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METHODS FOR EXTRACTING HEAT AND SO_2 FROM SULPHITE WASTE LYE CONTAINING SO_2

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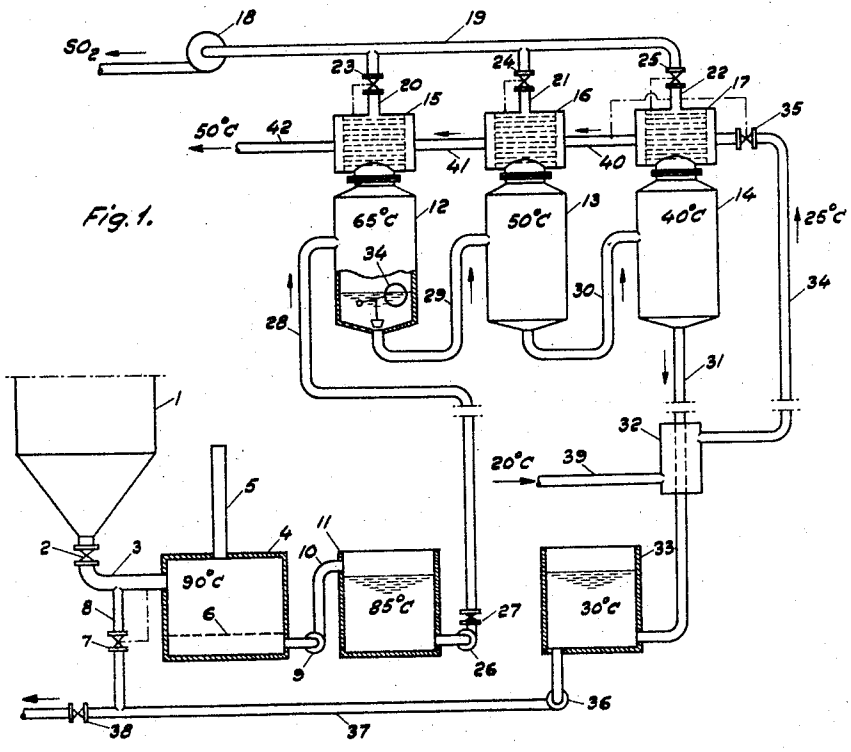
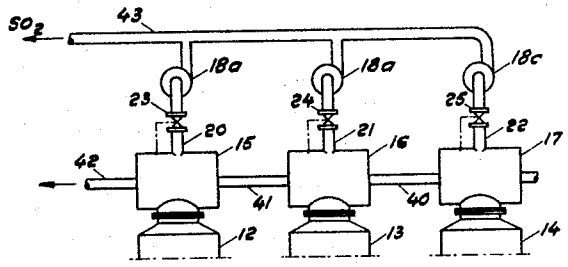


Fig. 1.

Fig. 2.



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METHODS FOR EXTRACTING HEAT AND SO_2 FROM SULPHITE WASTE LYE CONTAINING SO_2

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4 Claims. (Cl. 92—2)

In connection with sulphite cellulose digestion it is a previously known practice, after terminated digestion or boiling and with the boiler still under pressure, and without any preceding removal of the lye, to eject the boiler content directly into a pulp bin which communicates with the atmospheric air, and to withdraw the lye in the latter instead of in the boiler. In this case, in the course of the ejection process which is carried out under large pressure drop, a violent defibration of the pulp will occur. The latter, therefore, will accumulate in the bin in a strongly defibrated state which involves the advantage that the lye is enabled to flow off and to be expelled from the pulp as completely as possible using a minimum amount of expulsion liquid. In this way it is possible to obtain a larger quantity of waste lye of a higher concentration than with the prior and, as far, most commonly practiced method according to which the lye removal was carried out in the boiler proper after lowering the pressure therein. This is a matter of great importance when the dry substance in the waste lye is to be recovered, and especially since, in this case, it would be essential to evaporate the lye as economically as possible.

In order to prevent vapours and gases from leaving the bin during the ejection process to such an extent as to be annoying to the surroundings, it is common practice to introduce a cooling medium into the ejection duct proper, said cooling medium suitably consisting of lye of a comparatively low temperature, and in sufficient quantity to lower the temperature of the boiling composition below 100° C., usually to 90 to 95° C., before it reaches the bin. In this way, at least a major portion of the SO_2 will remain in the waste lye. Thereafter, the heat content of the lye is usually utilized for water heating through heat exchange between the lye and cooling water in an indirectly acting heat exchanger, the sulphur in the lye being, however, in this instance not recovered but will be lost.

The present invention relates to a method of extracting both SO_2 and heat from hot lye which contains SO_2, for example after the ejection process now described. The main object of the invention is to improve such extraction, and to this purpose, according to the invention, steps are taken to subject the hot, SO_2-containing lye discharged from the bin, at least without any substantial preceding cooling thereof other than that imparted thereto by heat losses when flowing through the ducting and the buffer tank, if any, to a series of successive pressure lowering processes each involving a temperature decrease of the lye and a consequent release therefrom of SO_2-containing vapour, and each being succeeded by a condensation process in which said vapour is condensed at, at least, approximately the decreased pressure involved and at a temperature corresponding thereto, while being indirectly cooled from a cooling medium which is utilized successively in the several separate condensation processes in turn from a condensation process occurring at a lower pressure and temperature

to a condensation process occurring at a higher pressure and temperature, the uncondensable SO_2-gas from each one of said processes being withdrawn from the system. The invention may be applied to sulphite cellulose digestion of the kind in which, after completing the digestion or boiling process and with the boiler maintained under pressure, and at least substantially without preceding lye removal, the boiler content is injected directly into a pulp bin in open communication with the atmospheric air, the lye removal from the pulp being completed in said bin.

The invention will now be described more in detail, reference being had to the accompanying drawing in which:

Fig. 1 illustrates diagrammatically a boiler having a discharge system operating on an ejection principle, and combined with a heat and SO_2 extraction system according to the present invention.

Fig. 2 illustrates a modification of a portion of said extraction system.

Identical parts of the two figures are designated with like reference numerals. Temperature values stated in this specification and in the accompanying drawing are not to be taken in a limiting sense but are merely to be considered by way of examples illustrating the descriptive matter.

Referring now to Fig. 1 of the drawing, the lower portion 1 of a boiler may be caused to discharge its content under pressure into the bin 4 through a bottom cock 2 and an ejector duct 3, said bin communicating with the atmosphere through a vent pipe 5. In its bottom portion said bin has a screen 6 through which the waste lye can be separated from the pulp. In the course of the discharge process lye of relatively low temperature is supplied through a valve 7 and duct 8 directly into the ejector duct 3 where it will mix with and lower the temperature of the boiler content before the latter will reach the bin. The valve 7 is controlled by a thermostat receiving its impulse from the ejector duct downstream of the point of mixing, so that the cooling lye will be supplied automatically in the proper proportion for the desired mixing temperature, for example 90 to 95° C. According to the explanations already given, it will be seen that the major portion, at least, of the SO_2 of the boiler content will remain dissolved in the bin content, i. e. in the hot waste lye driven off therefrom through the screen 6.

The hot SO_2-containing waste lye is pumped into the buffer tank 11 through the duct 10 by means of a pump 9. Some heat will be lost on the way to and in the tank, so that in the tank the lye is presumed to have a temperature of 80 to 85° C. at which it is passed to a heat and SO_2-extraction system according to the invention. This system consists essentially of three expansion vessels 12, 13 and 14 each in communication with a corresponding surface condenser 15, 16 and 17. Each expansion vessel and its condenser are evacuated in common by a fan 18 through a collector duct 19 and branch conduits 20, 21 and 22, respectively, having automatic by-pass valves 23, 24 and 25, respectively. These valves enable the vacuum in the various expansion vessels and corresponding condensers to be regulated to and maintained at a desired level decreasing in pressure value from the tank 11 is introduced into the system by the order from number 12 to number 13 and then to number 14. The valve 25 might be omitted, if desired. Lye from the tank 11 is introduced into the expansion vessel pump 26, valve 27 and duct 28 into the expansion vessel 12, therefrom through a duct 29 into the expansion vessel 13 and therefrom in turn through the duct 30 into the expansion vessel 14 from which the lye, which is now substantially stripped of its SO_2-content, is discharged from the system through the duct 31 and pre-heater 32

into a receiver 33. A float valve 34 in each expansion vessel (only shown in the vessel 12) controls the discharge of the lye from each expansion vessel in such a manner that a definite lye level is maintained therein so as to prevent any through-flow of vapour.

From the receiver 33 lye may be tapped for evaporation or any other process through the pump 36, conduit 37 and valve 38, and/or for being recirculated as cooling lye through the valve 7 and conduit 8 and into the ejector conduit 3.

The cooling medium for the condensers being, for instance, water, is introduced into the system through the conduit 39, pre-heater 32, wherein it is preheated by discharge lye, conduit 34 and valve 35 to the condenser 17, passing the condensers 17, 16 and 15 in turn through conduits 40 and 41, that is in the same range of order as the condensers operate at pressures and temperatures increasing from one condenser to the other at the steam-side of the system. The cooling medium then leaves the system through the conduit 42. The valve 35 is controlled by a thermostat receiving its operating impulses from the cooling medium outlet 40 from the condenser 17.

As the lye passes through the system it will be subjected, in each expansion vessel, to a pressure decrease which will incur a supply of vapour to the corresponding condenser from which latter uncondensable SO_2-gas escapes from the system. The cooling medium in its turn will be heated to higher and higher temperatures when passing from one condenser to another, and it is primarily this effect that constitutes the essential value of the present invention, since high-temperature heat will be obtained at the same time as SO_2 is extracted. A few facts with regard to the temperature conditions of the process have been stated and indicate, inter alia, that it is possible upon an expansion down to 40° C. to attain a temperature of 50° C. of the discharged cooling medium which should not be possible if the expansion was carried out in one single stage.

Instead of water serving as the cooling medium, in which case the process is utilized for hot-water production, it will be possible in the same way to use some other medium the heating of which is desired, such as acid for the boiling operation.

In Fig. 2 which illustrates a modified method of evacuating the several expansion vessels and their respective condensers, the conduits 20, 21 and 22 are each connected to a corresponding suction fan 18*a*, 18*b* and 18*c*, respectively. Whilst compressing the several gas phases, said fans supply the latter to a common discharge duct 43. This arrangement causes a considerable reduction of the compression work as compared to the arrangement of a common fan as shown in Fig. 1 in which all gas will have to be compressed from the lowest pressure which is that prevailing in the separator 14.

What I claim is:

1. A method in the boiling of sulfite cellulose employing lye comprising the steps of first terminating the boiling process and then, with the boiler still under approximately the boiling pressure and without any substantial preceding removal of lye from the boiler, ejecting the boiler contents, including lye and pulp, directly into a pulp bin communicating directly with the atmospheric air while cooling said boiler contents during said ejection so as to cause said contents to enter said bin at a temperature in the range of 90° C. to 100° C. with substantially all of the SO_2 of the boiler contents remaining dissolved in the lye collected in the bin, withdrawing said hot lye containing SO_2 from the pulp in said bin, subjecting a flow of said withdrawn lye without any substantial preceding cooling thereof, other than that due to heat losses if any, in succession to each of several simultaneously occurring vacuum pressure lowering steps, each of said steps involving a temperature decrease of the lye and a consequent release therefrom of vapor containing SO_2 as the flow of lye passes from one pressure lowering step to the next, each of said steps being succeeded by a condensation step in which said vapor is condensed at approximately the pressure of the corresponding pressure lowering step and at a temperature corresponding thereto while indirectly cooling said vapor by a cooling medium, utilizing said cooling medium successively in the said several separate condensation steps in turn from a condensation step proceeding at a lower pressure and temperature to a condensation step proceeding at a higher pressure and temperature, thereby heating said cooling medium stagewise to a temperature near that of the highest temperature condensation step and withdrawing the uncondensable SO_2 gas obtained in each of said steps from the system.

2. A method as in claim 1 wherein lye which has been subjected to the last pressure reduction step is discharged from the system while being utilized for indirect heating of the cooling medium supplied into the condensation steps.

3. A method as in claim 1 wherein acid for the boiling operation is used as said cooling medium and wherein said condensation steps are utilized for the preheating of such acid.

4. A method as claimed in claim 1 wherein cold water is used as said cooling medium and wherein said condensation processes are utilized for hot-water production.

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