Nov. 26, 1929. R. L. LOOMIS 1,737,284

LAMINATED PULP BOARD AND PROCESS OF MAKING THE SAME

Filed Aug. 5, 1926

Fig. 1.

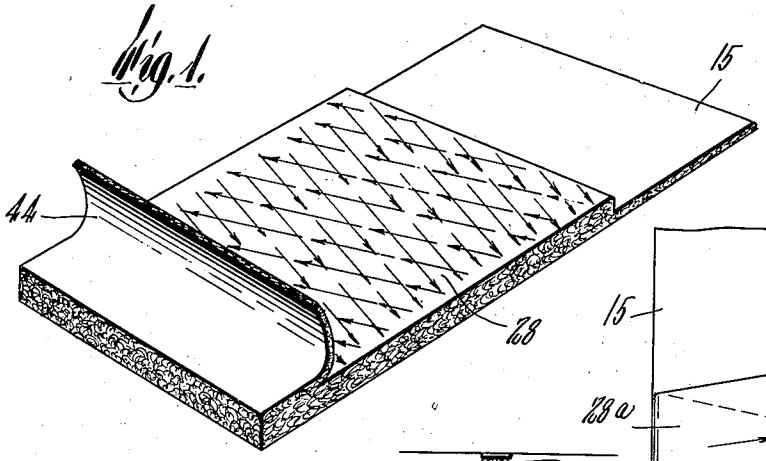


Fig. 2.

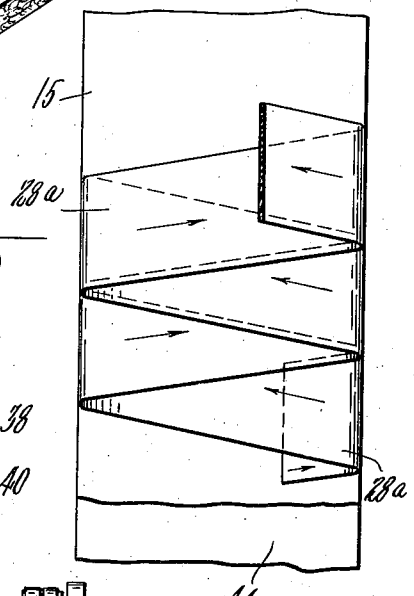
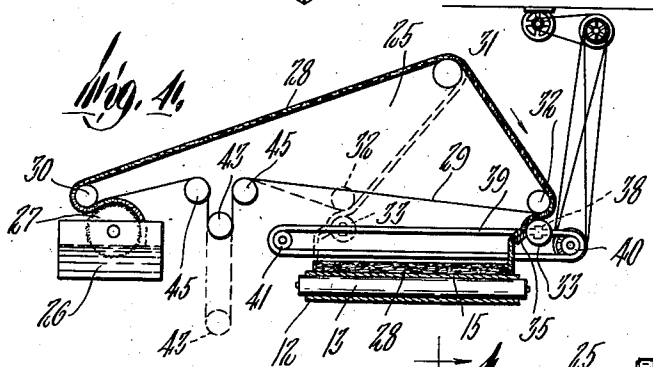


Fig. 4.



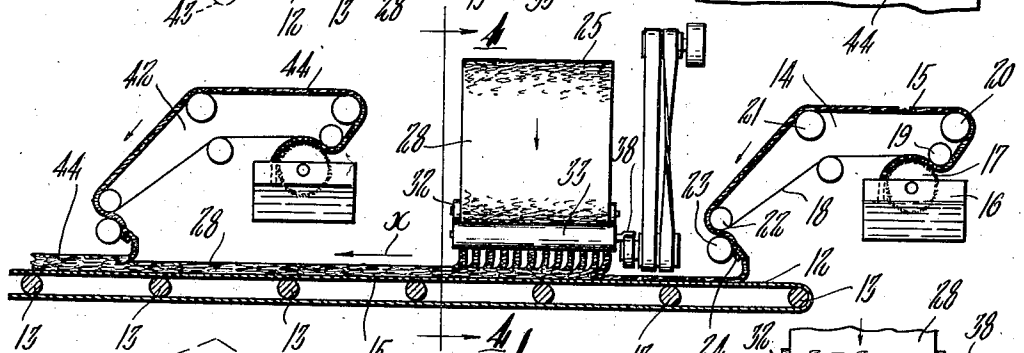


Fig. 3.

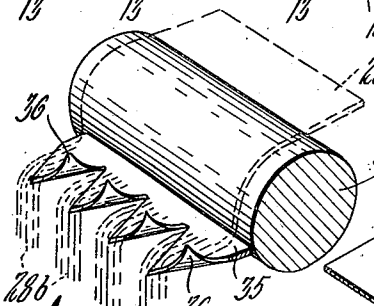


Fig. 5.

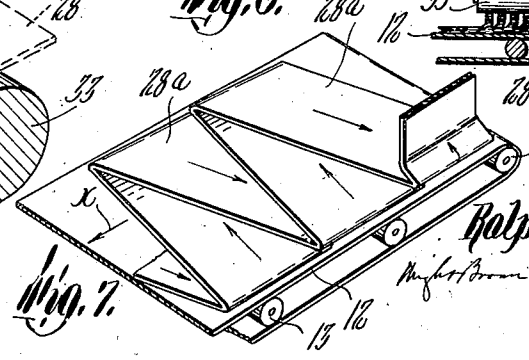


Fig. 7.

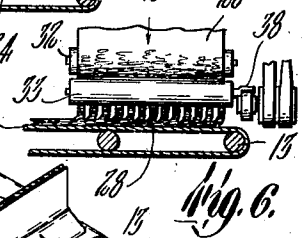


Fig. 6.

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UNITED STATES PATENT OFFICE

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LAMINATED PULP BOARD AND PROCESS OF MAKING THE SAME

Application filed August 5, 1926. Serial No. 127,291.

This invention relates particularly to relatively thick and rigid pulp board, adapted for use in the construction of buildings and for other purposes.

One object is to provide a laminated pulp board which includes facing or liner webs forming the opposite sides of the board, and a filler web interposed between the facing webs, the fibers of the facing webs extending longitudinally of the board, while the fibers of the filler web extend in different directions, crosswise of the board, the arrangement of the fibers being such that they collectively oppose strains tending to bend and crack the board in any direction. Other objects will appear hereinafter.

Of the accompanying drawings forming a part of this specification,—

Figure 1 shows in perspective, a portion of an incomplete pulp board constructed in accordance with the invention, one of the facing layers being partially broken away, and the remaining portion partially displaced.

Figure 2 is a top plan view of the same.

Figure 3 shows in elevation and somewhat diagrammatically, the apparatus hereinafter described.

Figure 4 is a section taken on the line 4—4 of Figure 3, looking toward the right and showing in side elevation and somewhat diagrammatically, the filler web-forming and delivering element hereinafter described.

Figure 5 shows in perspective one of the rolls shown by Figures 3 and 4, and the web-subdividing doctor hereinafter described.

Figure 6 is a view similar to a portion of Figure 3, the primary and secondary facing web-forming elements being omitted.

Figure 7 shows in perspective a portion of the conveyor and a portion of a laminated web formed thereon, without facing webs.

The same reference characters indicate the same parts in all of the figures.

A suitable apparatus for carrying out my invention is shown more or less diagrammatically, by Figures 3 and 4, and comprises an endless conveyor or belt 12, having an upwardly facing upper stretch and mounted on suitable rollers 13, means (not shown) being provided for moving the upper stretch in the direction indicated by the arrow x (Figure 3).

The apparatus comprises also a primary bottom web-forming element, designated as a whole by 14, including means for forming a bottom web 15 of pulp, and means for delivering the web to the conveyor. In this instance, the primary element includes a vat 16, supplied with pulp, and a cylinder mold 17, having a foraminous periphery rotatable in the vat and adapted to raise the beginning of the web 15 therefrom, and present it to an endless band 18, in a well known manner. The layer and band pass between the periphery of the cylinder mold and a couch roll 19, and are guided by rolls 20, 21 and 22 to a roll 23, supported above the conveyor 12. A doctor 24 detaches the web from the roll 23, so that the web is deposited on the conveyor 12 and is moved progressively endwise by the latter in a predetermined path, under an intermediate element of the apparatus, designated as a whole by 25. Either of the rolls supporting the band 18 may be positively driven to move the band and progressively feed the web.

The intermediate element, shown in elevation by Figure 4, is adapted to form and deliver a filler web 28. Said element includes a vat 26, supplied with pulp, a cylinder mold 27, rotatable in the vat and adapted to raise the beginning of the filler web 28 therefrom, and present it to an endless band 29. The web and band pass between the periphery of the cylinder mold 27 and a couch roll 30, and are guided by rolls 31 and 32 to a roll 33, supported above the conveyor 12. The axes of the rolls 32 and 33 are parallel with the path of the bottom web 15, and said rolls are reciprocated crosswise of said path, as indicated by full and dotted lines in Figure 4, so that they constitute reciprocating means for delivering the filling web 28, upon a portion of the bottom web 15, in a series of folds 28^a extending crosswise of the path of the moving bottom web. The movement of the bottom web, therefore, imparts a zigzag form to the filler web, the folds 28^a extending obliquely across the bottom web, as indicated by Figure 2. The folds of the filler

web include a series of top stretches, indicated by full lines, and a series of bottom stretches, indicated by dotted lines, in Figure 2, the bottom stretches contacting with the bottom facing web. The arrows in Figure 2 indicate the directions taken by the top and bottom stretches of the filler web. A doctor 35 detaches the filler web 28 from the roll 33, so that the web is deposited on the bottom web 15. As best shown by Figure 5, the doctor 35 may be provided with a series of upstanding knives 36, adapted to subdivide the filler web 28 into ribbons 28^b which are laid side by side on the bottom web.

The axes of the rolls 32 and 33 may be connected by any suitable means, so that they are permanently associated and caused to nip the interposed filler web. These rolls may be loosely rotatable, the progressive movement of the web being caused by positively rotating another roll, such as the roll 31. In this instance, the couple formed by the rolls 32 and 33 is connected by a member 38 (Figure 3) with a belt 39, running on pulleys 40 and 41, journaled in fixed bearings. The belt may be driven by any suitable means, first in one direction, and then in the opposite direction, so that it reciprocates the rolls 32 and 33 between the limits shown by the full and dotted lines in Figure 3, the direction of movement of the belt being automatically reversed at suitable intervals.

Finally the apparatus includes a secondary facing web-forming element, designated as a whole by 42, having means for forming a top facing web 44. This element may be in all essential particulars a duplicate of the element 14, and is spaced from the latter, so that the two elements are at opposite sides of the intermediate element 25.

The top facing web 44 is deposited by the delivering means of the secondary element 42, upon the top stretches of the moving filler web 28, and is moved longitudinally by the movement of the bottom and filler webs.

The laminated structure produced as above described, is carried from the secondary element 42 by the conveyor 12, and may be subsequently treated in any desired manner, to adapt it for use.

The band 29 of the intermediate element may be maintained at a uniform tension by a loose-weighted roll 43, supported in a bight of the band depending between two guide rolls 45.

The invention is not limited to the production of pulp board which includes the facing webs 15 and 44, and may be carried out by forming and depositing only the web 28 on a continuously moving support, such as the conveyor 12, as indicated by Figures 6 and 7, the primary and secondary facing web-forming and depositing elements 14 and 42 being omitted from an apparatus employed in practising the invention.

It will be seen that the invention is carried out by continuously forming an elongated web, or a plurality of webs of web pulp, in which the grain of the pulp extends longitudinally, and depositing the same as formed on a moving support in such manner as to produce superimposed layers in which the grain extends in different directions, so that in the finished board, the tensile strength, due to the longitudinal direction or laying of the fibers, is balanced, the fibers extending in different directions, so that the board has equal, or approximately equal tensile strength and stiffness in a number of different directions, and does not have a superior tensile strength and stiffness in one direction only. This statement applies to board made as last described, with reference to Figures 6 and 7, as well as to board made as described with reference to Figures 3 and 4. The board may be made of any desired thickness. Owing to the fact that the layers are formed while the pulp is wet, they are better felted or caused to adhere to each other, than when layers of dry, or approximately dry pulp are superimposed on each other.

The object of subdividing the web 28 into ribbons before it is deposited on a moving support, is to enable it to be folded to form the described zigzag stretches without liability of forming wrinkles or irregular protuberances at and near the folds. The web may be subdivided into ribbons by any other suitable means.

I claim:

1. That improvement in the continuous process of making a laminated strip from semi-fluid pulp which consists in forming, on a rotary cylindrical mold, a web in which the grain extends longitudinally, transferring the web while wet, from the mold to a supporting conveyer, again transferring the wet web from the conveyer to a roll beside the conveyer, detaching the web from the periphery of the roll by a doctor, allowing the detached portion of the web to drop upon a substantially horizontal support, moving the support longitudinally in close proximity to the doctor, and reciprocating the dropping portion of the web crosswise of the support, to form a strip composed of zigzag outer and inner stretches parallel with the grain, crossing each other, and caused by the wetness of the pulp to adhere to each other, the grain of the outer stretches crossing that of the inner stretches, and drying the strip to stiffen it and increase the adhesion of the stretches to each other.

2. A laminated strip composed of an elongated web, formed from wet pulp, the grain of which extends longitudinally, the web being disposed in zigzag outer and inner stretches, crossing and adhering to each other, and stiffened by drying, the grain of the outer stretches crossing that of the inner stretches,

so that the strip has no unidirectional grain and presents uniform resistance to both lengthwise and crosswise bending strain, the stretches being longitudinally divided, so that each is composed of a plurality of longitudinal members separated from each other by longitudinal openings, crossing the openings between the members of another stretch, to impart a cellular form to the strip.

3. That improvement in the continuous process of making a laminated strip from semi-fluid pulp, while the pulp is wet, which consists in continuously forming a single elongated web in which the grain extends longitudinally, continuously supporting and feeding a portion of the web from the point of its beginning to a delivery point, allowing an unsupported portion of the web to drop from the delivering point, longitudinally dividing the dropping portion of the web into a plurality of relatively narrow strips arranged edge to edge and separated from each other by longitudinal openings, progressively moving a support under the dropping portion, laterally reciprocating the dropping portion crosswise of the path of the support while the pulp is wet to form a strip composed of upper and lower zigzag stretches caused by the wetness of the pulp to adhere to each other, each stretch being composed of a plurality of separated longitudinal members, the openings between the members of each stretch crossing the openings between the members of another stretch so the completed strip has a cellular formation, and drying the strip to stiffen it and increase the adhesion of the stretches to each other, the grain of the outer stretches covering that of the inner stretches so that the dried strip has no unidirectional grain and presents equal resistance to lengthwise and crosswise bending strains.

4. That improvement in the continuous process of making a laminated strip from semi-fluid pulp, while the pulp is wet, which consist in continuously forming a single elongated web in which the grain extends longitudinally, continuously supporting and feeding a portion of the web from the point of its beginning to a delivery point, allowing an unsupported portion of the web to drop from the delivering point, longitudinally dividing the dropping portion of the web into a plurality of relatively narrow strips arranged edge to edge and separated from each other by longitudinal openings, progressively moving a support under the dropping portion, laterally reciprocating the dropping portion crosswise of the path of the support while the pulp is wet to form a strip composed of upper and lower zigzag stretches caused by the wetness of the pulp to adhere to each other, each stretch being composed of a plurality of separated longitudinal members, the openings between the members of each stretch crossing the openings between the members of another stretch so that the completed strip has a cellular formation, and drying the strip to stiffen it and increase the adhesion of the stretches to each other, the grain of the outer stretches covering that of the inner stretches so that the dried strip has no unidirectional grain and presents equal resistance to lengthwise and crosswise bending strains, and applying a facing to said strip.

5. That improvement in the continuous process of making an elongated strip from semi-fluid pulp which consists in forming, on a rotary cylinder mould, a web in which the grain extends longitudinally, transferring the web while wet from a mould to a supporting conveyor, again transferring the wet web from the conveyor to a roll beside the conveyor, detaching the web from the periphery of the roll by a doctor, allowing the detached portion of the web to drop upon a web supported on a substantially horizontal support, moving the support and the web thereon in close proximity to the doctor, and reciprocating the dropping portion of the web crosswise of the supports to form a faced strip composed of zigzag outer and inner stretches parallel with the grain, crossing each other, and caused by the wetness of the pulp to adhere to each other and to the facing, the grain of the outer stretches crossing that of the inner stretches, and drying the faced strip to stiffen it and increase the adhesion of the stretches to each other.

6. A laminated strip composed of an elongated web, formed from wet pulp, the grain of which extends longitudinally, the web being disposed in zigzag outer and inner stretches, crossing and adhering to each other and stiffened by drying, the grain of the outer stretches crossing that of the inner stretches so that the strip has no unidirectional grain and presents uniform resistance to both lengthwise and crosswise bending strain, the stretches being longitudinally divided so that each is composed of a plurality of longitudinal members separated from each other by longitudinal openings, crossing the openings between the members of another stretch, to impact a cellular form to the strip, and a facing thereon.

7. The step in the method of making a fibrous sheet of uniform thickness which comprises laying down a plurality of narrow, moist, pulp webs simultaneously in adjacent side by side relation transversely upon a moving conveyor to form a plurality of overlapping folds of pulp webs.

8. The method of making a fibrous sheet of uniform thickness which comprises laying down a plurality of narrow, moist pulp webs in adjacent, side by side relation transversely upon a moving conveyor to form a plurality of overlapping folds of pulp webs.

9. The method of making a fibrous sheet which comprises forming a suspension of pulp, forming a plurality of narrow webs from said pulp in adjacent side by side relation, and laying down said webs together transversely upon a moving conveyor to form a plurality of overlapping folds of pulp webs.

10. The method of making a fibrous sheet which comprises dividing a moist pulp web into a plurality of narrow webs, and laying down said narrow webs together transversely upon a moving conveyor to form a plurality of overlapping folds.

11. As an article of manufacture, a fibrous sheet comprising a plurality of overlapping folds of a plurality of narrow pulp webs in side by side relation, said folds having edges extending in transverse relation to the machine direction of the finished sheet.

In testimony whereof I have affixed my signature.

RALPH L. LOOMIS.