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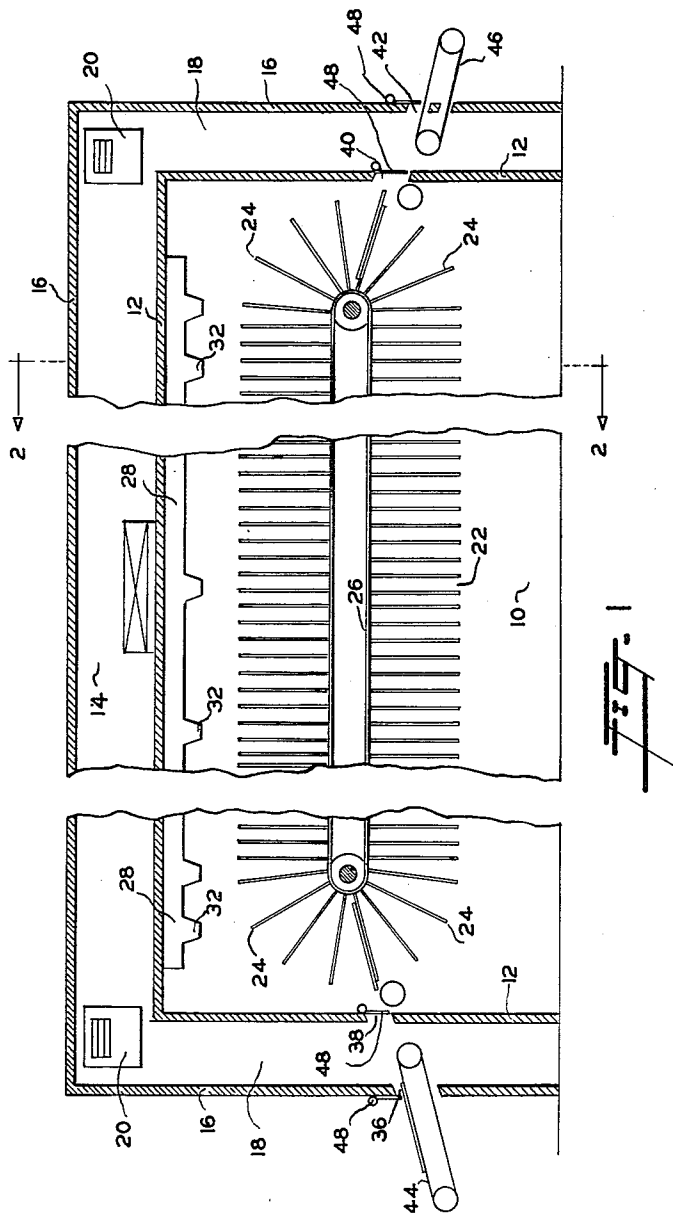
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DEVICE FOR HUMIDIFYING HARDBOARD

Filed March 15, 1957

2 Sheets-Sheet 1



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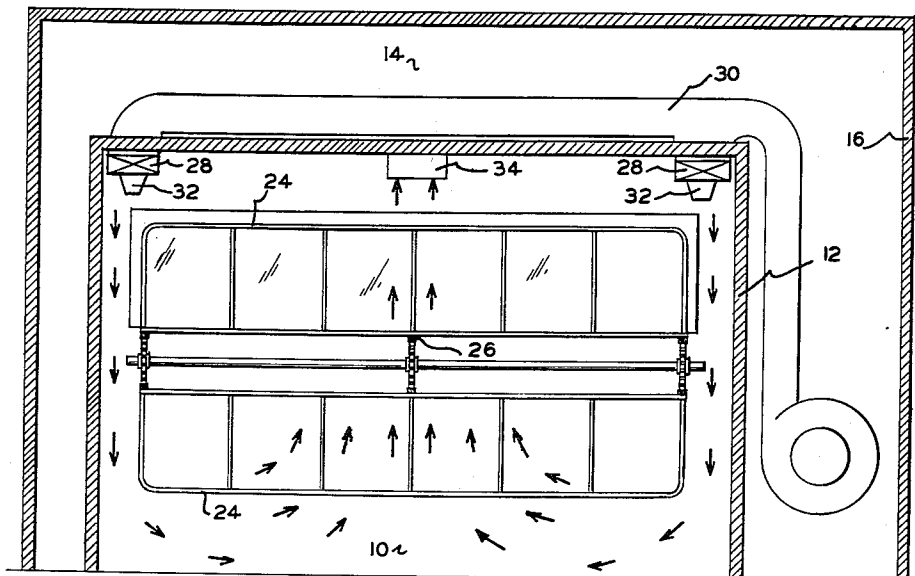


FIG. 2

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DEVICE FOR HUMIDIFYING HARDBOARD

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2 Claims. (Cl. 34—150)

The present invention relates to the finishing of lignocellulose hardboard products. More particularly, the invention relates to a novel and improved device for effecting moisture regain in hardboard sheets. Even more particularly, the invention relates to a novel humidification chamber adapted to effect moisture regain in hardboard sheets without appreciable damage to the surfaces of such sheets.

In the manufacture of lignocellulose hardboard sheet articles, the finished products are usually characterized by a substantially complete lack of moisture subsequent to the consolidation thereof which is carried out under considerable heat and pressure. In many instances, hardboard sheets are subjected to additional finishing treatments wherein the boards are impregnated with drying oils and the like materials or are coated with various film forming compositions such as enamels, resins, and the like. Hardboard sheets which are so treated are invariably subjected to a baking cycle in order to cure the compositions with which they have been treated. In any case, before the hardboard sheets are sold and are installed by customers, it is desirable and, indeed, even necessary that they be conditioned to effect a moisture uptake, or regain, equivalent to that normally encountered under atmospheric conditions. The conditioning of the hardboard prevents undue dimensional changes therein during use thus substantially eliminating unsightly warping and/or shrinkage. Manufacturers have generally subjected their hardboard products to a humidification treatment wherein from about 2% to about 6% of moisture is forced into the hardboard sheets as rapidly as possible. The amount of moisture absorbed by the sheets usually lies within the above stated range which represents substantially equilibrium moisture content for most atmospheric conditions.

According to prior art practices, hardboard sheets have been charged in spaced apart relationship to a humidification chamber and therein subjected to a warm, humid atmosphere. Normally, temperatures have not appreciably exceeded 110° F. since it has been known that temperatures above about 110° F., when employed together with high relative humidity as, for example, 90%–95% have caused the large fibers, which are always present to some degree in the surfaces of the sheets, to swell and rupture. Inasmuch as these swollen fibers never return to their original condition, the surfaces of the hardboard sheets have been permanently disfigured and have not been acceptable commercially. The humidification conditions which have been acceptable to the art, however, necessitate the employment of extremely lengthy moisture regain cycles. For example, it has often been necessary to humidify relatively dense hardboard sheets for a period of 20 hours or more in order to effect a moisture regain of about 4% to about 6%. In the case of sheets which have been coated with baked enamels and the like finishing compositions, these lengthy humidification cycles have often resulted in rupture of the surface fibers on the

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coated surfaces. Where this has happened, the sheets have had no commercial value whatever.

It has recently been discovered that moisture regain in hardboard sheet articles may be effected at relatively elevated temperatures under conditions which are so maintained that any appreciable condensation of moisture on the sheet surfaces is prevented. The novel humidification method is described and claimed in copending patent application Serial No. 646,469 of Charles F. Story, filed on even date herewith and now Patent No. 2,919,492. Briefly, that invention is directed to effecting moisture regain in hardboard sheet articles over a dry bulb temperature range of from about 140° F. to about 190° F. and at relative humidities which result in equilibrium moisture uptakes within the range of about 2% to about 6%. Under the stated conditions, and where any substantial amount of moisture condensation on the sheet surfaces is prevented, hardboard sheets so humidified are characterized by their freedom from surface imperfections due to swelling and rupturing of surface fibers. This is true not only in the case of untreated hardboard articles but equally as well in the case of hardboard which has been coated or impregnated as above described. The moisture regain is effected within a time range of about 30 minutes to about 6 hours depending on the conditions selected. In general, it has been discovered that the force which drives the moisture into hardboard products results from the dry bulb temperature, and the rate of moisture regain increases in approximately direct proportion with increase in temperature. The amount of moisture regain increases with the increase in relative humidity at any given temperature. The novel method presents a decided advantage to the art inasmuch as it enables the humidification of hardboard sheets to be effected within shorter periods of time than have previously been required.

The present invention is directed to the provision of a novel and improved humidification chamber which is adapted to perform the above described processes.

It is a principal object of the invention to provide a humidification device which permits the use of dry bulb temperatures as high as about 190° F. together with a relatively humid atmosphere without appreciable damage to the hardboard sheets.

Another object of the invention resides in the provision of a novel humidification device which prevents any appreciable amount of moisture condensation on the surfaces of the hardboard sheets. Further objects of the invention will become apparent from the following description thereof. The description is directed particularly to the accompanying drawings in which

FIG. 1 is a diagrammatic side elevation of the novel humidification device, partially broken away, and

FIG. 2 is a diagrammatic sectional view along line 2—2 of FIG. 1.

In the drawings, a preferred type of humidification chamber consists essentially of a rectangular inner chamber 10, enclosed by the casing walls 12, and an outer rectangular chamber 14 defined by the casing walls 16. The area between the two chambers, generally referred to by the numeral 18 is provided with heaters shown generally at 20. The casing walls 16 of the outer chamber 14 are preferably constructed of an insulating material

to prevent excessive heat loss from the device. The casing walls 12 of the inner chamber 10 may be constructed of any desired structural material within limits of thermal conductivity characteristics which will hereinafter be pointed out with more particularity. A wicket-type conveyor 22 is positioned within the inner chamber 10. The individual wickets 24 may be suitably mounted on a conventional chain or belt as shown diagrammatically at 26. The humidifying atmosphere inlet ducts 28 are positioned against the upper wall 12 of the inner chamber 10 and a feed duct 30 is connected thereto. The inlet ducts 28 are provided with a plurality of nozzles 32 which serve to direct the humidifying atmosphere downwardly along the sides of the inner chamber 10 as shown in FIG. 2. A return duct 34, located longitudinally along the central portion of the upper wall 12, provides an exhaust route for the humidifying atmosphere and the gaseous medium is recirculated through conventional heating and humidifying means (not shown). The humidification chamber is provided with inlet openings or slots 36 and 38 and discharge slots 40 and 42 extending laterally across the end walls 12 and 16 of the inner and outer chambers, respectively. Suitable conveyor means 44 and 46, such as conventional belt or chain conveyors, are provided for charging hardboard sheets into and discharging them from the chamber, respectively. The operating mechanisms for conveyors 22, 44, and 46 are of conventional design and are so controlled as to feed a series of hardboard sheets into consecutive wickets of the wicket conveyor 22 and to discharge the conditioned sheets from the novel device. The inlet and discharge slots or openings are also provided with gated or hinged closure means, indicated generally by the numeral 48, for preventing any appreciable escape of heat and moisture from the humidification chamber.

As stated hereinbefore, the walls 12 of the inner chamber 10 may be constructed of any suitable structural material such as wood, hardboard itself, asbestos cement sheets, structural metal, and the like materials. Particularly suitable for the inner chamber construction is stainless steel, as well as coated steel such as an asphalt and vinyl coated steel.

One of the outstanding features of the present invention resides in the discovery that by means of the proper regulation of the temperature of the walls 12 of the inner chamber 10, condensation of moisture within the chamber itself and on the surfaces of the hardboard sheets supported therein may be substantially eliminated. In a general sense, the walls 12 must be maintained at a temperature which is not appreciably lower than the dew point of the humidifying atmosphere within the inner chamber 10. Obviously, depending upon the structural material employed in the walls 12, the thermal conductivity thereof will vary within wide limits. For example, where the walls 12 are comprised of material such as stainless steel or its equivalent structural material having a high degree of thermal conductivity, the temperature of the walls must be maintained at a point within a very few degrees of the wet bulb temperature within the chamber 10. Where a material of relatively low thermal conductivity is employed to form the walls 12, there may be a relatively wide differential between the temperature of the air within the space 14 and that of the humidifying atmosphere within the chamber 10. The differential which may be tolerated is entirely dependent on the thermal conductivity of the material used in constructing the walls 12. The regulation of the temperature of the walls 12 is effected by the heating means 20 which, as stated before, serve to heat the space 14 between the inner and outer chambers.

Another outstanding feature of the invention resides in the relationship between the duct arrangement for circulating the humidifying medium, namely, moisture and air, and the positioning of the wicket conveyor 22. It will be seen from FIG. 1 that there is a considerable space below the wickets 24 and the base of the humidification

chamber. In effect, as the humidifying atmosphere is directed downwardly through the nozzles 32 and between the vertically opposed hardboard sheets within the conveyor 22, this space below the conveyor serves as a plenum chamber. The stream of humid gas is thereby rendered turbulent and, as the gas ascends between the hardboard sheets and into the exhaust duct 34, the contained moisture of the gas uniformly contacts the surfaces of all of the hardboard sheets within the chamber. As will be seen in FIG. 2, the inlet duct 28 and the nozzles 32 are positioned near the side walls of the inner chamber so that the humid gas flows downwardly at the edges of the hardboard sheets and upwardly between them to the exhaust duct 34.

The novel humidification device of the invention, therefore, comprises the combination of a double walled chamber, so constructed and controlled as to prevent condensation of moisture within the inner chamber, together with a particular type conveyor and a humidifying atmosphere supply duct system which insures uniform circulation of the atmosphere within the humidification chamber. The device may be operated continuously where desired or, obviously, it may be charged with hardboard sheets intermittently in a batch type operation.

Although the invention has been described in detail with particular reference to the accompanying drawings, it will be obvious that modifications within the skill of the art may be resorted to without departing from the spirit thereof. It is therefore to be understood that the invention is to be limited only by the scope of the appended claims.

I claim:

1. A humidification device comprising an outer rectangular casing, a similarly shaped inner casing in spaced relationship with said outer casing, each of said casings having opposed side walls and end walls providing an inner chamber and an outer chamber, heating means for maintaining a heated atmosphere in said outer chamber, an inlet opening in an end wall of each of said casings and an outlet opening in the opposed end wall of each of said casings, said openings adapted to enable the passage therethrough of sheet articles, gate elements hinged to the end walls immediately above the openings, conveying means within said inner chamber adapted to support and convey therethrough said sheet articles in substantially upright spaced-apart relationship, longitudinally extending supply ducts positioned along the top of said inner chamber parallel to and adjacent to the side walls thereof, a plurality of nozzles projecting downwardly from said supply ducts adapted to forcibly discharge a heated humid gaseous medium downwardly along the side walls of said inner chamber, and an exhaust duct positioned along the top of said inner chamber to remove the gaseous medium from the chamber.

2. A humidification device comprising an outer rectangular casing, a similarly shaped inner casing in spaced relationship with said outer casing, each of said casings having opposed side walls and end walls providing an inner chamber and an outer chamber, heating means for maintaining a heated atmosphere in said outer chamber, an inlet opening in an end wall of each of said casings and an outlet opening in the opposed end wall of each of said casings, said openings adapted to enable the passage therethrough of sheet articles, gate elements hinged to the end walls immediately above the openings, wicket conveying means within said inner chamber adapted to support and convey therethrough said sheet articles in substantially upright spaced-apart relationship, longitudinally extending supply ducts positioned along the top of said inner chamber parallel to and adjacent to the side walls thereof, a plurality of nozzles projecting downwardly from said supply ducts adapted to forcibly discharge a heated humid gaseous medium downwardly along the side walls of said inner chamber, and an exhaust duct positioned longitudinally along the cen-

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tral portion of the top of said inner chamber to remove the gaseous medium from the chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

5

1,288,810	Birchbauer	Dec. 24, 1918
1,308,837	Blakeney	July 8, 1919
1,399,415	Taliaferro	Dec. 6, 1921
1,469,976	Walsh	Oct. 9, 1923
1,577,509	Witham	Mar. 23, 1926

10

1,668,995
1,727,964
1,738,946
1,932,124
2,505,973
2,668,366
2,904,893

689,992

6

Woolever	May 8, 1928
Coleman	Sept. 10, 1929
Chapin et al.	Dec. 10, 1929
Tobey	Oct. 24, 1933
Julian	May 2, 1950
Barnett	Feb. 9, 1954
Willey	Sept. 22, 1959

FOREIGN PATENTS

France	June 3, 1930
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