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METHOD OF PRODUCING LIGNOCELLULOSE HARDBOARD

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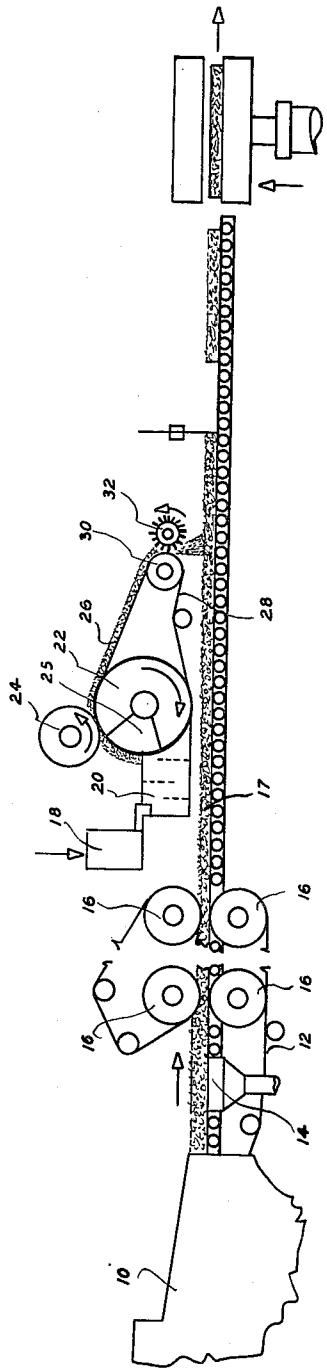

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METHOD OF PRODUCING LIGNOCELLULOSE HARDBOARD

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The present invention relates to the production of lignocellulose hardboard sheet articles. More particularly, the invention relates to a novel method for the production of hardboard sheet articles characterized by their freedom from surface defects, by their decorative appearance, and by improved physical properties. The invention includes the novel process, the improved hardboard articles, and the apparatus for their production.

In the conventional prior art production of hardboard, it has been the practice to first form a wet lap or mat of lignocellulose fiber on a traveling screen. The wet lap has been formed by flowing a dilute aqueous slurry containing about 2% to 3% of fiber through a headbox and thence onto the forming screen. In the case of cylinder-type forming machines, the mat has been formed on the suction portion of the cylinder and then transfered to a traveling screen. Thereafter, the wet mat was partially dewatered by passage over a free drainage area, over suction boxes, and then between several pairs of pressure rolls. The partially dewatered lap, usually containing about 40–60% of water was then pressed in a heated hydraulic press to its final consolidated, hard, and dense sheet form. In some instances, the wet lap has been dried to substantial dryness and then consolidated in this condition.

All of the prior art wet-forming processes were subject to one serious problem which stemmed from an inherent physical characteristic present in all such aqueous fiber slurry systems. The individual fibers in the system have tended to clump together and, in the felting procedure, the wet lap has consisted of a multiplicity of tiny balls or clumps of fibers together with a mass of individual fibers. The sheet products have been characterized by small areas of high density interspersed among areas of lower density which cause the surfaces of the hardboard sheets to present a mottled, or cockled, appearance. Additionally, the cockled surfaces have been non-uniform with respect to their paint hold-out properties. Many attempts have been made to overcome this serious problem. Principally, the prior art has sought to prevent clumping of the fibers by the alteration of head box design and by the provision of so-called flow spreaders. However, up to the present time the problem still exists in all wet-forming processes.

It is a primary object of the present invention to provide a novel method whereby surface defects due to fiber clumping are eliminated in the production of hardboard sheet articles.

Another object of the invention resides in the provision of a novel means for depositing fibers and other particulate materials in the form of individual and separate particles.

Still another object of the invention resides in the provision of hardboard sheet articles whose surfaces are free from defects and are characterized by greatly improved physical properties. Further objects of the invention will become apparent from the following detailed description thereof.

The description will be given with particular reference to the accompanying drawing in which a schematic representation of a board forming machine and hydraulic press shows the means for carrying out the novel method.

In carying out the invention, wood, or woody material from various vegetable growths, is first hydrolyzed to the extent that the fibers may later be consolidated and welded together by the application of heat and pressure. Subsequent to hydrolysis, the lignocellulose is reduced to fiber form and slurried in water. The fibrous slurry, usually containing about 2–3% by dry weight of fiber, is pumped into a headbox which is designated in the drawing by the numeral **10**. From the headbox **10** the slurry is flowed onto the traveling screen **12** where it first passes over a free drainage area. The lap or mat **17** then passes over one or more suction boxes **14** and then between pressure rolls **16** which may also be equipped with suction means. At this point, the wet lap **17** will normally contain about 40–60% of water although it appears to be quite dry. Beyond the pressure rolls the lap is conveyed along rollers inasmuch as it is self-sustaining to the degree that a screen or belt is no longer required.

A second slurry is prepared by dispersing in water additional lignocellulose fiber, pigment, resin, or mixtures containing the desired particulate material. This second slurry will normally not contain more than about 3% by weght of the selected fibrous and/or particulate material. The slurry is pumped from the storage tank **18** into the headbox **20** and is picked up on the suction roll **22**. Passage beneath the roll **24** and over the suction section **25** thereof reduces the water content of this mat **26** to about 75–85%. The mat **26** travels along the wire screen **28** until it is in relatively close proximity to the wet lap **17** at the point where the wire screen **28** passes around the roll **30**.

A revolving brush **32** contacts the mat **26** and, inasmuch as it revolves very rapidly, throws the particles down onto the wet lap **17** where they impinge upon the lap surface with considerable force. It has been found that best results are obtained when the brush **32** rotates at a speed of at least about 600 r.p.m. When the brush has a diameter of for example, 8 inches the bristles thereof are traveling at a speed of about 1600 feet per minute. However, rotational speeds in excess of about 2500 r.p.m. (about 5,300 ft./min.) create windage problems which may cause adverse effects in the overlay. Within these limits a very uniform layer of material is deposited on the wet lap.

The composite wet lap is thereafter cut into the desired lengths which are traveled either directly into a heated multi-platen hydraulic press or into a drier. Where the laps are conveyed directly to the hydraulic press, it is common practice to employ a wire screen beneath the laps to provide drainage means for the water which is expressed from the laps. Pressures of about 300–600 p.s.i. are usually sufficient to consolidate the laps to specific gravities of about 1 although in some instances it is desirable to obtain hardboard sheets with average specific gravities of about 0.9 or slightly lower.

The laps which are dried before pressing are traveled through a drier having several different temperature zones ranging from about 750° F. to about 320° F. The substantially dried laps containing from about 0% to about 8% of moisture are then usually consolidated between two smooth press plates to obtain hardboard sheets having two smooth surface. Pressures of as much as about 2,000 p.s.i. are employed in this process and the finished sheets have specific gravities of from about 1.05 to about 1.2.

The novel method affords many advantages not heretofore available to manufacturers of hardboard sheet articles. Inasmuch as the fibers which are deposited by the revolving brush are separated and thrown with considerable force, there is an entwining and interlocking effect in the overlay. Thus, a very thin layer of such material conceals the clumps of the wet-formed lap. The slurry to be employed in this secondary deposition may therefore contain as little as about 0.5% by weight of solids. The exact proportion of solids to water will, of course, depend to a great extent on the speed of travel of

the board forming screen, the speed of the revolving brush, and the thickness desired in the so-deposited layer in the finished sheet product. The brush itself should be one in which the bristles are spaced apart some distance as, for example, about 0.25–0.5 inch. It has been found that a conventional brush with its bristles close together tends to become loaded with fiber or other material to be deposited and loses efficiency very rapidly.

Furthermore, the fibers to be impinged on the wet lap surface may be mixed with any desired materials such as resins, pigments, dyes, mineral fibers, and the like to afford distinctive and/or decorative characteristics to the finished products.

Another important feature of the invention resides in the deposition of the overlay subsequent to removal of as much water as possible from the wet lap. Where the overlay mat is deposited on a wet lap containing in excess of about 60% of water, the process water intermingles with the particulate material deposited and nullifies the advantages which are derived from the novel method. It is to be understood, therefore, that the mat deposited by means of the high speed brush must be applied after the wet lap has passed through the pressure rolls.

In most instances the desired smoothness in the finished product may be obtained by depositing sufficient particulate material in the overlay to provide a final consolidated thickness of about 2–5 mils. However, where desired, the overlay may be as thick as about 20 mils or more depending upon the desired characteristics. The material to be deposited by means of the high speed brush may include any type of fibrous material as well as pigments, resins, dyes, and the like particulate materials. In all instances, the surface of the finished hardboard sheet is greatly improved in appearance and in its physical properties, including improved paint hold-out characteristics.

I claim:

1. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming machine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, forming a second aqueous slurry containing about 1–3% of solid particulate material, forming a wet mat from said second slurry, partially dewatering said mat to a water content of about 75–85%, forcefully throwing the particulate material of said mat upon the surface of said wet lap in an amount sufficient to provide on the surface of the finished product an overlay about 2–20 mils thick, and thereafter consolidating the so-formed composite lap under heat and pressure.

2. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming machine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, forming a second aqueous slurry containing about 1–3% of solid particulate material, forming a wet mat from said second slurry, partially dewatering said mat to a water content of about 75–85%, forcefully throwing the particulate material of said mat upon the surface of said wet lap in an amount sufficient to provide on the surface of the finished product an overlay about 2–20 mils thick, drying said lap to a moisture content not appreciably greater than about 8%, and thereafter consolidating said dried lap under heat and pressure to obtain a hardboard characterized by its freedom from surface defects.

3. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming machine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, impinging on the surface of said partially dewatered lap at a rate of about 1600–5300 feet per minute a particulate material from a wet mat containing about 15–25% by dry weight of said material, and thereafter consolidating said lap under heat and pressure to obtain a hardboard characterized by its freedom from surface defects.

4. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming machine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, forming a second aqueous slurry containing about 1–3% of solid particulate material, forming a wet mat from said second slurry, partilly dewatering said mat to a water content of about 75–85%, throwing the particulate material of said mat upon the surface of said wet lap at a speed of about 1600–5300 feet per minute in an amount sufficient to provide on the surface of the finished product an overlay about 2–20 mils thick, and thereafter consolidating the so-formed composite lap under heat and pressure.

5. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming machine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, impinging on the surface of said partially dewatered lap at a rate of about 1600–5300 feet per minute a particulate material from a wet mat containing about 15–25% by dry weight of said material, drying said lap to a moisture content not appreciably greater than about 8%, and thereafter consolidating said dried lap under heat and pressure to obtain a hardboard characterized by its freedom from surface defects.

6. A method for producing lignocellulose hardboard which comprises forming an aqueous slurry of hydrolyzed lignocellulose fiber containing about 2–3% of fiber by dry weight, forming a wet lap of said fiber on the traveling screen of a board forming mchine, partially dewatering said lap by suction and pressure treatment to a moisture content of about 40–60%, forming a second aqueous slurry containing about 1–3% of solid particulate material, forming a wet mat from said second slurry, partially dewatering said mat to a water content of about 75–85%, throwing the particulate material of said mat upon the surface of said wet lap at a speed of about 1600–5300 feet per minute in an amount sufficient to provide on the surface of the finished product an overlay about 2–20 mils thick, drying said lap to a moisture content not appreciably greater than about 8%, and thereafter consolidating said dried lap under heat and pressure to obtain a hardboard characterized by its freedom from surface defects.

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