March 23, 1926. 1,578,020

A. ELMENDORF

METHOD OF DRYING AND HANDLING WOOD VENEER

Filed Nov. 21, 1921

Fig. 1.

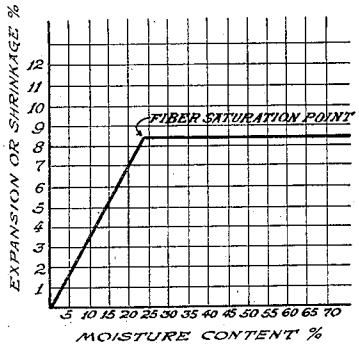


Fig. 2.

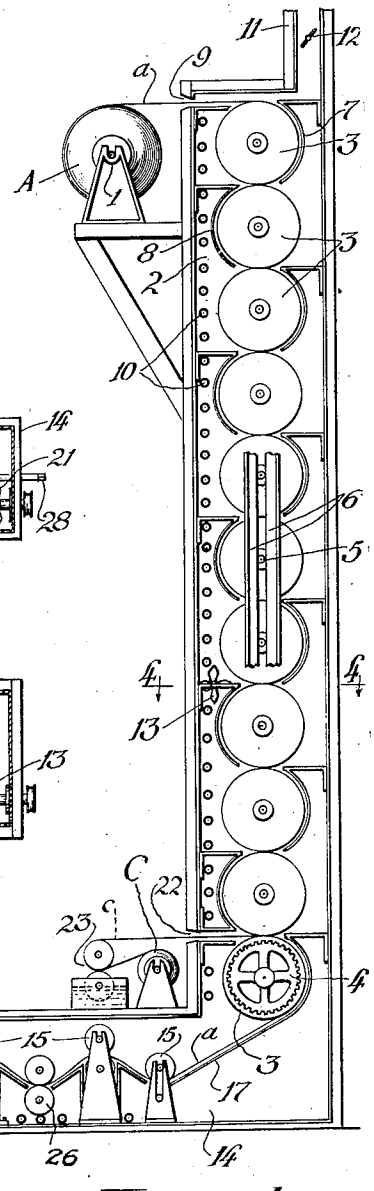


Fig. 3.

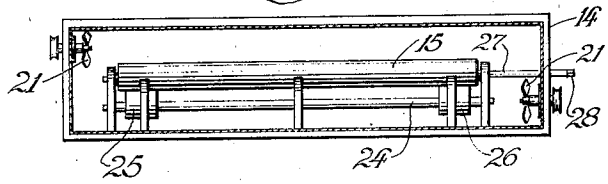
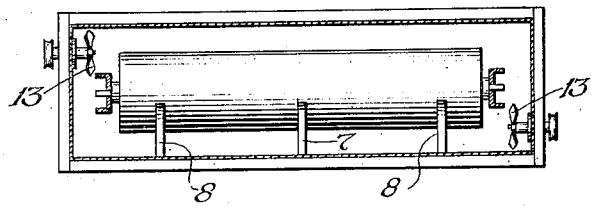


Fig. 4.



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UNITED STATES PATENT OFFICE.

ARMIN ELMENDORF, OF CHICAGO, ILLINOIS.

METHOD OF DRYING AND HANDLING WOOD VENEER.

Application filed November 21, 1921. Serial No. 516,528.

To all whom it may concern:

Be it known that I, ARMIN ELMENDORF, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have invented a certain new and useful Improvement in Methods of Drying and Handling Wood Veneer, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

The common method of handling wood veneer is to cut or tear it into sheets as it is formed from the log, the sheets being then dried and reaching the consumer in what should be a flat dry state. There are several common methods of drying, namely between hot plates, between rolls in a heated chamber, and in kilns. It is very seldom that a sheet of veneer emerges from the drying process without being warped and cracked. Therefore, although the ordinary drying methods are comparatively slow and costly, they do not result in the production of unformly flat, sound sheets even though the sheets at the beginning of the drying processes may have been flawless.

After the sheets have been dried they are comparatively fragile so that in handling and transporting them, further breaking or cracking thereof, particularly along the edges, invariably occurs. Therefore when the veneer reaches the consumer who is to work it up into finished products, it is in the form of more or less warped and cracked sheets which must be flattened and trimmed, the trimming alone often resulting in a great waste of material due to the fact that a large percentage of the stock must sometimes be cut away to remove portions unfit for use.

The object of the present invention is to produce a simple, novel and economical method of handling and drying veneer, so that the veneer will reach the consumer in a sound unwarped condition and there will be a minimum waste of material from the time the veneer is fashioned from the log to the time it is cut up by the consumer.

When veneer is cut from the log it is in a wet state, that is a state in which the moisture content is above what is known as the fiber saturation point. As long as the moisture content remains above the saturation point there is substantially no expansion or contraction of the veneer as the amount of moisture increases or decreases. As soon as the moisture content drops below the saturation point, in the drying of the veneer, contraction across the grain begins. Similarly for any increase or decrease in the moisture content, as long as the total remains below the saturation point, there is a corresponding expansion or contraction of the veneer. In the ordinary methods of handling veneer, it is dried sufficiently, in the course of manufacture, to reduce moisture content below the saturation point, thus permitting cracking and warping to take place and leaving the sheets in a comparatively fragile condition which causes them to break and crack still more during subsequent transportation and handling.

In accordance with my invention the veneer is not cut or broken into sheets as it is formed, but is rolled up so that if desired, all of the veneer obtained from a log may be in a single long sheet. I then dry the sheet by carrying it through a suitable drying chamber in which the heat, humidity and convection factors are properly coordinated effectually to dry the veneer, without danger of checking the surface, until the moisture content has dropped to a point in the vicinity of the saturation point. This first drying step does not result in any appreciable contraction of the veneer but, after the saturation point has been passed in the downward direction, further drying is accompanied by a contraction of the veneer. The second stage of the drying is accomplished while the veneer is being held together in such a manner that it cannot be split although retaining its natural flexibility. The most convenient way to hold the veneer together and prevent it from splitting is to attach adhesive tapes to the same when, in its travel, it reaches a point where the moisture content is in the vicinity of the saturation point. The adhesive tape is preferably made of cloth or other strong flexible material and, while the veneer is shrinking in the direction of the length of the tapes during the second stage of the drying process, the tapes do not shrink but compensate for the shortening of the veneer by wrinkling. This wrinkling of the tapes of course loosens them and, if left loose, would make them useless. I therefore press down the wrinkles as they are formed so that the

tapes are in effect progressively shortened by a wrinkling operation and kept cemented to the veneer notwithstanding such wrinkling. The tapes, even in their wrinkled conditions, therefore possess tensile strength in the direction of their lengths and serve effectively to tie or bind the fibers together and prevent cracking or splitting. The drying operation is preferably continuous, the sheet of veneer being progressively unrolled, dried, and again rolled up with the tapes fastened thereto. During the drying process the veneer is fed transversely to the grain and over guides whose axes are parallel with the grain, the guides being preferably so disposed that the veneer is bent first in one direction and then in the other to make a series of transverse corrugations, thereby insuring that the drying will be accomplished while a line drawn transversely of the sheet at any point remains a straight line which ultimately becomes an element of a cylinder when the veneer is rolled up after the drying operation.

The dried and taped roll of veneer may be transported and handled in that form, no division of the material into strips or panels being done until the veneer reaches the user. When the veneer reaches the user it is flat along transverse lines and may readily be flattened out in the lengthwise direction. Since there is no splitting or cracking of the veneer in drying, there will be little need for cutting away stock along the edges in order to remove unsound portions.

The various features of novelty whereby my invention is characterized will hereinafter be pointed out with particularity in the claims; but, for a full understanding of my invention and of its objects and advantages, reference may be had to the following detailed description taken in connection with the accompanying drawing, wherein:

Figure 1 is a diagram showing a typical expansion and contraction curve for wood based on variation in moisture content;

Fig. 2 is a side elevation, with the near wall removed, of an apparatus in which my invention may conveniently be carried out;

Fig. 3 is a section taken approximately on line 3—3 of Fig. 2; and

Fig. 4 is a section taken approximately on line 4—4 of Fig. 2.

Referring to the drawing, A represents a roll of wet veneer which is adapted to be supported in suitable bearings 1 outside of and near the top of a vertically-elongated chamber 2. In the chamber 2 are a series of light rolls 3 of comparatively large diameter, the lowermost roll being at the bottom of the chamber and being supported so as to be held against movements other than rotary movements. The lower roll may be driven in any suitable way as, for example, by an element co-operating with a gear wheel or sprocket wheel 4 mounted on the roll. The remaining rolls of the series rest one upon the other, their journals 5 projecting into slots or ways formed between pairs of vertical guides 6 arranged at opposite ends of the rolls. This arrangement permits the rolls to rotate freely in contact with each other and to adjust themselves in the vertical direction. Behind the uppermost roll and every other roll of the series are arranged guide fingers 7 while in front of the remaining rolls of the series are similar guide fingers 8. The fingers are so proportioned that when the sheet of veneer *a* is passed into the top of the chamber 2 through a slot or opening 9, it will move across the top of the uppermost roll and then be deflected downwardly around the roll and forwardly across the top of the second roll where it engages with the guide fingers 8 in front of the second roll and is carried down around the front of the second roll and underneath the latter. In this way when the veneer is fed into the apparatus, it will be positively guided in position between each pair of rolls and, by the time it reaches the bottom of the chamber, it has taken on a sinuous or deeply waved form. However, the curvatures are all in one direction, all lines extending transversely of the sheet being kept straight. Furthermore, as any section of the sheet passes along the series of rolls it is first bent in one direction and then in the opposite direction so that there is no tendency to give it a permanent curvature.

When the lowermost roll of the series is driven, all of the other rolls are set in motion, each roll forming with the next one above it a friction drive. This relation between the rolls is not disturbed by the presence of the veneer between them because each section of veneer acts as though it were a part of the lowermost roll along the line of contact between two rolls. As the lowermost roll is driven, the entire series is set in rotation and the veneer is advanced downwardly through the chamber. Within the chamber are steam coils 10. At the top of the chamber is an outlet flue 11 controlled by a damper 12. Within the chamber are fans 13 at opposite ends of the rollers, although only one such fan is illustrated in Fig. 2. As the veneer passes down through the chamber, it is gradually dried, the various factors entering into the drying process being so regulated that the surplus moisture, that is the moisture which must be removed to bring the moisture content into the vicinity of the fiber saturation point, is driven out of the veneer so that each portion of the veneer as it reaches the bottom of the chamber is superficially dried. Consequently in passing down through the vertical

chamber the veneer moves free from tension because there is no shrinking of the veneer on account of the loss of moisture until the vicinity of the saturation point has been reached. Therefore there is no danger of tearing the veneer.

The upright chamber 2 communicates with the top of a horizontal chamber 14 at one end of the latter. In this horizontal chamber are a series of rolls 15 spaced apart from each other and arranged in staggered relation to each other; half of the rolls being conveniently placed at one elevation and alternate rolls at a lower elevation. Suitable guides 16 are associated with the rolls 15 so that after the veneer has been directed by a suitable guide 17 from the lowermost roll 3 to the first of the rolls 15, the guides 16 will insure that the veneer will be properly guided past the series of rolls 15 by which it will be given a sinuous or wave-like configuration; but, being alternately waved in one direction and then the other as it passes through the lower chamber so that there will be no tendency to cause it to set permanently in curves or waves. After passing through the horizontal chamber, the veneer is wound on a roll B beyond the end of the chamber; this roll being preferably driven by a suitable driving mechanism 18 which does not positively drive the roll of veneer but permits slippage to occur; such drive mechanisms being commonly used in paper making.

In the bottom of the chamber 14 are steam pipes 20 and the chamber is also provided with fans 21, arranged at opposite ends of the rolls 15. The factors that determine the extent of drying of the veneer in this chamber are so regulated that the drying is carried to any desired point below the fiber saturation point. The drying of the veneer in the horizontal chamber is accompanied by a contraction or shrinking of the veneer transversely of the grain, that is in the direction of travel of the sheet. It is for this reason that the rolls over which it passes in this chamber are spaced apart from each other, thus avoiding the tearing of the material. The veneer cannot be positively driven by the rolls through the horizontal chamber as it is through the upright chamber but it is most conveniently pulled along from the end which is being wound on the roll B. Even the slight pull required to draw the veneer through the horizontal chamber might cause the veneer to tear and splitting or cracking of the veneer in this chamber might also result from other causes. In order to prevent the tearing of the veneer either by the pull on the same while it is going through the horizontal chamber or from other causes, I apply to at least one face of the veneer one or more tapes which are fed against the veneer when it reaches the bottom of the upright chamber, namely the point where a condition of approximate fiber saturation exists. Two such tapes, one along each edge, are preferably applied. One of these tapes is shown in Fig. 2, the same being wound on a roll C lying in front of a slot 22 in the wall of the upright chamber at about the level of the top of the lowermost roll 3. The tape *c* is carried from the roll C through an apparatus 23 for applying glue or moisture, as the case may be. The tape is then carried forward between the two lowermost rolls 3 and is pressed by the same into contact with the veneer; these two rolls serving also as the feed rolls for drawing in the tape.

As the taped veneer passes onward through the horizontal chamber, the veneer shrinks or contracts but the tape does not and, in order to permit the tape to serve its intended purpose it must be pressed down and the wrinkles therein flattened as wrinkles are formed during the shortening of the tape. This may conveniently be accomplished by associating with each of the rolls 15 a pressure device which will act on the tape or tapes passing over that roll. In the arrangement shown, as best seen in Fig. 3, the pressure device consists of a shaft 24 having thereon two short roller sections 25 and 26 so placed that as the veneer passes between a roll 15 and the corresponding pressure device, the members 25 and 26 engage the tape and press it flat. In this way, as the veneer shrinks, the tapes are alternately wrinkled and pressed so that they will serve effectually to bind the veneer against splitting or cracking and will also give mechanical strength to the veneer to permit the same to be drawn through the lower chamber without danger of tearing the same.

I prefer to employ a higher temperature in the upright chamber than in the lower chamber, the temperature in the upright chamber being preferably somewhat above the boiling point of water and the temperature in the lower chamber being preferably below the boiling point of water. The fans circulate the gaseous atmosphere within the chambers, thus permitting rapid drying to be effected by reason of the passage of currents of air across the surface of the veneer. The humidity in each of the chambers may be controlled by varying the amount of air that is drawn into the system in proportion to the amount of air and watery vapor that is permitted to flow out through the flue, and by varying the pressure of the steam in the heating coils so as to vary the temperature. Consequently the three factors consisting of heat, humidity and convection may all be regulated so as to produce rapid drying without inducing splitting or checking.

It will therefore be seen that the veneer

will be rapidly dried and, since it is bent first in one direction and then in the other as it travels through the drying chambers, any tendency to warp is entirely overcome and when the veneer is dry and wound up in the form of a roll as a finished product, all transverse lines will be straight, that is elements of the cylindrical shape which the veneer takes when rolled up.

If desired, each of the rolls 15 may be provided with a shaft 27 extending out through one side of the chamber 14 and provided with a squared end 28. A wrench may be applied to the squared end of one shaft after the other in the series of rolls in the horizontal chamber so as to draw the advancing free end of a piece of veneer through the horizontal chamber and bring it in position to be engaged with the roll on which it is to be wound up.

I claim:

1. The method of treating veneer which consists in drying it until the moisture content is in the vicinity of the fiber saturation point, applying adhesive tape to the veneer transversely of the grain, and then further drying the veneer.

2. The method of treating veneer which consists in drying it until the moisture content is in the vicinity of the fiber saturation point, applying adhesive tape to the veneer transversely of the grain, then further drying the veneer, and pressing the tape against the veneer and flattening the same as wrinkles are produced in the tape by reason of the shrinking of the veneer.

3. The method of treating veneer which consists in partially drying it while bending it alternately in opposite directions parallel to the fibres so as to maintain them straight, applying adhesive tape to the veneer across the grain, and then further drying the veneer.

4. The method of treating veneer which consists in partially drying it while bending it alternately in opposite directions parallel to the fibres to maintain them straight, applying adhesive tape to the veneer across the grain, further drying the veneer and at the same time bending it alternately in opposite directions so as to maintain lines running across the same in the direction of the grain straight.

5. The method of treating veneer which consists in partially drying it while bending it alternately in opposite directions parallel to the fibres to keep them straight, applying adhesive tape to the veneer across the grain, further drying the veneer and at the same time bending it alternately in opposite directions so as to maintain lines running across the same in the direction of the grain straight, and ironing out the wrinkles in the tape as they are formed due to the shrinkage of the veneer.

6. The method of partially drying veneer which consists in passing it through a series of rolls resting one on top of the other so as to cause the veneer to assume a sinuous shape while in contact with the rolls, rotating the lowermost roll so as to cause the remaining rolls of the series to be frictionally driven, and passing heated air over the veneer while it is passing through the rolls.

7. The method of treating veneer which consists in applying adhesive tape to the veneer transversely of the grain and while the veneer still contains moisture to be removed, and then drying the veneer to remove such moisture.

8. The method of treating veneer which consists in drying it until the moisture content is in the vicinity of the fiber saturation point, cementing to the veneer a member to reinforce it transversely of the grain, and then further drying the veneer.

9. The method of treating veneer which consists in drying it until the moisture content is in the vicinity of the fiber saturation point, applying adhesive tape to the veneer transversely of the grain along the two edges, and then further drying the veneer.

10. The method of drying veneer which consists in passing it over a series of rolls arranged to cause the veneer to assume a sinuous shape along lines transverse to the fibers in the veneer, while in contact with the rolls and applying heat to the veneer during its passage over the rolls.

11. The method of drying veneer which consists in bending it alternately in opposite directions parallel to the fibres to keep the fibres straight, and simultaneously applying heat to the veneer.

12. The method of treating veneer which consists in drying it and, during the drying process, applying reinforcing strips to the surface of the veneer transversely of the grain.

13. The method of treating veneer which consists in drying it slowly and, during the drying operation, gluing reinforcing strips transversely of the grain on two edges.

In testimony whereof I sign this specification.

ARMIN ELMENDORF.