

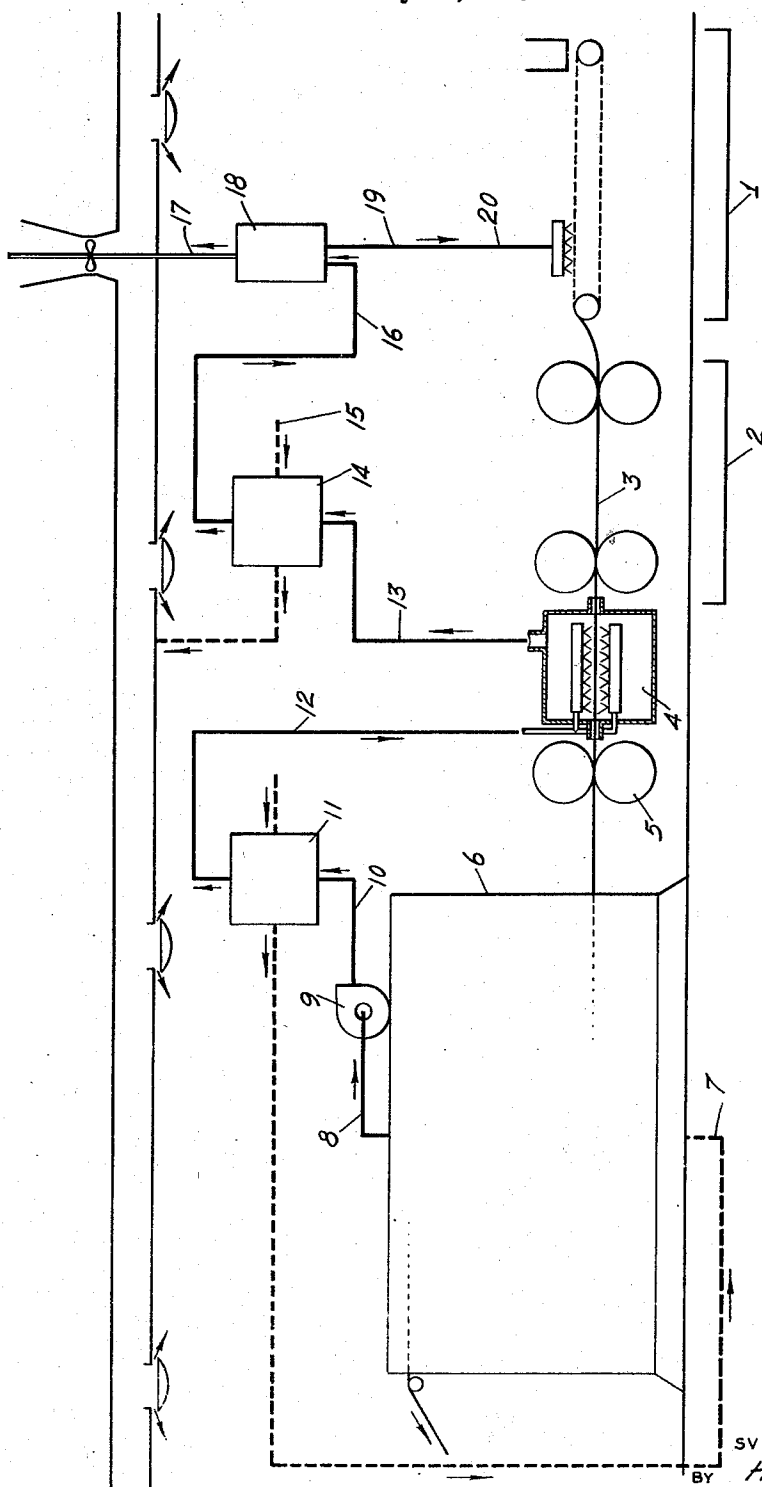
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METHOD FOR DEHYDRATING AND DRYING OF WEB-LIKE MATERIAL

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METHOD FOR DEHYDRATING AND DRYING OF WEB-LIKE MATERIAL

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The present invention relates to a new method for dehydrating and drying of web-like material for instance, cellulose by pressing and drying by means of heated air in a dryer (drying chamber).

In cellulose dryers for instance it is desired to convey heat at a lowest possible cost to the cellulose web during its passing through the dehydrating section, the so-called wet section. This intends to raise the temperature of the web material in order to increase the viscosity of the water which in great quantities is included in the wet cellulose web and which water must be pressed out in as great quantities as possible. The efficiency will hereby be improved by increasing the pressure of pressing and by raising the temperature. The pressing must, however, be effected at a reasonable pressure so that the cellulose fibres are not damaged. Increasing of the pressure involves furthermore a heavy increase of the support wear and a great consumption of power. At higher temperatures of the cellulose web the efficiency of the pressing is increased. It is thus possible to obtain a higher degree of dryness of the material at a fixed velocity of a machine and a fixed pressure before said material continues into the dryer for final drying. The high temperature of the web material and the high degree of dryness caused thereby after passing the pressing section involve partly that the dryer can be built smaller for a fixed capacity and partly that the consumption of heat (consumption of steam) will be lower per unit of weight of dried material.

Heating of such web-like material has previously been effected in any one of the following manners:

By conveying heated water to the wire section of the wet section.

By letting the web pass over a number of steam heated cylinders after the water partly has been pressed out.

By conveying high pressure steam directly to the web material by blowing against and/or along the web.

By using of electric radiation batteries.

With reference to the first mentioned of the above methods it is only possible to obtain a very limited raising of temperature unless absurdly large quantities of water having a high temperature are supplied.

As to the three other methods known it is applicable to all of them that a high valuable heat is used. In the second and the third cases high pressure steam is used as a heating medium. In the last mentioned case electric power is used. As these known methods cause relatively high running expenses only the second case has been more commonly used but it has the disadvantage of consuming large quantities of valuable steam.

The invention relates to a method for utilizing the heat or part of the heat already conveyed to the device when said heat primarily has been utilized for drying purposes by heating of the web-like material and the water included therein.

The invention is substantially characterized in that the web-like material is heated by means of warm and

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humid air during its passing between the rollers in the dehydrating section, which air is recirculated from the dryer (the drying chamber) arranged behind the dehydrating section in the feeding direction of the material and is conveyed to the web-like material at one or more places during the pressing.

According to a convenient modification of this method the heated and humid air discharged from the dryer is primarily conveyed into a recovering device for preheating of the dry air conveyed to the drying chamber and is thereafter blown in the previously indicated manner against the web-like material and by passing heat exchangers is finally brought partly to heat ventilating air, for instance, for adjacent rooms and partly to heat water for instance, to be conveyed to the web-like material in a stage of treatment earlier than that of the pressing rollers.

According to the method with respect to the invention low-grade heat, so-called waste heat is utilized.

According to the invention a more effective dehydrating work (pressing work) and a higher degree of dryness is obtained by utilizing low-grade heat before the web material enters the drying chamber. Among other things this involves that a smaller and cheaper type of drying chamber is utilized and that a lower cost of drying per unit of weight of treated material is obtained without supplying of expensive high valuable heat.

The invention will now be more fully described within the scope of the following claims. The humid air leaving the dryer, which air is intended to be used, has normally a dry temperature of 100–150° C. and a wet temperature of 60–70° C. when leaving the drying chamber. It is usually most advantageous to use this air first for preheating of dry air entering the drying chamber and thus lower the temperature of the humid air to the dew-point or proximately to this point. Utilizing a certain part of the heat of this saturated humid air the temperature of the web material is raised before entering the last couple of rollers in the wet section, for instance, from about 10° C. to about 55° C. Such raising of the temperature of the web material involves an approximate increase of the degree of dryness of about 2–3% after the last couple of rollers. This means on the other hand that a quantity of 10–15% less water is evaporated per unit of weight of dried material. The dryer can therefore be made 10–15% smaller in a corresponding degree and the quantity of heat consumed for drying will also be 10–15% lower per unit of weight of treated material.

The above mentioned figures are of course only examples. They vary dependent on different conditions, for instance, from the type of pressing arrangements and the pressure of steam etc. by which the drying chamber and the ventilating arrangements built in said drying chamber are operated.

The principal object of the present invention is to provide a novel method for dehydrating and drying web-like material which utilizes a substantially smaller amount of heat than presently existing methods.

The accompanying drawing illustrates diagrammatically the above mentioned method.

In the drawing 1 indicates the screen section of the web-like material 3 and 2 the dehydrating section. The preheater of the material is designated 4 and the press arrangements arranged after said preheater are designated 5. The device 6 is a closed dryer of conventional type containing the usual heating means where the web material is subjected to drying by means of hot air 7. As shown said air is preheated in the heat exchanger 11 by means of the humid and hot air 8 discharged from the drying chamber 6 and forced by the fan 9. through the heat exchanger 11. The air 12 in the pre-

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heater 4 is forced past the web material after part of its heat content has been utilized in the heat exchanger 11. From the preheater 4 the air 13 is conveyed through the heat exchanger 14 for preheating of the ventilating air 15, for instance, to be blown in the adjacent rooms. Finally the contents of heat of the air 16 is utilized in a hot water tank 18 in order to raise the temperature of the water 19 which conveniently is conveyed to the wire screen 1. After leaving the hot water tank the air is discharged at 17.

What I claim is:

1. In the method of dehydrating and subsequently drying wet web material, the steps which comprise dehydrating the web by expressing a part of the moisture from the wet web material, decreasing the viscosity of the remaining moisture by preheating the web and expressing a portion of the remaining moisture from the preheated web; subsequently drying the web by passing the web through a drying chamber and causing heated air to circulate through said drying chamber into contact with said web to dry the latter; and utilizing the exhaust hot air from the drying chamber as the source of heat for said preheating of the web.

2. In the method of dehydrating and subsequently drying wet web material, the steps which comprise dehydrating the web by expressing a part of the moisture from the wet web material, decreasing the viscosity of the remaining moisture by preheating the web, expressing additional moisture from the preheated web, subsequently drying the web by passing the web through a drying chamber and causing heated air to circulate through said drying chamber into contact with said web to dry the latter, utilizing the exhaust hot air from the drying chamber to preheat the air entering said drying chamber, and using the warm exhaust air from said preheating of the air as the source of heat for said preheating of the web.

3. In apparatus for dehydrating and subsequently drying wet web material, a dehydrating section comprising a series of cooperating opposed pressing rolls between which the web passes to remove moisture from the wet web material, and a preheater through which the web passes positioned in advance of the last rolls of said series of pressing rolls, said preheater operable to decrease the viscosity of the moisture remaining in said web; a dryer through which the partially dehydrated web material subsequently passes, means to circulate warm drying medium through said dryer to dry the web material, and means to conduct the warm drying medium discharged from the dryer to said preheater for preheating the web.

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4. In apparatus for dehydrating and subsequently drying wet web material, a dehydrating section comprising a series of cooperating opposed pressing rolls between which the web passes to remove moisture from the wet web material, and a preheater through which said web passes positioned in advance of the last rolls of said series of pressing rolls, said preheater operable to decrease the viscosity of the moisture remaining in said web; a dryer through which the partially dehydrated web material subsequently passes, means to circulate warm drying medium through said dryer to dry the web material, a preheater for said drying medium to preheat the same before it enters the dryer, and means to conduct the warm drying medium exhausted from said dryer through said last-mentioned preheater into said first-mentioned preheater.

5. In the method of processing material to form a dry web of said material, the steps which comprise moistening the material with warm liquid, compacting the moistened material into a web, and dehydrating the web by expressing a part of the moisture from the wet web, decreasing the viscosity of the remaining moisture by preheating the web, and expressing a portion of the remaining moisture from the preheated web, and subsequently drying the web by passing the web through a drying chamber and causing heated air to circulate through said drying chamber into contact with said web to dry the latter, utilizing the exhaust hot air from the drying chamber to preheat the air entering said drying chamber, utilizing the warm exhaust air from the preheating of the air as a source of heat for said preheating of the web, and utilizing the exhaust hot air from the preheating of the web to warm the liquid used to moisten said material.

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