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CONCENTRATING SYSTEM FOR BLACK LIQUOR TREATING COMBINATION

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Fig. 2.

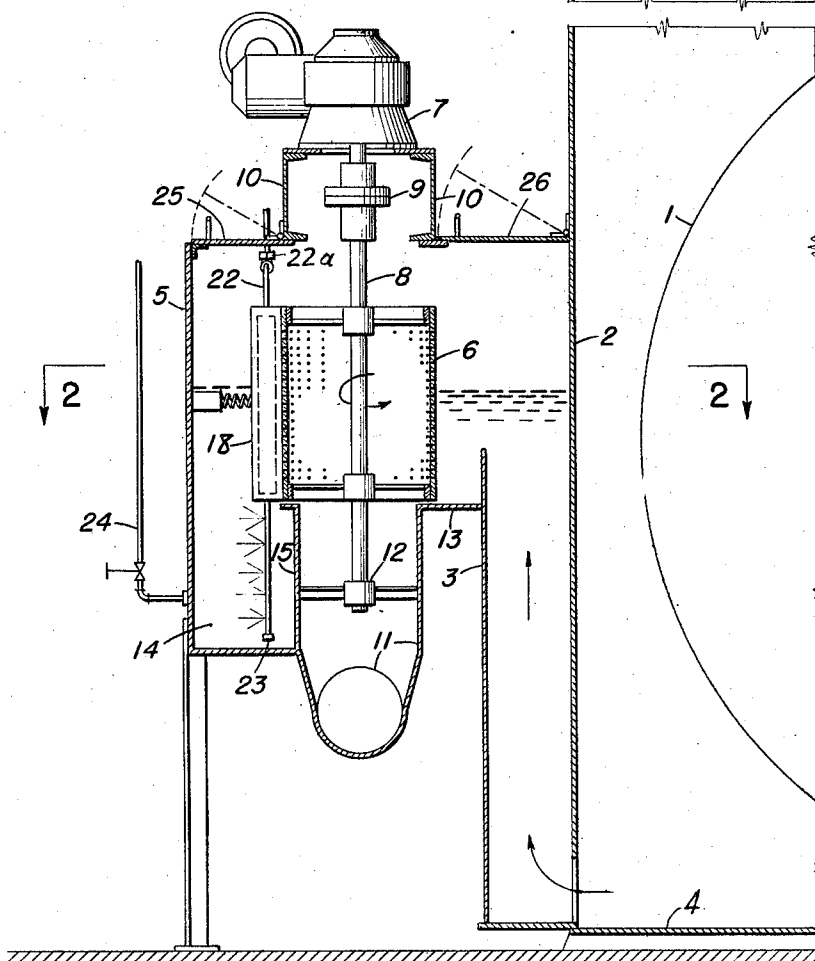
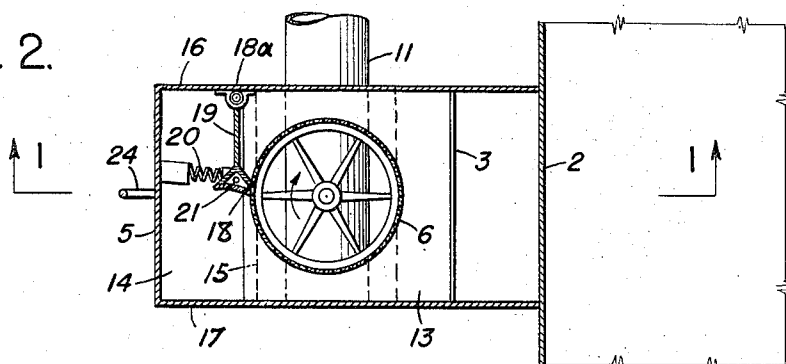


Fig. 1.

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CONCENTRATING SYSTEM FOR BLACK LIQUOR TREATING COMBINATION

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4 Claims. (Cl. 23—275)

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This invention relates to means for screening chemicals and particularly improved means for screening the heavy black liquor of wood pulp mills prior to its introduction into a smelting furnace in a system for recovering chemicals from said black liquor.

Briefly, the system ordinarily employed comprises a smelter furnace from which the products of combustion pass through a waste heat boiler and thence through an evaporator. The black liquor from the digestion of the wood pulp is reduced to the desired density or concentration of solids and is then sprayed into the furnace wherein it is evaporated while in suspension to dryness sufficient to sustain combustion of the combustible matter in the chemical falling onto the hearth. Due to the heat of combustion on the hearth, reduction of chemical takes place and the reduced chemical runs from the hearth in a molten state. The chemical is then converted to so-called white liquor and reused as a solvent for the wood pulp in the digestors.

The products of combustion rising from the hearth into the furnace furnish the heat for evaporation of the sprayed-in black liquor. Some of the black liquor is carried upwardly through the boiler and thence into the evaporator where it is reclaimed in a bath of black liquor. In the evaporator the previously concentrated black liquor is brought up to a suitable density and is then conducted into the salt cake mixing tank wherein additional salt cake is added to the liquor. From the salt cake tank the liquor is pumped through suitable heaters to the nozzles by which it is sprayed into the furnace.

Such a process is disclosed in the U. S. Patent No. 2,213,052 issued August 27, 1940, to Rosenkrants and Hamm. The evaporator illustrated in the patent is known as the "cascade type" and comprises revolving discs or plates that dip into the liquor and in their rotation expose a film of it to hot flue gases directed over the discs and above the surface of the body of liquor in the evaporator. The level of liquor in the evaporator is determined by a dam over which it flows into an overflow box. The latter is provided with a screen through which the liquor must pass in an uninterrupted flow on its way to pumps which deliver it to the recovery furnace.

The delivery of the liquor from the evaporator to a tank prior to its entry into the pumps has presented great difficulties by the presence of lumps in the liquor leaving the evaporator.

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Should such lumps enter the pumps their operation will be impaired. Since the heavy liquor in the evaporator is usually at a temperature not far above the congealing point, any relatively cold regions in the corners or recesses of the evaporator will cause congealing and the formation of lumps. A coating will form where the liquor is splashed onto the walls of the evaporator to eventually break off in lumps. The lumps pass with the liquor into the overflow box and must be removed therefrom before entering the pump suction.

It is an object of this invention to provide improved means for automatically removing lumps from the heavy liquor leaving an evaporator of a chemical recovery system or leaving a similar apparatus containing a liquor at a temperature where cooling will cause congealing and the formation of lumps.

The invention will be best understood upon consideration of the following detailed description of an illustrative embodiment thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a cross section in elevation of the overflow box of an evaporator embodying the invention, taken on line 1—1 of Figure 2; and Figure 2 is a cross section taken on line 2—2 of Figure 1.

Since the construction of cascade-type of evaporators is well known (and has been earlier described herein), Figure 1 represents only those parts of such an evaporator as are directly associated with the improvement of my invention. Thus reference character 1 designates one of the rotary discs (or the disc-carrying plates) located adjacent the end wall 2 of the evaporator. This wall 2 is spaced from a dam 3 to form a channel as represented, and the wall bottom is spaced from the bottom 4 of the evaporator as shown. Through the latter space the liquor leaves the evaporator to flow upwardly in the channel formed by the end wall 2 and dam 3 and thence into the overflow box generally designated as 5.

According to the invention, a cylindrical filter screen 6 is vertically mounted as represented within overflow box 5. This screen 6 has its lower portions immersed in the black liquor and is caused to rotate at a slow speed, as about five revolutions per minute, by means of a suitable motor and speed reducer 7 attached to the upper end of the screen shaft 8 by means of a coupling 9. The motor 7, shaft 8 and screen 6 are shown as being supported on beams 10. Below screen 6

is a concentrically placed outlet conduit 11 which forms a running seal with the bottom of the screen 6 and conducts the screened material with the liquor out of the overflow box 5. A bearing 12 mounted in outlet conduit 11 supports the bottom end of shaft 8. A partition 13 extends from the top of outlet 11 and from around the screen 6 to the dam 3 and to the side plates 16 and 17 to form a bottom for the overflow box 5.

On the opposite side of the screen 6 from the dam 3 is a lump chamber 14 whose bottom extends below the level of partition 13 and whose inner side 15 extends to the side plates 16 and 17 of the overflow box 5. Any material too large to pass through the screen will fall into the chamber 14.

The liquor in passing through the overflow box 5 will flow through the screen 6 from the outside thereof and the screened liquor then flows downward within the screen into outlet pipe 11 to the salt cake mixing tank (not shown) where make up salt is added. Any lumps or foreign material in the black liquor will be retained on the outer surface of the screen and in order to continuously remove these and present a clean screen, a scraper 18 is provided. The scraper 18 is hinged at 18a (see Figure 2) on arm 19 at the side plate 16 and is caused to bear against the screen by pressure means such as springs 20. The scraper 18 is made of hollow construction to provide a chamber 21 which may be supplied with steam through a pipe 22 provided at its upper end with a swivel joint 22a. The lower end of scraper 18 has a perforated pipe 23 extending from chamber 21 into the lump chamber 14.

The lumps in chamber 14 will be acted upon by the steam jets issuing from pipe 23 and be thereby softened and dissolved to the state where they will be absorbed by the surrounding liquor and therewith flow through the screen. A dilution liquor pipe 24 entering this lump dissolving chamber 14 also is provided to periodically add weak black liquor or water to accelerate the dissolving action of the lumps taking place therein.

The top of the overflow box 5 is completely closed by hinged doors 25 and 26. By such closure, the hot vapors that normally rise from the liquor will assist in keeping any liquor accumulations on the screen above the liquor level soft and in a condition which will permit easy removal by the scraper.

While one preferred embodiment of my invention has been shown and described, it will be understood that such showing is illustrative rather than restrictive and that changes in construction, combination and arrangement of parts may be made without departing from the spirit and scope of the invention as claimed.

I claim:

1. In combination, an evaporator for concentrating waste liquor from pulp mills, an overflow box connected to receive the concentrated liquor from the evaporator, a cylindrical screen disposed in said overflow box for at least partial submergence in said concentrated liquor with the screen axis substantially vertical, means forming an outlet in the lower portion of the overflow box communicating at the screen bottom with the hollow interior of the screen cylinder and arranged so that liquor leaving the box must pass into that outlet through the perforate wall of said cylinder, a substantially vertical shaft extending axially through the cylindrical screen and supporting same thereon for rotation therewith, bearings for said shaft, motor means for rotating the shaft

and said screen in those bearings, a scraper for said rotatable screen also disposed in generally vertical position along one side of the screen cylinder in said overflow box, mounting means for said scraper and cooperating yieldable means urging the scraper against the outside of said cylindrical screen whereby liquor lumps deposited thereon by passage of the liquor inwardly through the screen perforations are removed therefrom by the screen rotation, means forming beneath said scraper and the portion of the screen that is contacted thereby a lump chamber which communicates with said overflow box and is filled with liquor therefrom and downwardly into which said removed liquor lumps drop from the scraper, means forming within said scraper adjacent its aforesaid contact with the screen an interior space that is adapted to receive a heating medium, and means for supplying said interior space with steam which raises the temperature of said scraper to above the melting point of the said liquor lumps and thereby facilitates the scraper's aforesaid transfer of those lumps from the rotating screen into said lump chamber therebeneath.

2. In combination, an evaporator for concentrating waste liquor from pulp mills, an overflow box connected to receive the concentrated liquor from the evaporator, a cylindrical screen disposed in said overflow box for at least partial submergence in said concentrated liquor with the screen axis substantially vertical, means forming an outlet in the lower portion of the overflow box communicating at the screen bottom with the hollow interior of the screen cylinder and arranged so that liquor leaving the box must pass into that outlet through the perforate wall of said cylinder, a substantially vertical shaft extending axially through the cylindrical screen and supporting same thereon for rotation therewith, bearings for said shaft, motor means for rotating the shaft and said screen in those bearings, a scraper for said rotatable screen also disposed in generally vertical position along one side of the screen cylinder in said overflow box, mounting means for said scraper and cooperating yieldable means urging the scraper against the outside of said cylindrical screen whereby liquor lumps deposited thereon by passage of the liquor inwardly through the screen perforations are removed therefrom by the screen rotation, means forming beneath said scraper and the portion of the screen that is contacted thereby a lump chamber which communicates with said overflow box and is filled with liquor therefrom and downwardly into which said removed liquor lumps drop from the scraper, means forming within said scraper adjacent its aforesaid contact with the screen an interior space that is adapted to receive heating steam, a conduit extension from said interior space which extension projects downwardly from the scraper into the aforesaid lump chamber below the screen and which has outlet perforations for discharge of steam into that chamber, and means for supplying the said scraper interior with steam which serves to raise the scraper temperature above the melting point of the aforesaid liquor lumps and which in discharging through said extension perforations into the liquor in said lump chamber further serves to melt the liquor lumps released therein to by the scraper from the rotating screen.

3. In a system for recovering chemical from the black liquor of pulp mills which system comprises an evaporator for concentrating the black

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liquor and apparatus for receiving said concentrated liquor from the evaporator and screening it, the combination in said apparatus of an overflow box connected to receive the concentrated liquor from the evaporator, a cylindrical screen disposed in said overflow box for at least partial submergence in said concentrated liquor with the screen axis substantially vertical, means forming an outlet in the lower portion of the overflow box communicating at the screen bottom with the hollow interior of the screen cylinder and arranged so that liquor leaving the box must pass into that outlet through the perforate wall of said cylinder, a substantially vertical shaft extending axially through the cylindrical screen and supporting same thereon for rotation therewith, bearings for said shaft, motor means for rotating the shaft and said screen in those bearings, a scraper for said rotatable screen also disposed in generally vertical position along one side of the screen cylinder in said overflow box, mounting means for said scraper and cooperating yieldable means urging the scraper against the outside of said cylindrical screen whereby liquor lumps deposited thereon by passage of the liquor inwardly through the screen perforations are removed therefrom by the screen rotation, means forming within said scraper adjacent its aforesaid contact with the screen an interior space that is adapted to receive heating steam, a conduit extension from said interior space which extension projects downwardly from the scraper into the aforesaid lump chamber below the screen and which has outlet perforations for discharge of steam into that chamber, and a steam supply conduit leading to the upper portion of said scraper interior for bringing therein steam which first heats the scraper itself and thereafter discharges through said extension perforations into the liquor in said lump chamber.

4. In combination, an evaporator for concentrating black liquor from pulp mills, an overflow box and a connection therefrom to the evaporator through which the concentrated liquor from said evaporator passes, a cylindrical screen disposed in said overflow box for at least partial

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submergence in said concentrated liquor with the screen axis substantially vertical, means forming an outlet in the lower portion of the overflow box communicating at the screen bottom with the hollow interior of the screen cylinder and arranged so that liquor leaving the box must pass to that outlet through the perforate wall of said cylinder, a substantially vertical shaft extending axially through the cylindrical screen and supporting same thereon for rotation therewith, a lower bearing for said shaft mounted in said outlet of the overflow box below the screen, an upper bearing for said shaft mounted on the overflow box above the screen, a motor means for rotating said shaft and screen, a scraper for said rotatable screen also disposed in generally vertical position along one side of the screen cylinder in said overflow box, mounting means for said scraper and cooperating yieldable means urging the scraper against the outside of said cylindrical screen whereby liquor lumps deposited thereon by passage of the liquor inwardly through the screen perforations are removed therefrom by the screen rotation, and means forming beneath said scraper and the portion of said screen that is contacted thereby a lump chamber which communicates with said overflow box and is filled with liquor therefrom and downwardly into which said removed liquor lumps drop from the scraper.

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