

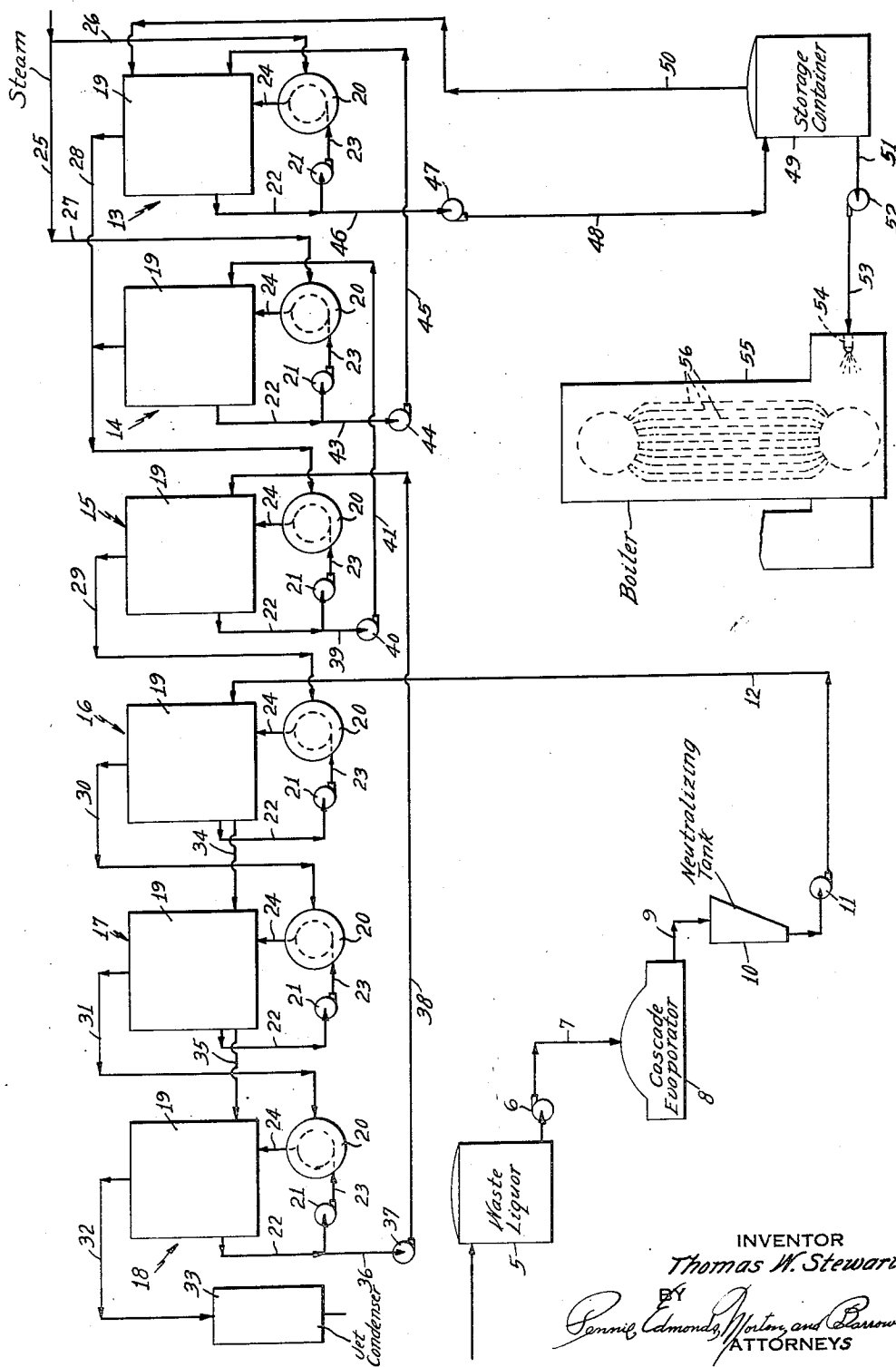
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METHOD OF HANDLING WASTE SULPHITE LIQUOR

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METHOD OF HANDLING WASTE SULFITE LIQUOR

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This invention relates to improvements in the method of handling and burning waste sulphite liquor and particularly to the storage of the liquor prior to burning thereof to recover magnesium oxide and sulphur dioxide from the liquor.

The application of the invention will be understood by reference to the patent to Palmrose et al. No. 2,320,294 issued May 25, 1943. This patent describes the digestion of ligneous material in magnesium bisulphite cooking liquor and the subsequent concentration and burning of the waste liquor to recover its principal constituents for further use in the system. In the patented method, the concentrated waste liquor leaving the last effect of a multiple effect evaporator is delivered through a pipe to the combustion furnace. In practical operation of such a method, it is necessary to have storage tanks for the concentrated liquor between the evaporator and the furnace. If the liquor is maintained at normal atmospheric pressure in such storage tanks, it loses its temperature rapidly and is no longer in the best condition for rapid firing. It is necessary, therefore, to install preheaters to bring the liquor back to firing temperature. This is both difficult and expensive because of the necessity for employing steam as a heating medium and particularly because the concentrated liquor has a strong scaling tendency and the heating surfaces are rapidly fouled and become inefficient.

Preheating is necessary in the usual methods of preparation of waste liquor for burning because of the lowering of the temperature of the waste liquor due to flashing. Such flashing occurs in the normal operation of a multiple effect evaporator when the most concentrated waste liquor is withdrawn from the last effect and is transferred to a container which is at a lower pressure. The sudden lowering of the pressure over the hot liquor, which has been heated at superatmospheric pressure to a temperature above its boiling point at atmospheric pressure, causes the liquor to immediately vaporize or flash. Normally, the pressure in the last effect of a multiple effect evaporator is in the range of 15-30 pounds gauge, so that the temperature of the liquor in the last effect is at the boiling point corresponding to that pressure. When, as in normal practice, the pressure of this liquor is relieved to atmospheric pressure, steam is flashed off until the temperature of the liquor is lowered to the boiling point of the liquor at atmospheric pressure. The present invention avoids loss of heat through flashing to atmospheric pressure and

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conserves heat in the liquor so that it may be burned without reheating.

This invention is directed to a method of burning concentrated waste liquor in which the liquor is concentrated by multiple effect evaporation at successively increasing pressures. It is then delivered from the last effect at the over-atmospheric pressure of the last effect to a storage container in which over-atmospheric pressure substantially equal to that in the last effect is maintained to conserve the heat of the concentrated liquor and to permit the delivery of the stored liquor to a burning zone at substantially the temperature maintained in the storage container. Conservation of heat in the liquor in the storage container will also depend upon the prevention of heat losses through radiation and conduction. Although this invention is not directed to the solution of these problems, which can be taken care of by well-known methods of insulation, the preferred embodiments of the invention serve to compensate for losses of heat through radiation and conduction by raising the temperature of the liquor in the storage container whenever it falls below the temperature of the liquor in the last effect.

Other objects and advantages of the invention will be apparent as it is better understood by reference to the following specification and the accompanying drawing, which illustrates diagrammatically the equipment required for concentrating, storing and burning the liquor.

The invention depends upon the maintenance of the concentrated waste liquor at a substantial pressure during storage so that its temperature will not fall below that suitable for efficient firing. Thus, if the pressure on the liquor is held at 15 pounds per square inch gauge, or higher, the temperature prevailing in the last effect of the evaporator, for example 250° F., will be maintained in the liquor in storage, and the liquor may be withdrawn as required and fired directly without further heating. In carrying out the invention, therefore, the liquor from the last effect of the evaporator is delivered to a storage tank of such construction that the liquor can be maintained at the pressure prevailing in the last effect, for example 15 pounds per square inch gauge. The liquor is then withdrawn as required from the storage tank and delivered to the burners.

Referring to the drawing, a tank 5 is provided for the unconcentrated waste liquor which is recovered from the digester and washers (not shown). The unconcentrated liquor is withdrawn

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by a pump 6 and delivered through a pipe 7 to a cascade evaporator 8 in which partial concentration is effected. The details of the cascade evaporator are well known and require, therefore, no further description. From the cascade evaporator, the liquor flows through a pipe 9 to a neutralizing tank 10 where acid constituents are neutralized by the addition of magnesium oxide to the liquor. From the neutralizing tank, the liquor is withdrawn through a pump 11 and delivered by a pipe 12 to the multiple effect evaporator.

The multiple effect evaporator comprises a plurality of effects, in the present case six, 13, 14, 15, 16, 17 and 18. It is understood that the number of effects may be varied, depending upon the particular liquor to be evaporated. Each effect comprises a vapor body 19, a heater 20, a circulating pump 21 and pipes 22, 23 and 24 to permit circulation of the liquor. The details of each of the effects are identical. They differ merely in the pressures maintained therein. For example, effects 13 and 14 may be operated at a pressure of fifteen pounds per square inch, gauge, effect 15 at a pressure of three to five pounds per square inch, gauge, effect 16 at a six-inch vacuum, effect 17 at an eighteen-inch vacuum, and effect 18 at a twenty-six to twenty-eight inch vacuum. Other pressures may be employed. Thus, effects 13 and 14 may be operated at pressures ranging from ten to twenty-five pounds per square inch, gauge more or less, with consequent variation in the pressures maintained in the remaining effects of the evaporator.

To effect evaporation, steam is supplied from a steam line 25 through branches 26 and 27 to the heaters 20 of effects 13 and 14. The vapor from the effects 13 and 14 is withdrawn through a vapor line 28 connected to each of the vapor bodies 19. The vapor from effects 13 and 14 is thus conveyed to the heater 20 of effect 15. The vapor from the effect 15 is withdrawn from the vapor body 19 of that effect through a pipe 29 and delivered to the heater 20 of effect 16. The vapor from effect 16 is withdrawn through pipe 30 and delivered to the heater 20 of effect 17. The vapor from effect 17 is withdrawn through a pipe 31 and delivered to the heater 20 of effect 18. The vapor from effect 18 is withdrawn through a pipe 32 and discharged through a jet condenser 33. It will be understood that in each of the effects the liquor is constantly circulated between the vapor body 19 and the heater 20 and that as the result of the heating the vapor is delivered from each vapor body in the manner indicated.

In the present instance, the liquor, partially concentrated in the cascade evaporator 8, is delivered to effect 16. After being heated therein and partially evaporated, the liquor is delivered through a pipe 34 to the effect 17 operating at a lower pressure. After heating in the effect 17, the further concentrated liquor is delivered through a pipe 35 to the effect 18 for further concentration. From the effect 18, the liquor is withdrawn through a pipe 36 and delivered by a pump 37 through a pipe 38 to effect 15, where it is heated by vapor from the effects 13 and 14. From the effect 15 the liquor is withdrawn through a pipe 39 and is transferred by a pump 40 through a pipe 41 to effect 14, where it is heated with steam. From the effect 14 the liquor is withdrawn through a pipe 43 and delivered by a pump 44 through a pipe 45 to effect 13, where it is further concentrated by heating with steam.

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Having attained its maximum concentration in effect 13, the liquor is withdrawn through a pipe 46 and delivered by a pump 47 and pipe 48 to the storage container 49. The latter is connected by a vent pipe 50 to the vapor body 19 of the effect 13 so that the pressure in the storage container 49 is identical with that in the vapor body 19 of effect 13. As the result thereof, the temperature of the liquor delivered to the storage container 49 should be in the neighborhood of 250° F., assuming that a pressure of fifteen pounds per square inch gauge is maintained in the vapor body 19 of effect 13. Because of the pressure maintained in the storage container 49, the liquid will remain at substantially the same temperature which will be higher or lower, depending upon the pressure maintained in the vapor body 19 of effect 13.

The liquor at the high temperature maintained as a result of pressure in the storage container 49 is in the best possible condition for firing without the necessity of employing steam for reheating the liquor before it is fired. It is withdrawn from the storage container 49 through a pipe 51 and is delivered by a pump 52 through a pipe 53 to the burner 54 of a furnace 55 having boiler tubes 56 wherein the heat developed by the burner 54 is utilized in producing steam for use in the plant. The method as described avoids the difficulties which have been met heretofore in handling concentrated liquor when the latter has been permitted to become partially cooled before it is delivered to the furnace for combustion. Such cooling, as indicated, necessitates reheating because the combustion does not occur efficiently if the liquid is supplied at too low a temperature. When it is held at a temperature approaching 250° F., the liquor burns readily, and no reheating is required in accordance with the present invention.

Various changes may be made in the details of the operation as described without departing from the invention or sacrificing the advantages thereof.

I claim:

1. The method of burning concentrated waste liquor from the digestion of ligno-cellulose material which comprises concentrating the liquor by multiple effect evaporation with at least the last effect maintained at over-atmospheric pressure, delivering the liquor at the over-atmospheric pressure therein to a storage container, maintaining the pressure in the storage container substantially at that of the last effect, thereby conserving the heat in the concentrated liquor, and delivering the heated liquor at substantially the temperature maintained in the storage container to the burning zone.

2. The method of burning concentrated waste liquor from the digestion of ligno-cellulose material which comprises concentrating the liquor first by cascade evaporation and then by multiple effect evaporation with at least the last effect maintained at over-atmospheric pressure, delivering the liquor at the over-atmospheric pressure therein to a storage container, maintaining the pressure in the storage container substantially at that of the last effect, thereby conserving the heat in the concentrated liquor, and delivering the heated liquor at substantially the temperature maintained in the storage container to the burning zone.

3. The method of burning concentrated waste liquor from the digestion of ligno-cellulose material which comprises concentrating the

liquor by multiple effect evaporation, the last effect operating at a pressure in the range of 10-25 pounds per square inch, delivering the liquor from the last effect to a storage container, maintaining substantially the same pressure in both the last effect and the storage container, thereby conserving the heat in the concentrated liquor, and delivering the heated liquor at substantially the temperature maintained in the storage container to the burning zone.

4. The method of burning concentrated waste liquor from the digestion of ligno-cellulose material which comprises circulating the liquor first by cascade evaporation and then by multiple effect evaporation, the last effect operating at a pressure in the range of 10-25 pounds per square inch, delivering the liquor from the last effect to a storage container, maintaining substantially the same pressure in both the last effect and the storage container, thereby con-

serving the heat in the concentrated liquor, and delivering the heated liquor at substantially the temperature maintained in the storage container to the burning zone.

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