PROCESS OF BENDING GRAINLESS LIGNO-CELLULOSE FIBER BOARD

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

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My invention relates to process of bending grainless ligno-cellulose fiber board.

The grainless ligno-cellulose fiber board, preferably to be used for bending in accordance with the process of the present invention, is preferably made in accordance with U. S. Patent to W. H. Mason, No. 1,663,505. These boards preferably contain sizing material, as for example contain sizing material in accordance with the patent to W. H. Mason No. 1,784,933. These boards also are preferably impregnated with resinate oil material, and baked or "tempered" in accordance with the patent to R. M. Boehm, No. 1,941,536. I make reference to these patents for the purpose of illustrating the type of grainless ligno-cellulose fiber boards which are preferably to be made use of for bending in accordance with the present invention, but without intention to limit the invention to the use of such grainless ligno-cellulose fiber boards, and the boards made use of for bending treatment in accordance with my invention may contain the invention of one or more or all of the said patents, but may also be otherwise produced, so long as they are hardboard made from self-bonding ligno-cellulose fiber.

The pieces of the board as taken for treatment are normally in an air-dried state, that is to say, may contain a small percentage of moisture, as for example, about 2 to 10% of moisture.

An additional moisture content is first imparted to such boards. This is preferably accomplished by immersing the board or piece thereof to be bent in a mixture of approximately 50% of water and approximately 50% of alcohol, preferably grain alcohol, heated, preferably to such a temperature that the boards can be handled after soaking by operatives without danger of burning their hands, as for example to approximately 140° F. A desirable good impregnation is obtained by soaking the boards in a hot alcohol-water mixture for a period of approximately one-half hour. However, this time can be increased, if desired, as for example the boards may be allowed to remain overnight in the soaking material. On soaking for one-half hour in the agent described, such tempered ligno-cellulose fiber boards one-fourth inch in thickness will absorb a considerable proportion of this soaking material, as, for example, an increase of about 10 to 15% gain in weight is usual. While the use of an alcohol-water mixture is preferred for impregnation treatment because the alcohol assists in getting quick penetration and permits use of lower temperatures than with water alone for example, other materials such as water alone can be used if desired.

After the impregnation treatment, the relatively wet board is ready to be placed in the hot bending press. In making chair-backs, for example, which have a simple part-cylindrical cross-sectional formation when completed, the pieces may, for example, be about 18 inches square. The pieces are preferably completely fabricated prior to the soaking treatment, as for example may be rounded off at the corners and at the edges so as to present a smooth rounded periphery having no projecting parts to catch the apper of the chair occupants. For bent pieces of other formations, such as chair seats, base boards, etc., bending dies are provided to give the desired shape. The bending dies are preferably provided with smooth impervious faces where they come in contact with the pieces to be bent and re-formed.

I have found that the best results are to be obtained by heating the bending dies for bending the ligno-cellulose fiber boards to a high temperature over about 415° F. and preferably to a temperature of about 425° F. or 450° F. and if the pieces are to be painted and some scorching is not objectionable, still higher temperatures may be used so long as material scorching is avoided.

Various means may be resorted to for heating the bending and forming dies, but preferably the heat is supplied by means of electrical heating elements disposed within cavities provided in the dies. Current control means are preferably provided to maintain the temperature of the dies at that selected for treatment of the pieces to be bent, as for example 450° F., the current being automatically switched on by known devices when the temperature drops somewhat and switched off when it rises somewhat as will be readily understood.

The closing of the bending and forming dies upon the piece being treated is preferably comparatively gradual, as for example in forming a chair-back having a curvature in one direction only, the convex die will make contact with the portion of the piece which is to be given the most extreme bending for a time interval of perhaps one-half minute before the dies are closed together with the pressure applied throughout the piece. In this way heat delivery is effected for an increased period of time to the portion of the piece which is to be given the severest bending treatment.
Rams are preferably provided for applying pressure to close the bending press, and may be actuated by any suitable mechanism or pneumatic pressure, for example. Pneumatic pressure is preferred, since rams when so actuated can yield to some extent if the ram pressure is overcome by pressure building up between the bending dies.

The pressure applied to the piece by the bending dies is preferably comparatively light, as for example about 50 to 100 lbs. per square inch gives good results. A pressure of 80 lbs. per square inch, for example, has been found to give good results when bending the tempered ligno-cellulose fiber board one-fourth inch thick, with a half hour preliminary soaking as described, and with a platen temperature of 450°F.

No attempt is made to bring the piece under bending treatment to complete dryness. Under the conditions just stated the period in which the press is closed with the complete pressure on the board may for example be about one-half minute. Under these conditions the finished pieces when removed between the highly heated bending dies may still have a material percentage, as 4%, of moisture remaining in them, and which could be removed from the finished piece if it were subjected to a drying treatment in an oven whereby it is dried down to constant weight. It is to be understood, of course, that such treatment of drying to constant weight is not a part of the present process.

For example, a lot of 12 chair-back pieces, each approximately 15 inches square and 1/4 inch thick, of the tempered ligno-cellulose fiber board above referred to, when first taken for treatment and containing atmospheric moisture, weighed 403 ounces. After the soaking treatment as above described with a water-alcohol mixture carried on for one-half hour at about 140°F, the weight had increased to 454 ounces, or about 10%. These pieces, which were originally parts of a flat or plane board, when removed from the bending press after one-half minute pressure at 40°F, platen temperature and a pressure of 80 lbs. per square inch, following one-half minute taken for gradual closing of the press, weighed as completed 412 ounces, and were good permanently-bent non-warping pieces with the cross-section having a maximum depth of about 2 inches. Upon drying such pieces, after completing in the manner described, to constant weight, the weight was reduced to 395 ounces, thereby showing that they contained approximately 17 ounces, or about 4% of moisture when removed from the press. Notwithstanding this moisture content, the finished pieces were free from explosion blisters, splits and other imperfections.

Without commitment to a particular theory of why the pieces are not injured upon opening the press at the platen temperature referred to, and with moisture content as stated, it is believed that the freedom from defects is due partly to steam escape by the route of the wire-mesh markings on the back of the pieces, and also partly to the relatively low pressure employed whereby steam is not confined in the pieces at a pressure high enough to cause injury thereto. Of course there is also some opportunity for edge escape of moisture, particularly when the pieces are thick and of relatively small dimensions. Furthermore, the rigidity of the pieces is enhanced by the bent shape being imparted thereto, apparently making them relatively more immune to injury from contained steam because of the new shape and conformation. Also by use of a pneumatically operated bending die press, the pneumatically operated rams may yield somewhat if sufficient pressure builds up between the bending dies to overcome the pressure on the rams, thereby permitting a slight or intermittent escape of steam, vapors, etc., during the hot bending operation.

In the drawing,

Fig. 1 is a cross-sectional view showing a bent base board of the grainless ligno-cellulose fiber material installed;

Fig. 2 is a perspective fragmentary view of the bent base board shown on a small scale in Fig. 1;

Fig. 3 is a perspective view of a laterally bent chair back;

Fig. 4 is a perspective view of a chair seat having a double bend;

Fig. 5 is a diagrammatic cross-sectional view of bending dies with fragmentary parts of a bending press; and

Fig. 6 is a plan view of the reverse side of the ligno-cellulose fiber board showing the wire mesh markings thereon with however the edge rounded off so that the screen marks are removed at the extreme edge portion.

Reference character 10 designates a base board of the grainless ligno-cellulose fiber with a permanently bent cope portion 12 at its lower edge, the same being shown as applied to a wall 14 and with floor covering material 16 abutting the bottom edge of the base board.

Reference character 15 designates a permanently bent chair back of the grainless ligno-cellulose fiber material, the lateral bend imparted thereto being designated by reference numeral 18.

Reference character 19 designates a permanently bent chair seat of the aforesaid material having reverse bends as indicated at 24 and 26.

In Fig. 6 I have shown a plan view of the reverse side of the ligno-cellulose fiber board 28 which is preferably used in accordance with my invention and contains on such reverse side wire-mesh markings as indicated at 30.

Reference character 32 designates an upper bending die and 34 a lower bending die of a form adapted to receive between them and impart a permanent bend to the chair back member 18.

The openings designated by reference numeral 36 are provided in the dies shown for the purpose of receiving heating elements, not shown. Reference character 38 designates the head plate of a press for resisting upward thrust of the die members, and which is preferably stationary. Reference character 40 designates the movable lower press head for the bending members which is preferably elevated by pneumatically actuated rams, not shown, and in addition to being elevated to apply pressure can be lowered to open the press, as diagrammatically indicated by the double arrow in Fig. 5.

It is to be understood that the specific disclosures herein contained are for purposes of illustration of preferred embodiments of the invention and not intended for limitation, the scope of the invention being indicated by my claims.

I claim:

1. Process of converting originally plane, dense, grainless hardboard of self-bonding ligno-cellulose fiber to permanently bent state, which consists in making application of moisture to the hardboard at a temperature materially below the boiling point and thereby increasing its moisture content, then bending the board and applying 2,398,685.
thereto a temperature of over 415° F. but not sufficient to cause material charring by pressing it between appropriately-formed bending dies heated to such temperature, and then releasing the bent hardboard while still containing a material proportion of the added moisture.

2. Process as claimed in claim 1, and wherein the bending dies are heated to a temperature of approximately 450° F. and this temperature is applied to the hardboard by the bending dies.

3. Process of converting originally plane, dense, grainless, moisture-containing hardboard of self-bonding ligno-cellulose fiber to permanently bent state, which consists in applying a liquid containing water to the hardboard at a temperature materially below the boiling point thereof to thereby increase its moisture content, then bending the board and applying thereto an elevated temperature but not sufficient to cause material charring by pressing it between appropriately formed heated bending dies, and then releasing the bent hardboard while still containing a material proportion of the added moisture.

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