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1,846,406

PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF SYNTHETIC LUMBER

Filed April 28, 1930

2 Sheets-Sheet 2

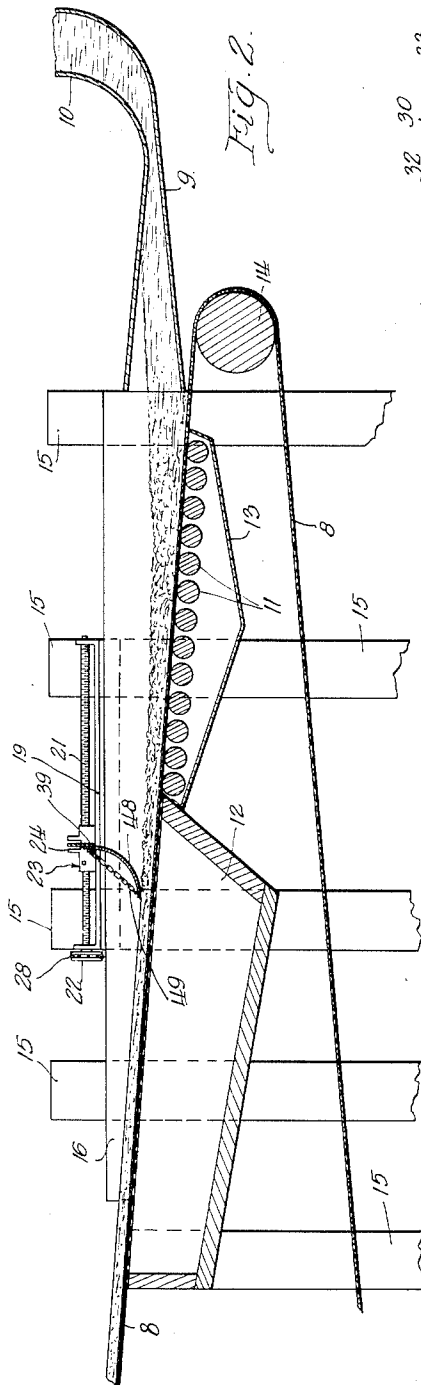


Fig. 2.

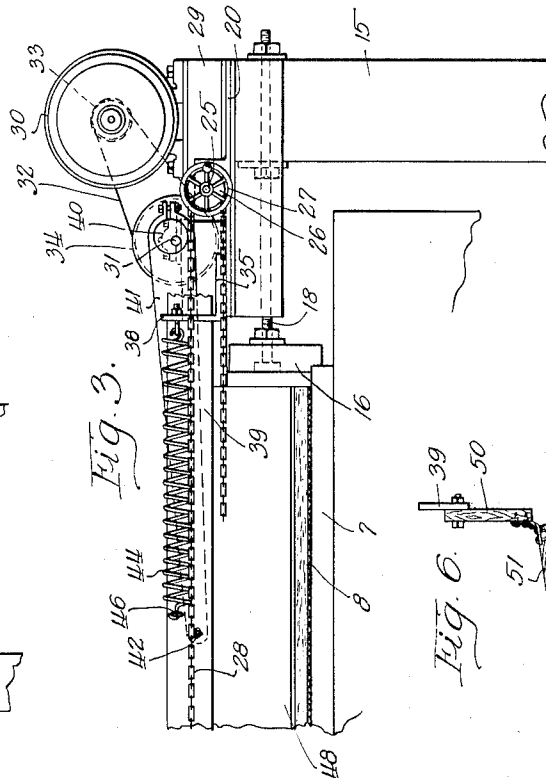


Fig. 3.

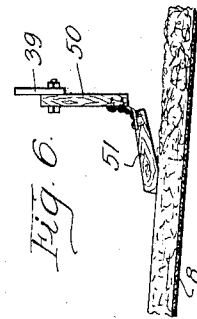


Fig. 6.

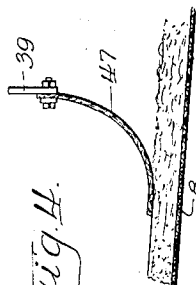


Fig. 4.

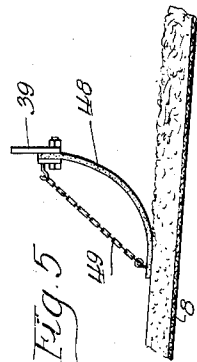


Fig. 5.

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PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF SYNTHETIC LUMBER

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This invention has to do with the manufacture of synthetic lumber, in the form of boards, out of corn stalks or other fibrous materials such as straw, wood waste, bagasse, steam exploded wood, spent licorice root, paunch press cake, broom corn, Jerusalem artichoke tops, sunflower stalks, etc. In treating such materials for that purpose the common practice is to reduce them to the form of pulp, either by mechanical treatment alone, usually in the presence of water, or by mechanical treatment after cooking them in certain chemicals to reduce them to a state in which they may more readily be felted into the form of a mat. After such preliminary treatment the materials are usually formed into a mat by the use of suitable apparatus, during which felting process a greater or less proportion of the water contained in the mass is removed, and the mat is then pressed to the desired density and thickness. After being dried and trimmed it is usually made ready for the market in the form of boards.

Many of the mat forming machines heretofore employed make use of suction to remove excess water during the formation of the mat, and in all machines of that type the top surface of the mat as delivered from the forming machine to the press is somewhat rough and lumpy. When such material enters the press, which may be of any suitable type, the lumpy surface of the mat is pressed down, and as the water is squeezed out, owing to the corrugation or roughness of the upper surface of the board, broad channels are formed through which the water tends to escape out of the press. The result of this is the production of a board which is either rough on the top surface when dried, or the top surface of which so reflects light from the water formed channels as to give the appearance of a rough surface. In either case this is objectionable because such a surface is not easy to decorate over when the board is used for interior building purposes, and oftentimes for other reasons it is preferable that the surface of the board be left smooth and free from such reflecting surfaces.

I have discovered that the rough surfaces

or lumps referred to are due to the formation of small clots of the pulp which are held in this rough state due to the jell-like structure of the mass. Each fiber is surrounded by water of hydration, which tends to form clots of fibers at the time of the delivery of the mass upon the mat forming machine, and the object of my present invention is to provide a method and apparatus by which such clots may be broken up or dissipated, so that when the mat passes to the press its upper surface will be practically free from any such lumps or excrescences, with the result that the board after the pressing operation will be smooth, and the formation of channels, or the light reflecting surfaces referred to, will have been avoided.

I accomplish this object by subjecting the upper surface of the mat, after it is formed, to superficial vibration, the effect of which is to cause the water of hydration of the particles to break loose from the clots, and the jell having been broken, the clots then become semi-liquid, which causes the surface to fall under the action of gravity, as is the case with all known viscous liquids, or suspensions of pulp in liquid, into a uniform smooth surface. The application of vibration to superficial the upper surface of the fibrous mat, prior to the pressing operation, for the purpose of reducing or eliminating the rough surfaces or lumps referred to constitutes the process of this application.

For the application of my improved process practically, various forms of apparatus may be satisfactorily employed, and in the accompanying drawings I have illustrated the form that I prefer to use, although it should be understood that, so far as the method is concerned, it may be practiced by means of other instrumentalities.

In the accompanying drawings,

Fig. 1 is a partial plan view of a mat forming machine equipped with means for applying vibration to the upper surface of the mat;

Fig. 2 is a partial longitudinal vertical section on line 2—2 of Fig. 1;

Fig. 3 is a partial transverse vertical section on line 3—3 of Fig. 1;

Fig. 4 is a sectional detail illustrating one form of wiper by which the vibratory action is applied to the surface of the mat; and

Figs. 5 and 6 are similar views showing modifications thereof.

Briefly stated, my improved apparatus comprises a vibratory member, preferably in the form of a plate that extends transversely of the forming machine across the mat, but out of contact therewith, and is provided with suitable means, such as a wiper, for applying the vibratory movement to the surface of the mat, without penetrating it, as it travels along under the vibratory member. Such wiper may be either in the form of a flexible sheet of cloth or equivalent material the lower marginal portion of which rests on and has frictional contact with the surface of the mat, or it may be in the form of a hinged block or plate supported by the vibratory member so that it bears on the surface of the mat and subjects it to the desired superficial vibratory action.

Referring now to the drawings, I shall describe in detail the apparatus therein illustrated, but it is to be understood that my invention is not restricted to the particular apparatus shown as it includes such modifications as may occur to those skilled in the art.

In the drawings, 7 indicates a mat forming machine of the type employing a traveling wire screen 8 upon which the pulp is deposited in the form of a semi-liquid mass from a chute 9 supplied by a pump connected with an inlet pipe 10. The wire screen 8, as is customary, travels over a series of reconditioning rolls 11, and over a suction box 12 by means of which suction is applied to the mass of pulp from below to remove excess water therefrom. Part of such excess water is removed by gravity as the pulp passes over the pre-conditioning rolls 11 and is caught by a pan 13 shown in Fig. 2. One of the rolls over which the screen 8 travels is indicated at 14. It will be understood that the suction box 12 is connected with a suitable pump by which a partial vacuum therein is maintained. In the illustrated construction the operating parts of the apparatus are supported by a series of posts 15 at opposite sides of the machine.

At opposite sides of the machine, near the margins of the wire screen, deckle boards are provided to confine the pulp at the sides. These deckle boards are adjustably supported by screws 17, 18 carried by certain of the posts 15 so that they may be set at different distances apart, and their angular relation may be altered. They are shown as being set at a rearwardly diverging angle to each other, but such arrangement is not claimed herein as it is included in a separate application.

Secured to two of the posts 15, at opposite sides of the machine, opposite the point where the mat is formed, are two brackets 19, 20

of any design suitable for the intended purpose. The bracket 19 supports a longitudinally extending screw threaded rod 21 provided with a pulley 22 at one end, as best shown in Fig. 1. Threaded on this rod is a guide preferably in the form of a sleeve 23 having a transverse groove 24, best shown in Fig. 2. A rod 25 similar to the rod 21 is carried by the bracket 20 and is provided near one end with a pulley 26 and with a hand wheel 27. The pulley 26 is in line with the pulley 22 on the rod 21, and these two pulleys are connected by a chain 28, so that by rotating the hand wheel 27 both rods 21, 25 may be similarly rotated. Threaded on the rod 25 is a bracket 29 which carries a small electric motor 30 and also a shaft 31. As best shown in Fig. 1, the shaft 21 is driven from the motor 30 by a belt 32 operating over pulleys 33, 34, the pulley 33 being mounted on the armature shaft of the motor 30 and the pulley 34 on the shaft 31. The latter shaft also carries a guide preferably in the form of a block 35 which is provided with a transverse groove 36 similar to the groove 24 and in alignment therewith. Obviously by rotating the hand wheel 27 the two guides may be simultaneously and equally adjusted lengthwise of the machine. The grooves 24 and 36 are best formed in upright flanges 37, 38 carried respectively by the members 23, 35, as best shown in Fig. 1. A vibratory member in the form of a transverse plate 39 extends across the machine above the mat, and out of contact therewith, said plate being somewhat longer than the distance between the guides 23, 35, and having its end portions resting in the grooves 24, 36. Thus when the plate 39 is vibrated transversely with respect to the line of movement of the mat, as hereinafter explained, it will be maintained in its proper position by the guides 23, 35.

Also mounted on the shaft 31 is an eccentric 40 fixed so as to rotate therewith, and mounted on said eccentric is a pitman 41 that is pivotally connected at 42 to the vibratory plate 39. By this arrangement, rotation of the shaft 31 reciprocates or vibrates the plate 39 transversely of the machine. Springs 43, 44 at opposite sides of the machine are connected respectively at their outer ends to the guides 23, 35 and at their inner ends to the plate 39 at the points 45, 46. These springs are of equal tension and tend to normally center the vibratory plate 39, and also to cushion said plate and take up the knock so that it will vibrate smoothly and satisfactorily.

Secured to the plate 39 and depending therefrom is a wiper preferably in the form of a flexible cloth or sheet 47 that extends transversely the full width of the mat, the lower end of said sheet being adapted to rest on the surface of and frictionally engage the

mat as the latter travels along under it due to the movement of the wire screen 8.

The sheet 47 may either be a suitable piece of cloth or other fabric as illustrated in Fig. 4, or it may be of any other suitable form which will apply the desired superficial vibratory movement to the surface of the mat without penetration thereof. In Fig. 5 I have shown the wiper as being formed of a thin flexible piece of rubber or rubber composition, 48, the pressure of which on the mat may be regulated by a chain 49, and in Fig. 6 I have shown the wiper as composed of a transverse board 50 having hinged to its lower margin a block 51 that bears on the surface of the mat.

From the foregoing description it will be understood that when the motor 30 is in operation the member 39 will be reciprocated or vibrated rapidly transversely of the mat, thereby moving the wiper in like manner upon the upper surface of the mat as it travels beneath it. In its vibratory movement the wiper is in frictional engagement with such upper surface but does not penetrate it, since should it do so it would roughen or plow it up and unfit the mat for use. It serves to disintegrate or break down the clots of pulp by releasing the water of hydration of the particles thereof, causing the clots to become semi-liquid and subside to give the mat a uniform smooth surface, so that when the mat is subjected to the pressing operation it will not have the channels or light reflecting surfaces referred to earlier in this specification. Besides this smoothing action the vibration has the effect of giving a very much stronger board, or surface on the board, without interfering with its insulating qualities by packing it tighter. This is due to the fact that the vibratory movement given the uppermost fibers is communicated to a greater or less extent to the adjacent underlying fibers, with the result that the fibers become more firmly interwoven, and consequently the mat and particularly that portion adjacent the surface thereof is made stronger.

In practice I have found that a small electric motor of from one-eighth to one-quarter horse power with a rating of about 900 R. P. M. is sufficient for the purpose, although I have satisfactorily used motors of lower and higher rating. Where the vibratory member is operated by an electric motor in the manner described the springs 43, 44 are desirable, but if the vibratory member 39 were operated by means such as an electromagnet, it would not be necessary to use the springs.

It will be understood, of course, that the wiper member may be attached to the vibratory member 39 in any suitable way, and also that my invention is not limited to mounting the vibratory member in guides of the particular form shown, although that construc-

tion is desirable as it provides convenient means for adjusting said member longitudinally of the machine as well as for its convenient application to the guides or its removal therefrom. The length of the wiper should be such that it may reciprocate properly between the deckle boards.

I claim:

1. The method of smoothing the upper surface of a fibrous mat which consists in applying vibration superficially thereto.
2. The method of smoothing the upper surface of a fibrous mat which consists in vibrating a suitable wiper bearing upon the surface of the mat without penetration thereof.
3. The method of smoothing the upper surface of a traveling fibrous mat which consists in vibrating a suitable frictional wiper upon the surface of the mat transversely of the direction of travel of the mat.
4. The method of smoothing the upper surface of a fibrous mat which consists in passing the mat under and in contact with a substantially smooth non-penetrating vibrating element.
5. The method of smoothing the upper surface of a fibrous mat which consists in passing the mat under and in contact with a transversely vibrating wiper that engages the surface of the mat without penetration thereof.
6. The combination with a mat forming apparatus, of a vibratory member, means for vibrating said member, and means carried by said member adapted to superficially engage the upper surface of the mat.
7. The combination with a mat forming apparatus, of a vibratory member above the surface of the mat, means for vibrating said member transversely of the mat, and means carried by said vibratory member adapted to frictionally engage the surface of the mat without penetrating the same.
8. The combination with a mat forming apparatus, of a vibratory member above the surface of the mat, means for vibrating said member transversely of the mat, and flexible means carried by said vibratory member adapted to engage the surface of the mat.
9. The combination with a mat forming apparatus, of a transversely disposed vibratory member, guides for the end portions of said member, means for vibrating said member, and means carried by said member adapted to superficially engage the surface of the mat to smooth the same.
10. The combination with a mat forming apparatus, of a transversely disposed vibratory member, guides for the end portions of said member, means for vibrating said member, cushioning springs for said vibratory member, and means carried by said member adapted to engage the surface of the mat to smooth the same.

11. The combination with a mat forming apparatus, of a transversely disposed vibratory member, guides for the end portions of said member, means for simultaneously adjusting said guides longitudinally of the apparatus, means for vibrating said member, and means carried by said member adapted to engage the surface of the mat without penetrating such surface to smooth the same.

12. The combination with a mat forming apparatus, of a transversely disposed vibratory member, guiding means for said member, a motor operatively connected with said member for vibrating the same, oppositely acting springs for cushioning and centering said member, and means carried by said member adapted to engage the surface of the mat to smooth the same.

13. The combination with a mat forming apparatus, of a vibratory member, means for vibrating said member transversely of the mat, and flexible smoothing means carried by said member and extending across the mat in engagement with the surface thereof.

14. The combination with a mat forming apparatus, of a vibratory plate extending transversely across the mat, means for vibrating said plate, means for guiding said plate, and flexible smoothing means carried by said plate and extending across the mat in engagement with the upper surface of the mat without penetrating the same.

In witness whereof I hereunto subscribe my name this 21st day of April, 1930.

ORLAND RUSSELL SWEENEY.

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