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EVAPORATION OF SOLUTIONS

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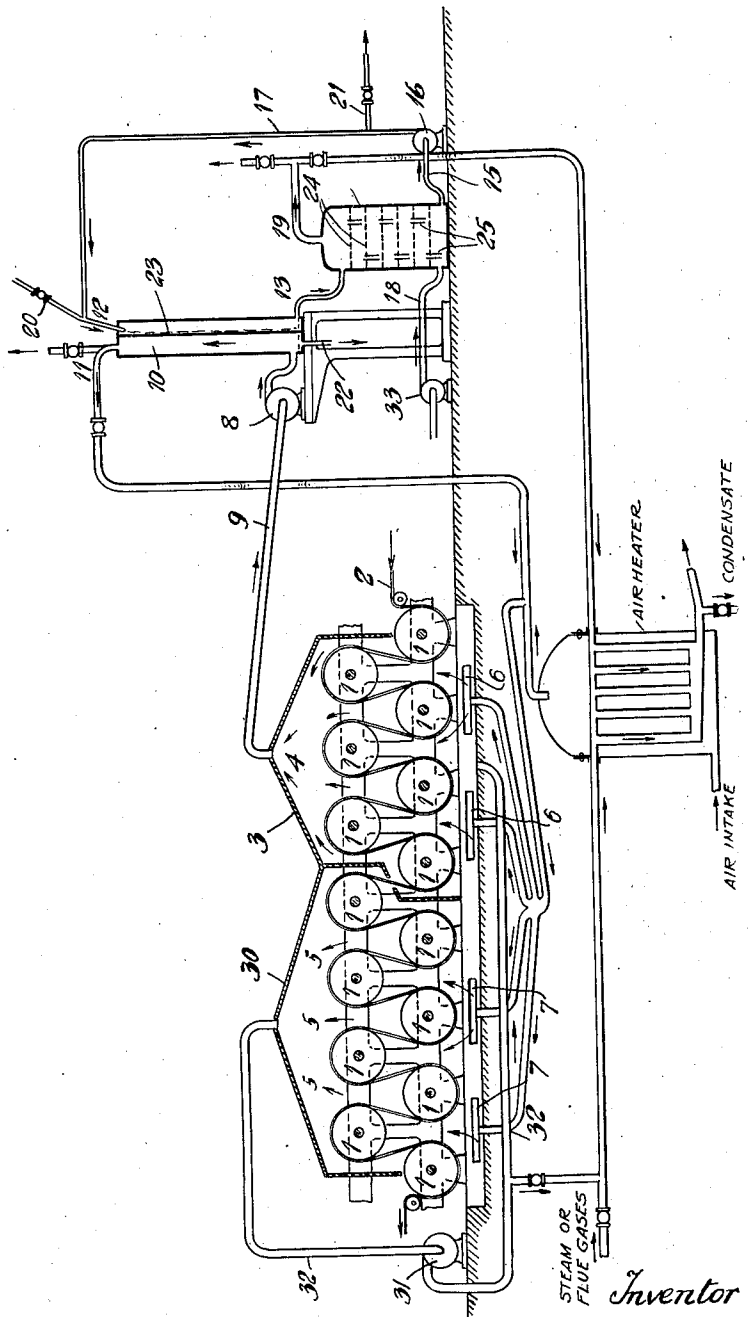

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EVAPORATION OF SOLUTIONS

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4 Claims. (Cl. 34—48)

In the manufacture of cellulose, that is to say of sulphite cellulose as well as of sulphate cellulose, for instance, great quantities of heat escape at the drying of the cellulose. This heat escapes from the drying rolls in mixture with air, the temperature of this air-vapor mixture being dependent on the quantities of air supplied to the drying rolls. Conditions are much the same in paper mills. The quantities of heat escaping from the drying rolls in the paper mills have been used heretofore only to heat the air in so-called heat recovering apparatus. In the manufacture of sulphite as well as of sulphate cellulose there is a great need, however, for heat for the evaporation of the lyes—with the sulphate cellulose the so-called black lye, and with the sulphite cellulose the so-called sulphite waste lye.

The present invention substantially consists in the use of the said heat quantities for concentrating solutions by vaporization, such as the said lyes. This may be effected in the following manner, for example.

The air-vapor mixture escaping from the drying rolls is recovered, the same being caused to deliver heat indirectly, through an intermediate partition, to the lyes in question, in which process the air-vapor mixture is cooled while the lye is being heated. The heat is substantially obtained from the latent heat of the condensed vapor. The lye thus heated is then cooled by evaporation of water from the hot lye with the aid of air, in a manner known per se.

Here, either the whole of the quantity of air-vapor mixture rising from the drying rolls or, preferably, only a part or parts thereof may be made use of, as will be described more fully hereinbelow.

The air-vapor mixture obtained in the first case has a comparatively low temperature of condensation, and for this reason it is not so suitable for the purpose as it would be if the temperature of condensation were somewhat higher.

The accompanying drawing illustrates an arrangement according to the invention, by means of which an air-vapor mixture of higher temperature is obtainable.

Here, 1 designates a number of drying cylinders having a board or paper web 2 running over the same.

The moisture of this web is lowered on the drying rolls successively from 50–70% water to 8 or 10% water. It is evident that the air surrounding the paper web in question absorbs water therefrom, and that such absorption may, if the paper web holds a great percentage of moisture, take place until the air has been saturated. On the other hand, however, it is obvious that board or paper having a low percentage of moisture, such as 10–30% water, cannot give off water to the surrounding air so that the latter will become fully saturated. By reason of the fact that the fibres of the paper web are hygroscopic, the cellulose will retain a certain quantity of water, even when it is surrounded by air which is not saturated with steam.

In the drying of cellulose it is of importance, moreover, that the cellulose does not have a high temperature when the percentage of water is low, that is to say at the dry end of the set of rolls, for in such case the quality of the cellulose will be impaired. On the other hand, no such disadvantages are involved in maintaining a high temperature in the cellulose web, as long as the moisture of the latter is great, that is to say at the wet end of the set of rolls.

These conditions are responsible for the impossibility to attain a high temperature in the air-vapor mixture escaping from the drying rolls, if the air-vapor, the so-called wet air, escaping from the various parts of the set of rolls, is mixed together. Only if the set of rolls be divided, so that the wet air from that part of the drying rolls where the moisture of the cellulose is still comparatively great, is taken per se, will it be possible to attain a relatively high temperature of this wet air. This is illustrated diagrammatically in the drawing. The air escaping from the wet portion of the set of rolls is removed through a screening housing 3, as at 4, without being mixed together with the air escaping from the dry portion of the set of rolls at 5. If at the same time a somewhat higher temperature is maintained in the cellulose web, in the portion screened by the housing 3, a higher temperature will be obtained in the air-vapor mixture escaping at 4. It is evident that this screening may be arranged in different ways, that is to say so that it will surround a portion of the set of rolls of varying size, it being likewise possible to arrange a plurality of such screening means.

Obviously, the air escaping at 5 has absorbed a much smaller quantity of water than that absorbed by the air escaping at 4. For this reason it is possible to use the air escaping at 5 as drying air in the portion of the set of rolls screened by the housing 3, in which case this air (which escapes at 5) is collected in a housing 30, and is blown, for instance by means of a fan 31, through a conduit 32 and the air intakes, underneath the portion of the set of rolls screened by the housing

3, or is supplied to said portion in some other way. This involves the advantage that small quantities of air only are required for the drying process, and the further advantage that the heat contents of the wet air escaping from the mill can be better utilized for evaporating purposes.

Part of the air escaping at 5 may be employed for preheating of air, that is to say of the fresh air taken in through the openings 7. This fresh air may also be heated in a known manner by the use of flue gases or steam, and/or by the air-vapor mixture escaping from the lye evaporators, as later described.

The drawing shows diagrammatically how the air-vapor (the wet air) obtained in the drying process is used for evaporation. The air-vapor mixture escaping at 4 is supposed, in accordance with the above considerations, to have a relatively high temperature, and is further assumed to be saturated. It will be understood that the high temperature of the saturated mixture is due to the heat imparted thereto before and/or during the passage through the drier housing, as by the heat obtained from steam heated drying rolls, although the particular source of this heat is not important to the broader aspects of the present invention. With the aid of the fan 8, this gas-vapor is conveyed through the conduit 9 to the heat chamber 10 of the evaporating apparatus, where it is cooled in a manner known per se, water being then condensed and drawn off at 22. The cooled air-vapor, the temperature of which is of course considerably lower than it was at the intake into the chamber 10, escapes from the heat chamber, as at 11. This air may be used anew in the set of rolls and may be introduced at 7 or 6, or at both of these points, on having been heated, if desired. The heat given off by the air-vapor has been absorbed by the solution taken in at 12 and flowing over the heat surface 23, preferably in counter-current against the air-vapor in 10. Thus the temperature of this solution will, when it escapes at 13, be considerably higher than it was when entering at 12. The hot solution obtained at 13 is introduced into an evaporator 14, whence it escapes through the pipe 15 to a pump 16, from which it is returned to the intake 12 through the pipe 17, and is again introduced into the heater. Air or other gas is introduced into the evaporator 14, as at 18, by means of a fan 33, and this air or gas is brought into contact with the solution, preferably in counter-current, from which solution water (solvent) evaporates by reason of the contact established. The air and the vapors forming escape at 19. A certain quantity of thinly liquid solution is supplied to the system, as at 20, and a certain quantity of concentrated solution is drawn off, as at 21. The evaporator 14, which is here shown as provided with a number of perforated partitions 24 with overflow pipes 25 arranged therebetween, may also be of other known construction. The air-vapor mixture escaping at 19 may be employed as a deliverer of heat in an evaporating unit, such as that above described (consisting of a heater and an evaporator), but operating at a lower temperature interval. In such case this second evaporating unit will correspond to a second effect in the ordinary multiple-effect evaporating systems. This air-vapor mixture may also be used to preheat the air taken in at 7 or 6, or at both of these points.

In order that the air-vapor escaping at 19 shall permit of being advantageously used as a deliverer of heat, it is necessary, however, that the temperature of this air-vapor (at 19) should not be too low. This can only be attained if the air-vapor coming to the heat chamber 10, that is to say the wet air from the drying rolls, has a comparatively high temperature.

What I claim is:—

1. In a plant for making cellulose or paper, the combination of a drier including a housing and means for conveying the cellulose or paper therethrough, means for supplying air to the interior of said housing for drying said cellulose or paper by direct contact therewith, means for heating the air thus supplied to the drier, means for segregating the hot moist air produced at the dry end of said drier from that produced at the wet end, means for supplying the hot moist air produced at the dry end of said drier to the wet end thereof for assisting in drying said cellulose or paper by direct contact therewith, a cellulose solution evaporator including a heating chamber having therein a heat transmitting wall, means for delivering the hot moist air from the wet end of said drier to said chamber and passing the same therethrough in heat exchanging relationship with said wall, means for circulating cellulose lye over the opposite side of said wall whereby said lye is heated by condensation of moisture from said hot moist air, and means for conducting a gas in direct contact with the heated lye to concentrate the same by evaporation.

2. A plant according to claim 1 including means for preheating the air before it is supplied to said drier housing, and means for recirculating the air escaping from the heating chamber of said evaporator through said preheating means and drier.

3. A plant according to claim 1 including means for preheating the air before it is supplied to said drier housing, and means for supplying the gas-vapor mixture resulting from direct contact of the gas with the lye in said evaporator to said preheating means to serve as the heating medium therefor.

4. A plant according to claim 1 including means for preheating the air before it is supplied to said drier housing, and means for supplying at least a portion of the hot moist air produced at the dry end of the drier to said preheating means to serve as the heating medium therefor.

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