the accumulator to the digester, and means for pumping hot acid liquor from the accumulator to the digester.

8. An apparatus for digesting fibrous material comprising a digester, a pressure accumulator elevated relatively to the digester, a valved conduit connecting the bottom portion of the accumulator to the lower portion of the digester, a pump, and valved branches connecting the pump to said conduit.

9. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for passing relief fluid from the top of the digester into the accumulator, and a valved conduit connecting the bottom of the accumulator to the lower portion of the digester.

10. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for feeding fresh acid liquor to the accumulator, means connecting the last mentioned means to the upper portion of the digester for passing hot relief fluids from the upper portion of the digester to the accumulator, and a valved conduit connecting the bottom of the accumulator to the lower portion of the digester.

11. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for feeding fresh acid liquor to the accumulator, means connecting the last mentioned means to the upper portion of the digester for passing hot relief fluids from the upper portion of the digester to the accumulator, a valved conduit connecting the bottom of the accumulator to the lower portion of the digester, and means for venting air from the top of the digester.

12. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for feeding fresh acid liquor to the accumulator, means connecting the last mentioned means to the upper portion of the digester for passing hot relief fluids from the upper portion of the digester to the accumulator, a valved conduit connecting the bottom of the accumulator to the lower portion of the digester, and means for pumping hot acid liquor from the accumulator into the digester.

13. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for feeding fresh acid liquor to the accumulator, means connecting the last mentioned means to the upper portion of the digester for passing hot relief fluids from the upper portion of the digester to the accumulator, a valved conduit connecting the bottom of the accumulator to the lower portion of the digester, a pump, and valved branches connecting said pump to the last mentioned conduit.

14. In the digestion of fibrous material, passing hot relief fluid from the top of a digester during cooking, directly into acid liquor contained in an elevated pressure accumulator, and thereby mixing the fluid with the fresh acid liquor and heating the latter, and utilizing the pressure and static head existing in the accumulator to flow hot acid liquor from the latter into the digester.

15. A method of cleaning the strainer leading to a relief branch at the top of a digester, consisting in reversely flowing steam through said branch.

16. In an apparatus for the digestion of fibrous material, a digester having a valved relief branch, of means for introducing steam into said branch for blowing accumulation off a screen connected to the branch.

17. In a process of the character described, passing high pressure gases from the top of a digester into the top of an accumulator to force cooking liquor from said accumulator into a digester.

18. In an apparatus of the character described, a digester, an acid liquor storage tank, a valved conduit leading from the storage tank and provided with a pump, an accumulator, a valved conduit connecting the bottom of the digester to the bottom of the accumulator, a pump interposed in the last mentioned conduit, and a valved by-pass pipe connecting said conduits and arranged adjacent to the inlets of the pumps.

19. In a process of cooking cellulose bearing materials for the production of pulp, the method which comprises charging the digester with the cellulose bearing material, closing the digester, and releasing into the digester, a hot charge of sulphite cooking liquor maintained under sufficient super-atmospheric pressure to supply the digester.

20. In a sulphite process for cooking cellulose bearing material for the production of pulp, the method which comprises charging a sulphite

digester with cellulose bearing material, sealing the digester, and releasing into the digester a hot charge of sulphite cooking liquor maintained under sufficient super-atmospheric pressure to charge the same into the digester without the use of a pump.

21. Apparatus of the character described, comprising a digester for cooking fibrous material with cooking liquor under pressure, a pressure accumulator for confining a supply of cooking liquor under super-atmospheric pressure, a relief pipe for said digester, means for connecting said relief pipe directly to said accumulator to supply heated relief liquor to the accumulator, and gravity means for supplying heated cooking liquor from the accumulator to said digester.

22. Apparatus of the character described, comprising a digester for cooking fibrous material with cooking liquor under pressure, a pressure accumulator for confining a supply of cooking liquor under super-atmospheric pressure, a raw cooking liquor storage tank, means for supplying cooking liquor from said storage tank to said accumulator, a liquor relief line for said digester, means for introducing heated relief liquor from

said relief line into said accumulator to thereby conserve the liquor and the heat of the liquor, and gravity means for supplying heated cooking liquor from said accumulator to said digester.

23. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for transferring relief fluids from the top portion of the digester directly into the lower portion of the accumulator, and a valved conduit connecting the bottom of the accumulator to the lower portion of the digester for transferring hot acid liquor from the accumulator into the digester.

24. An apparatus for digesting fibrous material, comprising a digester, a pressure accumulator elevated relatively to the digester, means for transferring relief fluids from the top portion of the digester directly into the lower portion of the accumulator, a valved conduit connecting the bottom of the accumulator to the lower portion of the digester for transferring hot acid liquor from the accumulator into the digester, and means for pumping hot acid liquor from the accumulator into the lower portion of the digester.

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