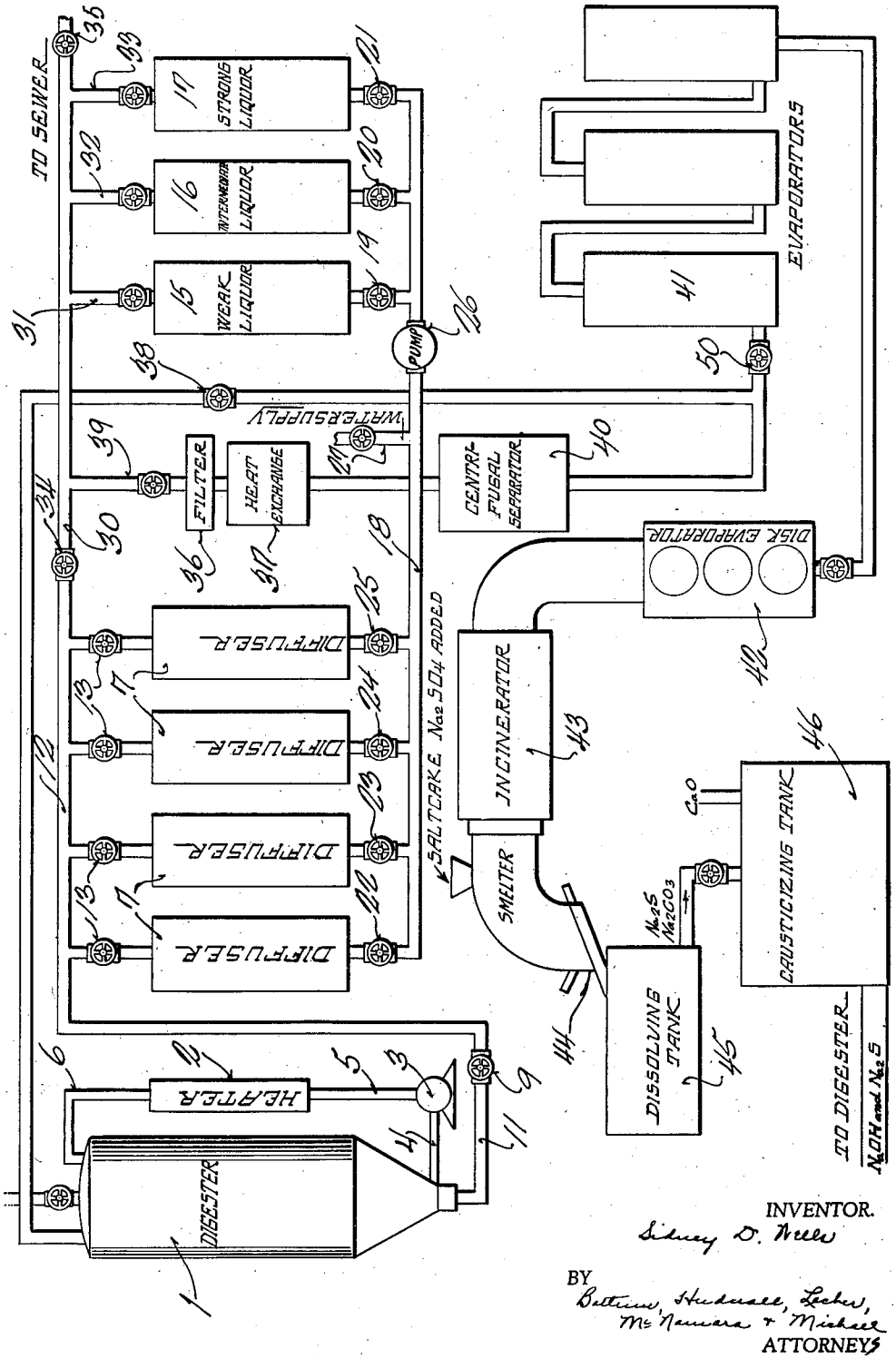
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PROCESS FOR THE MANUFACTURE OF PAPER PULP

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PROCESS FOR THE MANUFACTURE OF PAPER PULP

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This invention relates to a process for manufacturing paper pulp and more particularly to the manufacture of sulphate pulp from fresh resinous woods.

While the invention is particularly applicable to the sulphate process and for use on resinous woods such as pine it is by no means restricted either to the sulphate process or to any particular species of wood. It may be employed with alkaline processes in general and with any of the various species of woods capable of being pulped by the sulphate or alkaline processes. In addition to the pines, hemlocks, firs, Douglas firs, or cedars may be used.

In woods of this character and especially in pines there are present when freshly cut, in addition to the resins, certain fats and waxes which render the cooking, washing and recovery operations extremely difficult on account of the tendency of the liquors containing these substances to foam excessively when agitated or disturbed in the least as they must be in the boiling, pumping or agitating operations involved in the process as well as in the running of the liquors from pipe lines into tanks or vessels or through pumps, disc evaporators or other instrumentalities wherein occur movement of the liquor or of objects in the liquor.

In order to preclude this foaming it has been the practice to age or expose these woods in the weather or to air after they have been cut for periods of one year or over, so that the fats, waxes and resins may be sufficiently altered by oxidation to diminish their foam producing properties and consequently the difficulties experienced in manufacturing such woods into pulp. This exposure or storage of the woods after they are cut is inconvenient and expensive. Where operations are carried on on a large scale the interest on the investment in the wood, the loss of wood due to decay and insects, the disbursements incident to insurance, taxes and supervision and the cost of piling and unpiling runs into substantial sums of money. This material expense is occasioned solely for the purpose of overcoming or diminishing the undesirable foaming properties.

The present invention proposes generally to so control the concentration of the cooking and washing liquors and so distribute the functions which the various liquors are required to perform that the strong liquor which has exerted the digestive action on the wood and is loaded with resins, fats and waxes will have such a specific gravity at that stage of the process where it is separated from the pulp as to enable it to be separated from the fats, waxes and resins under the influence of centrifugal force. As a consequence of this separation the liquor may be subsequently handled without the occurrence of foaming trouble. It may be mixed with fresh white liquor and used as cooking liquor for subsequent digestions or it might be sent through the recovery apparatus wherein the soda base used in making up the fresh white liquor is recovered in accordance with well known practices. In general, it may be run into tanks used in digestion, evaporated in vacuum evaporators or disc evaporators and otherwise handled or treated without the occurrence of the undesirable foaming.

In the drawing, the figure is a diagrammatic view of an apparatus which may be employed for carrying out the present invention.

Referring to the drawing, the numeral 1 designates the digester in which the wood in the form of chips or in any other suitable form is placed and cooked or digested by the cooking liquor which, in the process selected for the sake of illustration, consists of a solution, the active ingredients of which are caustic soda and sodium sulphide. The cooking charge must be made up of at least twice as much black liquor (spent liquor) as white liquor, the black liquor density being between 13° and 19° Bé. at 170° F. and the white liquor density not less than 19° Bé. at 170° F. In order to maintain this proper concentration the digester is equipped with the conventional type of indirect heater designated at 2, the cooking liquor during the digesting operation being circulated through the heater and digester by means of a pump 3 drawing liquor out of the digester through a pipe line 4 and forcing it through the heater and back into the digester through pipe lines 5 and 6. The use of indirect heat minimizes dilution and is preferred for that reason but the heating effect can be produced by having steam act directly on the cooking liquor and the stock. This, however, requires a greater concentration to compensate for the dilution resulting from condensation of the steam admitted to the digester. At least four diffusers or washing tanks designated at 7 are provided to serve each digester. The discharge outlet of the digester is connected by a pipe line 11 with a manifold 12 and between the manifold and the several diffusers are valve controlled connections or branches 13. A shut-off valve 9 is provided in the pipe line 11. Each diffuser has a capacity sufficient to receive the full contents of the di-

gester. A plurality of diffusers are provided for each digester as the process is preferably carried on continuously and such continuous action requires that there always be a diffuser available to receive the contents of the digester.

When the contents of the digester has been blown or otherwise suitably transferred into one of the diffusers communication between the diffusers 7 and the digester 1 is cut off by closing valve 9 and the diffuser so loaded has its contents washed first with strong liquor, then with intermediate liquor and then with weak liquor. The terms "weak", "intermediate" and "strong" indicate the relative concentrations of the liquors that is the percentage of active solids (ligno-sodium compounds, sodium resinates, etc.) dissolved therein. To facilitate this washing, tanks 15, 16 and 17 are provided and contain respectively weak liquor, intermediate liquor and strong liquor. A supply line or conduit 18 is provided between the bottoms of the tanks 15, 16 and 17 and the bottoms of the diffusers 7, this supply line having valve controlled branches 19, 20 and 21 connecting it with the tanks 15, 16 and 17 and valve controlled branches 22, 23, 24 and 25 connecting it with the lower ends of the diffusers. A pump 26 is provided in this supply line and is operable to force either weak, intermediate or strong liquor therethrough from any one of the tanks 15, 16 or 17 to any one of the diffusers 7 depending upon the adjustments of the valves 19 to 25. A water supply pipe 27 is also connected with this supply line 18 so that water may be flowed through the diffusers when desired. A return line 30 is also provided and has valve controlled branches 31, 32 and 33 connecting it with the upper ends of the tanks 15, 16 and 17. The return line 30 is also suitably connected to the upper ends of the diffusers 7. For this purpose separate valve controlled connections may be provided between the return line 30 and each diffuser 7, but in the diagram, for the sake of simplicity in illustration, the return line 30 is shown as having a valve controlled connection 34 with the manifold 12 and consequently when said valve controlled connection 34 is opened the return line 30 communicates with the diffusers through the valve controlled branches 13 of the manifold 12. Communication of the return line 30 with a sewer or point of discharge is regulated by means of a valve 35. The return line 30 is also connected through a valve controlled pipe line 39 with a filter 36 which discharges into a heat exchanger 37. The heat exchanger 37 cools the liquor passing therethrough and delivers it to a centrifugal separator 40 which is operable to separate the resins, fats and waxes from the liquor sent therethrough. The liquor cleared of such resins, fats and waxes may be returned to the digester if desired through a valve controlled pipe line 38 or it may be carried through a recovery system of a conventional type wherein the soda base used in making up fresh white liquor is recovered in accordance with usual practices. Such a recovery system consists of a suitable number of evaporators designated at 41 and 42, an incinerator 43, a smelter 44, a dissolving tank 45 and a causticizing tank 46 as is well known to those skilled in the art.

As pointed out, the cooking charge must be made up of at least twice as much black liquor (spent liquor) as white liquor with the black liquor density between 13° and 19° Bé. at 170° F. and the white liquor density at more than 19° Bé. at 170° F. Such concentration must be maintained and it conveniently can be by the use of the indirect heater 2.

After the cooking is completed the contents of the digester are blown into one of the diffusers 7 and the cooking liquor, now spent, is removed from the fiber by washing with liquors of graduated densities obtained from previous cooks and finally with water. Such graduated washing is carried out by appropriately manipulating the valves controlling the communication between the storage tanks 15, 16 and 17 for the washing liquors and the diffuser in which stock is undergoing treatment. The spent cooking liquor forced out ahead of the washing liquors, if of such density as to warrant recovery or reuse, is carried down through the valve controlled pipe line 39 to the filter 36 which removes fiber and is then passed into the heat exchanger 37 where it is cooled down to between 80° F. and 130° F. It is then passed directly to the centrifugal separator 40 wherein the soap, fats, waxes and resins occurring in suspension or in colloidal solution in the liquor are removed. The liquor stripped of these foam producing substances is now in condition for reuse or for the recovery operations. If it is to be reused it may be carried back through the valve controlled pipe line 38 to the digester. If the soda base is to be recovered from the black liquor the valve 50 is opened and it is passed through the evaporators 41 and 42, through the incinerator 43, smelter 44, to the dissolving tank. In other words, it is subjected to the usual evaporated and burning operations but inasmuch as the foam producing substances have been removed foaming troubles will not be encountered. The smelt is delivered from the smelter to the dissolving tank 45 and from the dissolving tank 45 to the causticizing tank 46. Salt cake (Na_2SO_4) may be added in the smelter to make up for the unavoidable losses of soda in the cycle. The soda base has in this way been recovered from the spent black liquor and converted back into a solution containing as its active ingredients sodium hydroxide and sodium sulphide, that is, the alkali cooking liquor ordinarily employed in the sulphate process.

It is understood that details of the recovery operation per se form no part of the present invention since this recovery operation is well known and widely practiced. The present invention is designed primarily to avoid the foaming troubles heretofore encountered in handling the spent black liquor after it had been used for digesting woods containing foam producing substances. This invention accomplishes this purpose easily and in a practical manner by maintaining the density of the cooking liquor such that it is separable from the foam producing substances suspended therein under the action of centrifugal force. Hence, without any evaporation, a step very likely to produce undesirable foaming, the cooking liquor may be relieved of its foam producing substances immediately after being removed from the digested stock. Usually it is desirable to run the cooking liquor through a filter and heat exchanger on its way from the diffusers to the centrifugal separator, but these steps are not apt to so disturb the cooking liquor as to induce foaming.

After the cooking liquor has been run off and treated in the manner described, the washing liquors begin to be discharged from the diffuser and by carefully observing the density of the washing liquors discharged from the diffusers and appropriate manipulation of the valves of the

system the strong black liquor may be delivered back to the strong liquor storage tank 17, the intermediate black liquor to the black liquor storage tank 16 and the weak liquor to the weak liquor storage tank 15.

The present process not only has the advantage of eliminating the necessity of aging the wood and of providing for substantially continuous operation but results in the recovery of valuable byproducts. The soaps, fats, and waxes separated by the centrifugal action can be used as received or further purified and refined for the manufacture of various chemical derivatives or products useful in the art. Industrial soaps and foam producers are obvious uses offering large outlets. Shoe blackening, lubricants, paints, etc., are also examples.

It is to be understood that the apparatus shown in the accompanying diagram has been selected merely for the purposes of illustration and that the method set out at length has likewise been selected for the purposes of illustration, the scope of the invention being indicated by the subjoined claims.

For example, where, in order to benefit by the more favorable conditions for causticization at lower densities, the recovery operation yields a causticized liquor below 19° Bé., then such caustic liquor may be concentrated by evaporation between the causticizing tank 46 and the digesters. Then again it may in some cases be desirable to use a combination heater and evaporator in lieu of the ordinary indirect heater 2 and thereby make it possible to go even further than merely maintaining the original concentration in the digesters. One type of combination heater and evaporator system that may be employed is the so-called "Albenielsen system".

The invention claimed is:

1. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor maintained at such a density as to be separable from foam producing substances suspended therein under the influence of centrifugal force, removing the cooking liquor from the digested stock, separating the foam producing substances from the liquor by means of centrifugal force and thereafter handling and using the cooking liquor as desired.

2. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor maintained at such a density as to be separable from foam producing substances suspended therein under the influence of centrifugal force, washing the cooking liquor from the digested stock with washing liquors of graduated strength, filtering and cooling the cooking liquor as it is washed from the stock, immediately thereafter separating the foam producing substances from said cooking liquor in a continuous centrifugal separator under the influence of centrifugal force and then handling and using the cooking liquor as desired.

3. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor composed of a mixture of at least twice as much black liquor as white liquor, with the black liquor density between 13° and 19° Bé. at 170° F. and the white liquor density not less than 19° Bé. at 170° F., maintaining the concentration of the cooking liquor during the digesting operation, washing the cooking liquor from the digested stock with washing liquors of graduated strength, filtering and cooling the cooking liquor as it is washed from the stock, immediately thereafter separating the foam producing substances from said cooking liquor under the influence of centrifugal force, and then reusing or evaporating and burning said cooking liquor to recover the soda base therefrom.

4. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor composed of a mixture of at least twice as much black liquor as white liquor, with the black liquor density between 13° and 19° Bé. at 170° F. and the white liquor density not less than 19° Bé. at 170° F., maintaining the concentration of the cooking liquor during the digesting operation, removing the cooking liquor from the digested stock, separating the foam producing substances from the cooking liquor by means of centrifugal force and thereafter handling and using the cooking liquor as desired.

5. The hereindescribed method of manufacturing paper pulp from woods containing foam producing substances which consists in digesting the wood in a cooking liquor while maintaining the cooking liquor at such density that it is separable from foam producing substances suspended therein under the influence of centrifugal force, separating the liquor from foam producing substances suspended therein by means of a centrifugal separator, and thereafter handling and using the cooking liquor as desired.

6. The hereindescribed method of manufacturing paper pulp from wood containing resin, fats, waxes, and the like, which consists in digesting the wood in a cooking liquor while maintaining the liquor at such density that it will be separable from fats, waxes, and resins suspended therein under the influence of centrifugal force, separating the cooking liquor from the digested stock, immediately thereafter separating the fats, waxes and resins from the cooking liquor under the influence of centrifugal force, and then reusing and reclaiming the cooking liquor as desired.

7. The hereindescribed method of manufacturing paper pulp from woods containing foam producing substances which consists in digesting the wood in a cooking liquor with the concentration of the liquor maintained within such range that it is separable from foam producing substances suspended therein under the influence of centrifugal force, separating the cooking liquor from the digested stock, filtering the cooking liquor, cooling the filtered liquor to between 80° F. and 130° F., passing the cooled and filtered liquor through a centrifugal separator to remove the foam producing substances from the cooking liquor under the influence of centrifugal force, and then reusing and reclaiming the cooking liquor as desired.

8. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor composed of a mixture of at least twice as much black liquor as white liquor, with the black liquor density between 13° and 19° Bé. at 170° F. and the white liquor density not less than 19° Bé. at 170° F., maintaining the concentration of the cooking liquor during the digesting operation, removing the cooking liquor from the digested stock, filtering the cooking liquor, cooling the filtered liquor to between 80° F. and 130° F., passing the cooled and filtered liquor

through a centrifugal separator to remove the foam producing substances therefrom and then reusing or recovering the cooking liquor as desired.

9. The hereindescribed method of manufacturing paper pulp from wood containing foam producing substances which consists in digesting the wood in a cooking liquor composed of a mixture of at least twice as much black liquor as white liquor, with the black liquor density between 13° and 19° Bé. at 170° F. and the white liquor density not less than 19° Bé. at 170° F., utilizing indirect heat during digesting operation to maintain the concentration of the cooking liquor, removing the cooking liquor from the digested stock, separating the foam producing substances from the liquor by means of centrifugal force and thereafter handling and using the cooking liquor as desired.

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