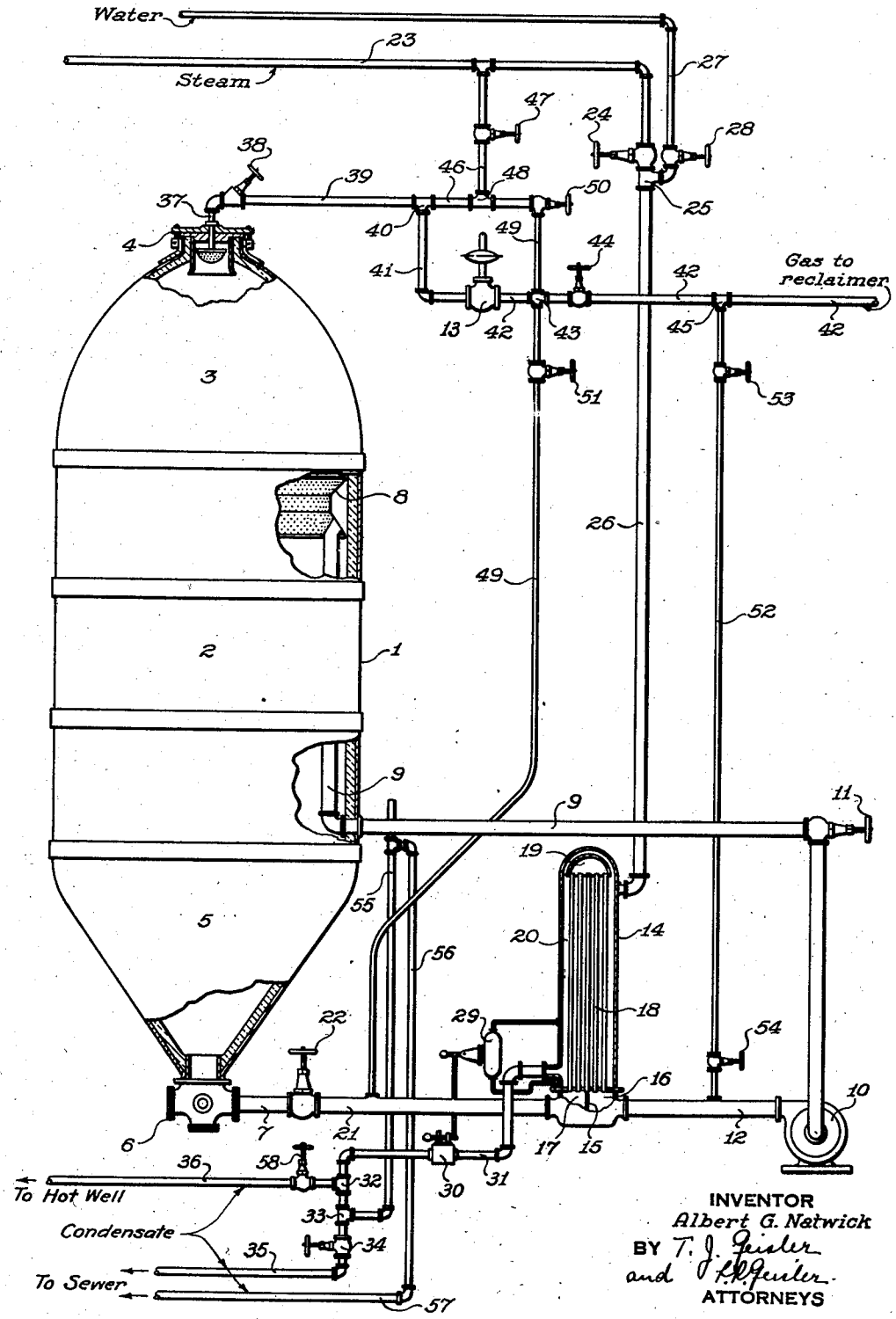
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METHOD FOR REMOVING LIME SCALE IN HEAT EXCHANGERS FOR SULPHITE PULP DIGESTERS

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METHOD FOR REMOVING LIME SCALE IN HEAT EXCHANGERS FOR SULPHITE PULP DIGESTERS

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1 Claim. (Cl. 92—7)

My invention relates to the process of making sulphite pulp for the manufacture of paper, and, more particularly, my invention relates to pulp digesters of the indirect heating type employed in the process. In pulp making apparatus of this type, a heater exchanger is located outside the digester and the cooking acid or "liquor" is caused to circulate in continuous cycles through the heater and digester and is maintained at the right temperature for producing uniform high quality of pulp.

The heater exchange consists of a series of tubes through which the liquor circulates, which tubes are enclosed in a jacket which is heated by steam supplied from a convenient source.

In the use of such heat exchangers it was found that the cooking liquor—consisting of a solution of SO_2 and lime, commonly termed calcium bisulphite liquor—in passing through the heat exchanger precipitates and deposits scale on the inside of the tubes thereof, which scale tends to adhere to the interior surfaces of the tubes and thus form an insulating medium which, when allowed to accumulate, interferes with the heat-transferring function of the heat exchanger and thus decreases the heating efficiency thereof.

It has been tried to reduce such deposit of scale in said tubes to a negligible minimum, by maintaining the linear velocity of the liquor through the tubes sufficiently high. But actual prolonged use of such method has shown that the deposit of scale can not be sufficiently avoided in that manner. Different ratios of free and combined SO_2 in cooking liquor have also been tried, but do not prevent some deposit inside said tubes.

Therefore, in order to keep the interior of said tubes adequately free from said scale, and thus maintain a resonably high degree of efficiency in the heat exchanger, it was found necessary frequently to clean the interior of the heater tubes. This cleaning was accomplished by disconnecting and dismantling the heat exchanger and passing either reamers, brushes or the like through the tubes thereof; or by first boiling the entire unit in stong acids, such as nitric acid, and then running brushes through said tubes. The latter method had to be used when the heater tubes were warped so that mechanical tube-cleaners could not be passed through them. Either method of cleaning involves considerable expenditure of time and labor.

The object of my invention is to provide a simple means for removing the scale deposits from the interior of said tubes, without disconnecting of the heat exchanger and the use of mechanical scouring devices is avoided, and instead, by my invention, the gases and vapors discharged by the relief outlet, are condensed in and thus utilized to effect the cleaning of said tubes; it being well known that a strong sulphur dioxide water solution is capable of dissolving lime deposits.

To this end my invention, briefly described, consists in removing such scale deposits as may occur from cook to cook from the tubes of the heat exchanger by causing the gases and vapors discharged from the digester relief-valve to flow through the tubes for a period, and lowering the temperature in the heat exchanger during such period to condense said discharge into a strong SO_2 water solution whereby to dissolve and remove said scale deposits from the heater.

And furthermore, to cause some contraction of said tubes, with the result that the crystalline calcium or lime scale which adhere to the interior of said tubes will be cracked and loosened. In this way said tubes may be readily cleaned whenever necessary. Moreover, this procedure may be carried on during a portion of the cooking period without interruption of the use of the digester and with little expense, and the heat exchanger thus maintained at high efficiency.

The specific devices which I have found convenient for carrying my invention into practice are schematically illustrated in the accompanying drawing of an elevation of the digester and associated elements, with parts shown in section, and are hereinafter fully described.

In the drawing, 1 designates a digester comprising the usual cylindrical portion 2, a dome 3, having a detachable top closure 4 provided with a relief valve or outlet 38, and an inverted conical base 5 terminating in a fitting 6 to which is connected an inlet pipe 7. The usual annular strainer 8 is provided in the upper portion of the digester and is fitted with a pipe 9 which leads to a liquor circulating pump 10 through an interposed valve 11. The pump 10 discharges into a pipe 12 connected to the intake side of the housing of the heat exchanger 14, which is divided as usual by a partition 15 into inlet and outlet chambers 16 and 17. A plurality of vertical liquor circulating tubes 18 connect said inlet and outlet chambers 16, 17 through an upper chamber or dome 19 and a jacket or housing 20 encloses the tubes 18 and upper chamber or dome 19. A pipe 21 leads from the outlet chamber 17 to the inlet pipe 7 of the digester 1 through the interposed valve 22.

During the normal operation of the digester 1, the valves 11 and 22 are open and the cook-

ing liquor is caused by the pump 10 to circulate continuously through the digester, the cooking liquor being heated during such circulation by passing through the tubes 18 of the heat exchanger 14 heated by live or exhaust steam introduced into the housing 20 via a pipe 23, valve 24 and pipe 26. A branch fitting 25 serves as a means for connecting a pipe 27, leading from a source of cold water, to the pipe 26 through a valve 28.

The condensate resulting from the transfer of heat from the steam to the tubes 18 is maintained at the desired low level during the operation of the heater and digester by a conventional float valve 29 connected to a balanced valve 30 interposed in a drain pipe 31 which is extended through T-fittings 32 and 33 and valve 34 to a waste pipe 35 leading to the sewer. A branch pipe 36, having a valve 58, is connected to the T 32 so that the condensate may be conducted to other parts of the plant when it is desired to utilize the hot water, in which case the waste pipe 35 is closed by the valve 34.

A stand pipe 55, which extends vertically from connection with the T 33 to a point above the top of the heat exchanger 14, and a discharge pipe 56, connected to the stand pipe 55 at a greater elevation than the chamber 19 of the heat exchanger and communicating with a waste pipe 57 leading to the sewer, or hot well, constitute a loop in the condensate drainage line 31.

The relief of the sulphur dioxide gas and water vapor generated in the digester during the cooking process is controlled, as usual, by a diaphragm motor valve 13 set to open when the pressure in the digester reaches a given point. To effect the said relief, a screened pipe section 37, fitted in the top closure 4, is connected through a valve 38, pipe 39, T 40 and pipe 41 to one side of the diaphragm motor valve 13, and the other side of this valve is connected through a pipe 42 having a valve 44 to an apparatus (not shown) for reclaiming the sulphur dioxide. For the purpose of my invention, a cross fitting 43 and a T-fitting 45 are placed in the pipe line 42.

The steam pipe 23 is connected by a pipe 46 to a T 48 in the pipe line 39 leading from the digester, and a valve 47 is interposed in the said connecting pipe 46. A branch pipe 49 having a valve 50 connects the T 48 of the steam pipe 46 with the pipe 21, and a valve 51 is interposed in the line adjacent the cross fitting 43. To the pipe 42 is connected a branch pipe 52 having two valves 53 and 54 and communicating with the pipe 12.

When the gases in the dome of the digester are to be conducted to the reclaiming apparatus, the valves 53, 54, 51, 50 and 47 are closed, thus confining the passage of the gases to the pipes 39, 41 and 42 leading directly to the reclaimer. The other pipes, valves and fittings described above constitute means for carrying out my invention and as such are auxiliary to and in no wise affect the normal operation of the digester.

When it is desired to clean the tubes 18 of the heat exchanger 14, it is not necessary to interrupt the operation of the digester, but all required is to pass the relief gases through said tubes 18 instead of to the gas-reclaimer. To pass the relief gases through the tubes 18 the valves 22 and 11 are closed, thus stopping the circulation of the cooking liquor through the tubes 18. Next, the valve 44 in the line 42 leading to the reclaimer is closed, and the valves 50, 51, 54 and 53 are opened, thus causing the sulphur dioxide gas and water vapor relieved from the digester to pass from pipe 39 through pipe 49 to pipe 21 thence upwardly and downwardly through the tubes 18 in the reverse direction to that of the normal course of the cooking acid and finally out to the reclaimer via pipes 12, 52 and 42.

At the same time, the valve 24 controlling the flow of steam from pipe 23 to pipe 26 is closed and the valve 28 in the water line 27 is opened. Cold water now enters the housing 20 and chills the tubes 18 with the result that the sulphur dioxide gas and water vapor flowing through are condensed into a strong solution of sulphur dioxide and water which rapidly dissolves the calcium or lime deposits on the interior of the said tubes and with the further result that the contraction due to exterior chilling of the metal tubes cracks and loosens the said deposits so that they are precipitated into the circulating scouring solution and are passed to the reclaimer.

In order to assure that the cooling water to fill the space about the heater tubes, the valves 34 and 58 are closed so that the cooling water draining from the heater housing 20 is now compelled to ascend the stand pipe 55 before flowing into the waste pipe, this provision thus assuring the complete immersion of the heater tubes regardless of the action of the float valve 29 which normally maintains a low level of liquid in the housing 20.

If so desired, the system may be flushed subsequent to the process of cleaning the heater tubes by closing the relief valve 38 and the water valve 28 and opening the valve 47 in the steam line 23, thus causing live steam under pressure to follow the path previously taken by the gas and water vapor through the heater tubes.

My above described apparatus may be modified in mechanical detail as deemed expedient so long as the principle of my invention is adhered to.

I claim:

In the manufacture of sulphite pulp with a digester of the indirect heating type having the usual external heat exchanger, the improved method of removing accumulated lime scale deposits from said exchanger without dismantling the exchanger, which method consists in temporarily discontinuing all circulation of the digester liquor through the exchanger, collecting sulphur dioxide gas and water vapor at the top of the digester and passing the same into said exchanger in place of the digester liquor, cooling said exchanger in order to condense said gas and vapor into a strong sulphur dioxide water solution, allowing said solution to remain in said exchanger as an acid scouring solution long enough to dissolve the lime scale deposits, and finally discharging the scouring solution with the dissolved lime entirely from said exchanger.

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