Oct. 15, 1940. W. H. MASON 2,217,691

HIGH TEMPERATURE IRONING OF FIBER WETLAP

Filed June 13, 1939

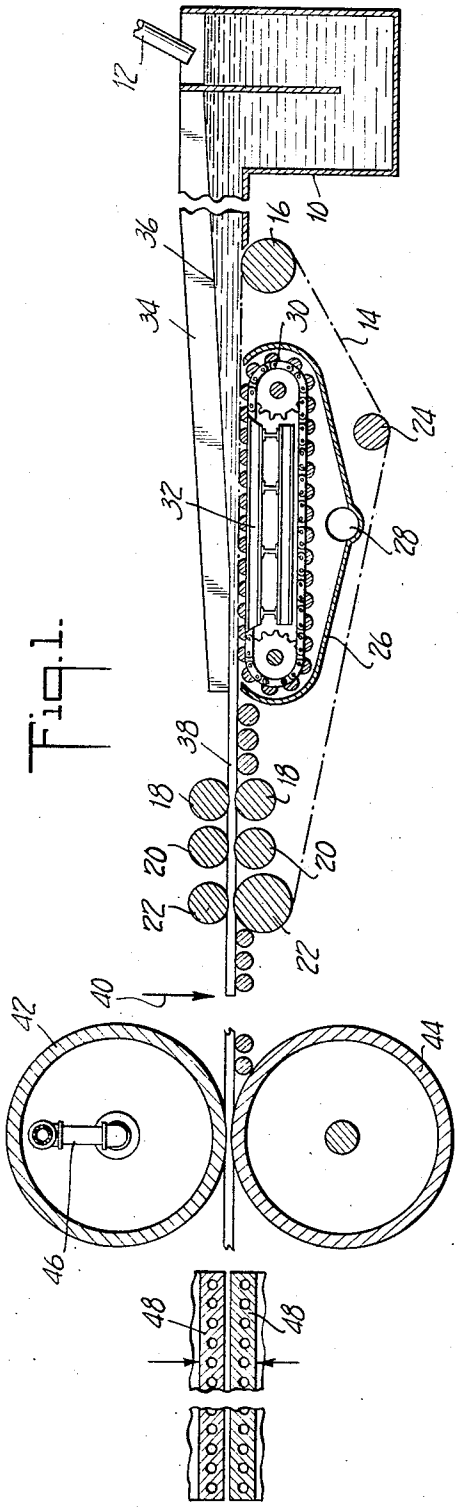


Fig. 1.

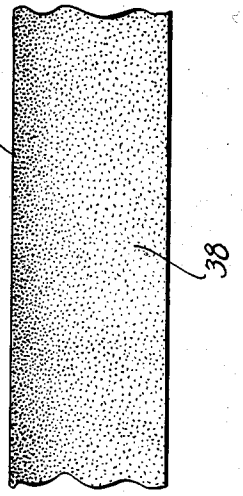


Fig. 3.

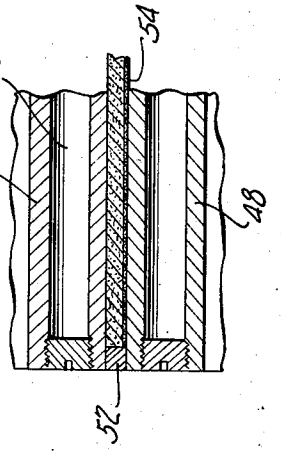


Fig. 2.

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Patented Oct. 15, 1940 2,217,691

UNITED STATES PATENT OFFICE

2,217,691

HIGH TEMPERATURE IRONING OF FIBER WETLAP

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Application June 13, 1939, Serial No. 278,818

8 Claims. (Cl. 92—39)

This application is a continuation-in-part of my application Serial No. 70,547, filed March 23, 1936.

The invention relates to the treatment of fiber wetlaps between their formation in a wet machine, as an Oliver or Fourdrinier machine or the like, and the area drying of the wetlap so obtained, and relates more particularly to a high temperature ironing step, performed on the wetlap at this intermediate stage between its formation and its area drying, and serving to produce a thin smooth hardened skin portion at the surface of the wetlap. The expression "area drying" is used herein to signify any drying operation in which substantially all of the water remaining in the wetlap is removed by drying, or by drying and pressing, throughout an extended area of both the length and width of the wetlap at one time, as by drying in a hot air drier such as a Coe drier, or by drying cut-off sections or boards of the wetlap in a platen press having its platens heated, preferably by means of steam, and having provision for moisture escape such as a wire screen between the wet fiber sheets and adjacent platens, and in other equivalent ways.

The principal object of the invention is the formation of a thin smooth skin at the surface of the wetlap after the wetlap has been formed and prior to its subsequent area drying.

It has heretofore been customary practice in making porous boards of ligno-cellulose material in subdivided state—herein designated as fiber and containing both fibers and small bundles of fibers—to confine the operation to the steps of forming a wet sheet or wetlap from a water bath or suspension of the fiber in water by means of a wet machine in which the wet sheet is passed through unheated squeeze rolls to eliminate excess water, and of then completing the finished board by drying the wet sheet so produced. In following this prior practice, dimples and other defects of formation are sometimes unavoidable in forming the fiber into wetlap sheets from water and will occasionally be formed and may remain in the sheet, and to some extent at least such defects or their traces will be discernible in the finished board. While such defects or traces of defects may not be especially noticeable in the finished board when used as-is without application of surface coating, they seem to be in some way magnified, or at least brought out more noticeably, when coatings are applied to the finished board, such as a coating or coatings of paint or equivalent materials, and appear as defects in the painted surface.

In following this prior practice in the manufacture of boards of the light and porous type known as insulation board or of the comparatively light and porous type which may be designated as semi-hard board or "Quarterboard" and which boards may be dried, for example, in platen presses with interposition of distance stops to limit the extent of approach of the press platens toward one another, the surface portions are only slightly, if any, harder or denser than the interior parts. When coatings, as of paint, for example, are applied to such boards, the paint or its constituents penetrate into the interior of the board to an undesirable extent, and such boards are not well adapted for coating, as painting, with economical use of the coating materials and production of a good painted or other coated surface. This objection of ready penetration does not apply to hard boards of the ligno-cellulose fiber, which are of high specific gravity as 1. or more, and the present invention is directed to include the manufacture of porous board such as the insulation board or semi-hard board above referred to.

The temperature which can be used in the drying operation of the prior art above referred to is limited by several factors. The drying takes a considerable time, and if the temperature is too high, scorching or burning may be caused. The drying of insulation boards in a Coe or other hot air drier, for example, takes a period of time of the order of 1 hour or more; and the drying operation in the platen-press drying varies from about 25 minutes for a semi-hard board of about 0.6 sp. gr. and approximately ¼" thick and dried in a hot platen press with stops between the press platens, up to about 45 minutes for the platen-press drying of an insulation board of about 0.3 sp. gr. and approximately ½" thick and also dried with use of stops between the press platens. Also, with use of too high temperatures for the drying operation as carried out in platen-press drying of porous boards such as insulation boards or semi-hard boards, there is a likelihood of producing defects in the finished board known as water spots. Because of the dangers of scorching or burning by use of too high temperature for too long a time in area drying, and the possible production of water spots or other defects by use of too high temperature in area drying, the temperature for the area drying operation performed on wetlaps cannot exceed a maximum of about 200° C., and in general the area drying of the wetlap must be performed at temperatures considerably lower than such maximum. Such temperature is too

low to produce the skin effect obtained with the present invention.

Ordinarily only one surface of the board would be coated with paint or the like. It is sufficient therefore to iron only one surface of the wetlap, although if desired both surfaces may be given the high temperature ironing treatment. While the board made with the ironing of the wetlap is especially well adapted for receiving application of surface coatings, such boards may be used without surface coatings if desired. Formation of a single thin, smooth, penetration-resisting skin at the upper surface of the wetlap is the preferable embodiment of the invention because if a second such surface were formed it would not ordinarily be painted, and because of the freer escape of steam formed by a single heated ironing roll, and this preferred embodiment will be described herein. In any case, the ironing operation is performed by passing the wetlap between a pair of rolls with each thereof in rolling contact with the sheet which is passed through and temporarily compressed between the rolls of the pair, expanding as it is released.

With the present invention, by reason of the presence of a high percentage of water in the wetlap and by confining the effect of the ironing operation to formation of an extremely thin skin, the permanent compaction obtained being limited to this thin skin part and not extending therebeyond into the porous body portion of the sheet, very high temperatures can be used in the ironing operation without burning, with the production of a very smooth skin in which surface defects are practically entirely ironed out, and no new defects such as water spots, or the like, are produced.

The temperature which can be applied in this manner varies with the speed of travel of the wetlap. With wetlap speeds of about 12 to 100 ft. per minute, for example, the ironing roll temperature can range from about 250° C. to about 400° C. with instancing as follows:

For 18 ft. per minute about 250—300° C. and preferably about 270° C.
For 60 ft. per minute about 300—340° C. and preferably about 320° C.
For 100 ft. per minute about 340—400° C. and preferably about 370° C.

In this ironing operation, no attempt is made to secure any permanent consolidation of the board except for the very thin skin produced at the upper surface of the board obtained by the application of the high ironing temperatures which have been described. Also it is not desirable to express water by the pair of rolls comprising the ironing roll or rolls because presence of free water would interfere with the ironing treatment and the board surface might be stained or discolored by streams of expressed water. The pressure of the ironing roll upon the surface of the wetlap therefore should not exceed and is desirably less than that exerted by the squeeze rolls of the wet machine, hereafter referred to. For these reasons the pressure for the hot ironing operation can be relatively low and is desirably of the order of about one to three thousand pounds per foot of width of wetlap. For example, in one case with a wetlap 4'—2" wide, and using a pair of rolls comprising an upper heated ironing roll 45" in diameter and weighing 7000 lbs., the weight of the ironing roll itself was found to be sufficient for making the pressure application, giving a pressure of about 1680 lbs. per foot of width of the wetlap. Of course lighter or heavier rolls can be used and in case a lighter roll is used, a part of the pressure can be applied as by use of hydraulic rams, or by means of springs, or the like, and considerable variation in the particular pressure can be made so long as a good ironing result is obtained and the pressure used is not so high as to express water or cause the skin or parts thereof to be pulled or pushed away from the body of the wetlap and produce delamination in the finished board.

In the accompanying drawing forming a part of this specification,

Fig. 1 is a diagrammatical longitudinal sectional view of a form of apparatus adapted to carry out my new process,

Fig. 2 is an enlarged vertical detail showing arrangement of one of the stop bars in a platen press, and

Fig. 3 is a transverse sectional view on an enlarged scale of the wetlap after ironing.

Reference character 10 designates a head box adapted to receive the watery pulp of lignocellulose fiber as the same is supplied, for example, from spout or spouts 12. From the head box the pulp is run onto the traveling Fourdrinier screen 14. This screen 14 runs around the roller 16 at the end adjacent to the head box 10. At the other end screen 14 runs around the lower members of the pairs of squeeze rolls 18, 18, 20, 20 and 22, 22, and may run under the idler roll or rolls 24. Beneath the Fourdrinier screen 14 is a suction box or boxes 26 provided with a water outlet 28 which is placed under suction. Where the Fourdrinier screen 14 runs over the suction box 26 it can be supported by a slab belt 30 traveling on suitable supports 32 at substantially the speed of the traveling Fourdrinier screen 14.

Side boards are indicated at 34, and the diminishing watery pulp level at 36. The pressure on the squeeze rolls 18, 18, etc. is preferably sufficient to reduce the water content of the fiber wetlap 38 formed on the Fourdrinier screen 14 considerably, as for example, to reduce it to approximately 40 to 60%.

A cutoff is diagrammatically indicated at 40 for cutting the wetlap 38 into board lengths which are passed through between a pair of pressure rolls 42, 44. These rolls are preferably several feet in diameter, as for example approximately 3'—9" in diameter, and at least the upper roll 42 is adapted for being heated to a high temperature as by means of a burner or burners such as the centrally inserted gas-fired heating burner 46 and so adapted to produce a thin skin 50 at the upper surface of the sheet.

The area drying means illustrated comprises pressure platens 48 of a multiple platen press heated as by means of steam circulated through passages 50. In making porous boards such as insulation boards or semi-hard boards in a platen press, the interspaced platens between which the boards are introduced are held to a predetermined minimum by insertion therebetween of the spacing bars, or stops 52 inserted between the edges of the platens. These stops may be dispensed with in making hard boards. With platen-press drying, a wire mesh sheet 54 is inserted between the wetlap and one platen, preferably the platen beneath the board, in order to permit escape of moisture. Other means of area drying, such as the well known Coe hot air drier, may be used for area drying of insulation board.

Instead of the forming machine of the Four-

drinier type, which is shown for purposes of illustration, various other forming machines, as an "Oliver" or the like machines, may be used.

The ligno-cellulose fiber which has been referred to is preferably raw fiber made in any way adapted to retain non-cellulose together with cellulose constituents. Completely raw fiber with no chemical digestion or addition of chemically digested fiber gives the most efficient self-bonding or welding properties, but in any case there should be sufficient of the non-cellulose fiber constituents or encrustants to give effective self-bonding or welding properties, and such fiber is referred to in my claims as at least principally raw fiber. The vegetable kingdom supplies numerous sources of ligno-cellulose fiber such as the wood of trees and woody material from shrubs, canes, grasses, straws, etc. While wood of trees is the preferred fiber supplying material, ligno-cellulose fiber from any source can be used.

Steam explosion, grinding and shredding are good examples of ways by which a raw fiber can be secured. The figures given herein were obtained with use of exploded wood fiber. Beating or other refinement is preferably not extensive. Specific gravity means weight of the board per unit volume.

The constituents readily soluble in water are ordinarily at least partially lost in the waste water, but can be retained in the board to some extent at least if desired.

Incorporation of about 2% of petrolatum is useful for securing enhancement of the naturally high resistance to absorption of water. Added binders are not essential, but may be included if desired, as by incorporation of approximately 4% of siccative material, of which tung oil is a good example, with heating conditions in the presence of oxygen to harden or set the binder material.

I claim:

1. Process of making a skin-surfaced, porous fiber board, which comprises the steps of forming from a water bath a wet felted sheet of fiber of ligno-cellulose wood or woody material which fiber contains at least the principal part of the non-cellulose or encrusting fiber constituents and is self-bonding, then pressing surplus water from the wet sheet by passing it through between squeeze rolls, and then hot-ironing the sheet, so freed from surplus water, by passing it through between press rolls at least one of which is heated to a temperature varying with the speed and which for ironing press roll surface speeds of about 12 to about 100 feet per minute is from about 250° C. to about 400° C., while applying pressure by the press rolls which does not exceed the pressure which had been applied by the squeeze rolls so as to avoid expression of water during the hot-ironing operation, said sheet expanding on leaving the press rolls, and then area-drying the skin-surfaced sheet, whereby a finished porous fiber board is produced having at least one thin-hot-ironed skin surface portion which is relatively compact, dense, smooth and impervious and does not extend therebeyond into the porous body of the board and is adapted for taking surface finishes as paint and the like.

2. Process as in claim 1, and wherein for an ironing press roll surface speed of about 18 feet per minute the temperature is about 250° C. to about 300° C.

3. Process as in claim 1, and wherein for an ironing press roll surface speed of about 60 feet per minute the temperature is about 300° C. to about 340° C.

4. Process as in claim 1, and wherein for an ironing press roll surface speed of about 100 feet per minute the temperature is about 340° C. to about 400° C.

5. Process as defined in claim 1, and wherein the sheet is severed into lengths after being passed through the squeeze rolls and before being passed through the hot-ironing press rolls.

6. Process as defined in claim 1, and wherein the pressure applied by the press rolls for hot-ironing is at least 1000 lbs. per foot of width of the sheet in contact with the press rolls.

7. Process as defined in claim 1, and wherein but one press roll is heated and but one skin-surfaced portion is formed.

8. Process as defined in claim 1, and wherein the sheet is severed into lengths after being passed through the squeeze rolls and before being passed through the hot-ironing press rolls, and wherein the pressures applied by the press rolls for hot-ironing is at least 1000 lbs. per foot of width of the sheet in contact with the press rolls, and wherein but one press roll is heated and but one skin-surface portion is formed.

WILLIAM H. MASON.