106. COMPOSITIONS,
COATING OR PLASTIC

81

CROSS REFERENCE

Examine

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FIBER PLANK

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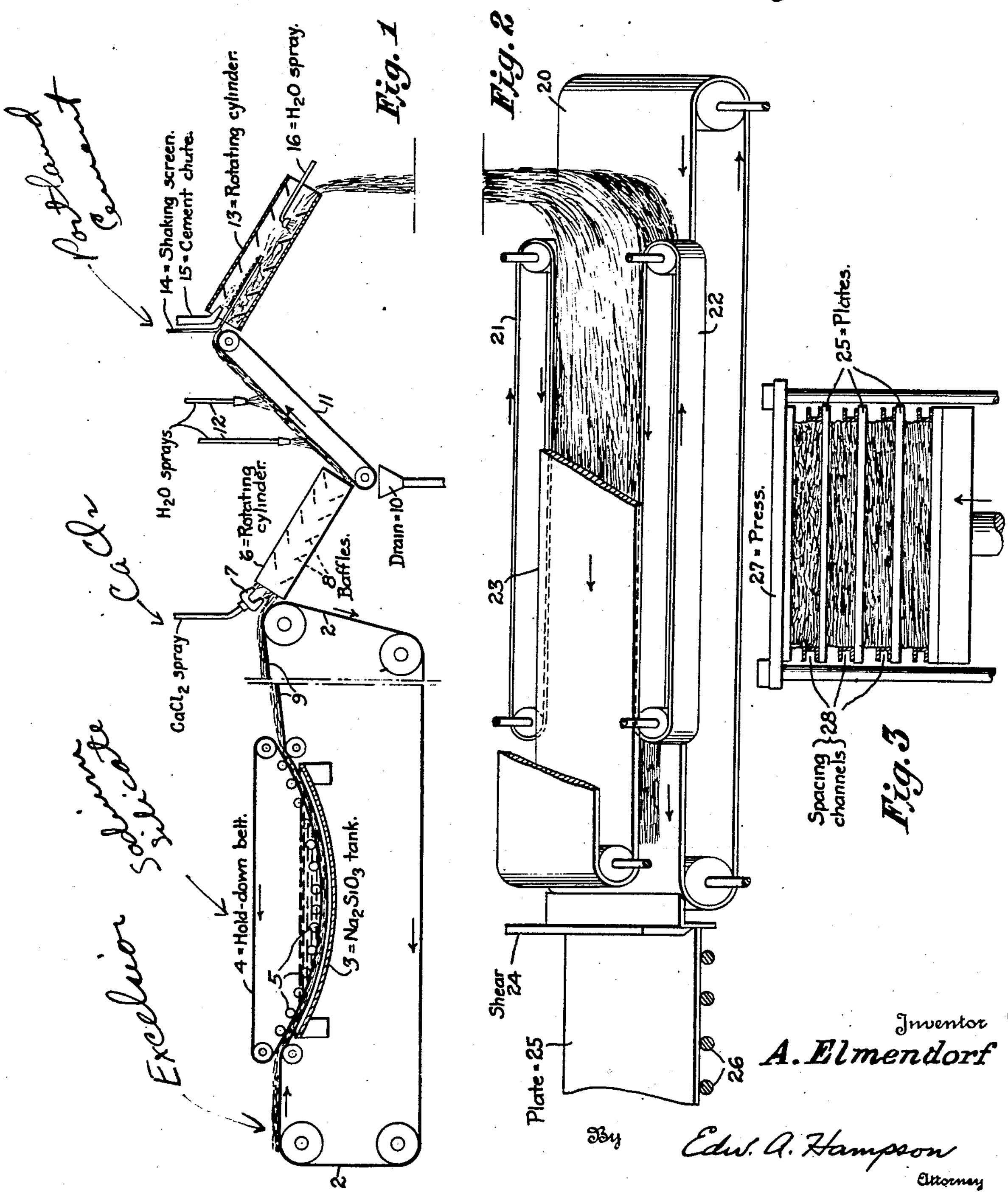
106-71
Coated w/ Ca silicate



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FIBER PLANK

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12 Claims. (Cl. 106—76)

This invention relating to cement-fiber boards has as an object the provision of such a board block or other insulating mass having relative rigidity so that it may be used particularly in building construction in various manners, not only to insulate against the transmission of sound, heat and cold, but also as a supporting base for desired finishes as in wall construction.

The principal object of the invention hereof is the provision of a cement-fiber board as above which is a distinct improvement over such boards as they have been heretofore proposed in that such cement-fiber boards made in accordance with the inventions hereof are decidedly superior in strength and stiffness when compared with boards of this type as heretofore proposed, and in addition has other improved and distinguishing characteristics as compared with cement-fiber boards heretofore proposed.

With the above and other and further objects of invention as will become apparent upon a reading of the specification hereof when considered in connection with the accompanying drawing, the invention resides in such an improved and novel cement-fiber board as well as in the method and apparatus employed to produce such board.

In order that the invention may be better understood, reference is made to the accompanying drawing, diagrammatic in form, wherein—

Figure 1 is representative of appropriate apparatus for treating the fibrous material preparatory to the formation thereof into a suitable web;

Figure 2 is representative of apparatus for forming the treated material into a web and cutting such web into suitable separate sheets; and

Figure 3 is representative of apparatus for compressing the formed and cut sheets.

Various bases may be used in the construction of this product but principally fibrous material is preferred because of its adaptability for the purpose desired, and woody and vegetable fibers have been found very advantageous primarily due to the cheapness of the source thereof. Almost any woody fiber may be used which is capable of providing fibrous elements of comparatively small cross-sectional area, and affording sufficient surface characteristics to receive and hold a coating adapted to serve as a bond between the fibrous elements and a strengthening substance of cementitious nature. In like manner various vegetable fibers may be employed having the same or substantially the same characteristics as just described to render them suitable as bases for the reinforcing or cementitious substance.

Various types of Portland cements may be used as the binder material for bonding together the fibrous elements into an integrated cement-fiber board in connection with which probably the most economical and satisfactory cement is the ordinary Portland cement or some of the various variations thereof, as, for example, the high-early-strength Portland cements.

More specifically woody fiber adapted to this invention is in the form of excelsior derived from the softer woods, particularly the poplars, since such provides qualities better suited to the treatment to be imparted than excelsior derived from the harder woods, and of these softer woods belonging to the poplar family, the aspen, yellow poplar and cotton wood have been found exceptionally satisfactory. The excelsior or fibrous base material should be in more or less ribbon form of a suitable cross-section, for example of a relative cross-section of the order of

0.1" x 0.12"

although it is to be understood that these dimensions given are not critical and are given merely as an example of a cross-section of a ribbon-like strand. Of the cementitious substances the best results are obtained from the use of ordinary Portland cement and Incor cement, which is a high-early-strength Portland cement.

The fibrous base material is first treated with sodium silicate and then with calcium chloride to precipitate calcium silicate on the fibers, the water soluble sodium chloride which is one of the products of the reaction being washed off, the action being represented by

$$Na_2SiO_3 \text{ plus } CaCl_2 \; CaSiO_3 \text{ plus } 2NaCl$$

after which the cement is added and the mass molded to desired shapes and sizes, and allowed to cure, and dried.

The following will be a discourse upon the formation of this product as by laboratory methods.

The laboratory apparatus consisted of containers in which the fibrous substance was mixed, molds within which the mix was placed, and other incidental devices including a humidity chamber, a steam chamber, and a drying oven.

The apparatus utilized for producing specimens consisted of forming frames and molds. The forming frame was of wood 24" x 24" x 4" inside dimensions. This frame was hinged on three corners with a clasp on the fourth corner to facilitate removal of the specimens. There is preferably provided a smooth surfaced flat sheet of material such as plywood on which the frame may be placed and a second sheet of like material which is cut to dimensions just slightly less than the 24" x 24" dimensions of the frame, so that such may be placed on top of material which has been placed in the frame, and upon the application of pressure thereon will serve to compress the such material within the frame. The cement-fiber mix prepared in accordance with the above is charged into the frame to substantially fill the frame and then by the application of suitable pressure to the pressure transmitting top cover of the frame the cement-fiber mix therein is compressed from its original depth of approximately 4" to preferably a depth or thickness of 1". After the cement-fiber mix has been compressed in the frame it is removed therefrom and placed in a mold.

The mold used comprised two ⅛" steel plates, approximately 29" x 29" which served as a top and bottom thereof. Angle irons 1" x 1" x ⅜" served as the sides of the mold. In the use of the mold the steel plates were pressed together by means of 2 x 4's and bolts until stopped by the angle irons comprising the sides of the mold and the angle irons were then forced inwardly into final position by hammering blocks between the plates sufficiently to drive the angle irons inwardly until the cement-fiber mass between the plates was reduced to an area of approximately 22" x 22", thus serving to compact and compress the edges of the cement-fiber mass. The friction between the two surface plates and the edges of the angle irons serves to hold the angle irons in position.

The fibers (excelsior) were mineralized in order to provide a coating serving as a bond between the fibers and the cementitious material. To this end, the fibers were treated with varying quantities of sodium silicate but the optimum value was found to be 45 or 50 grams of sodium silicate (40° Bé., DuPont grade F, approximate alkali-silica ratio 1:3) per 250 grams of fiber. It was found that the fiber would take up approximately 600 cc. of liquid per 250 grams of fiber. Consequently, the silicate used in the treatment was diluted to this concentration and the fibers soaked in this solution from 2 to 45 minutes. After soaking, a 5% solution of calcium chloride was added to the impregnated fibers and the whole thoroughly stirred in order to insure intimate contact of the chloride solution with all of the fibers. One thousand grams of a 2½ calcium chloride solution per 45 grams of sodium silicate (40° Bé.) was used to precipitate calcium silicate on the fibers, this quantity being in excess of the amount theoretically necessary to precipitate all of the silicate.

Although the precipitation of calcium silicate is practically instantaneous, the fibers were allowed to stand in the calcium chloride solution from 1 to 15 minutes in order to determine the optimum time for the formation of firm silica gel. Following the addition of calcium chloride the fibers were washed twice by decantation in order to remove the sodium chloride formed as a by-product of the reaction. The cement was added to the coated (mineralized) fibers in two ways, viz., in the form of a powder, and as a slurry. When added as a powder the fibers were soaked in water so that the cement would form a thin uniform coating around the fibers. The cement was then dusted on the wet fibers with a 40 mesh sieve, stirring all the time in order to obtain a uniform coating. The optimum cement-to-fiber ratio (Portland cement) was found to be 2.8:1 (700 grams of cement to 250 grams of fiber). The fibers would not retain enough moisture to form a uniform coating with this amount of cement, hence an additional 60 grams of water per 700 grams of cement was sprinkled into the cement-fiber mix and the whole again stirred until a uniform coating on the fibers was obtained.

In those cases where the cement was added to the fibers in the form of a slurry, the slurry was added gradually with continued stirring in order to obtain a uniform coating of cement on the fibers. The slurry was added to dry fibers and to fibers previously moistened with small amounts of water, but it is to be noted that in the latter case, that is, where the slurry is added to fibers previously moistened with water, the amount of water used for moistening should be held to a low amount or the slurry should be on the thick side, since the total water in the mix (the water in the fibers plus the water in the slurry) might otherwise be sufficient to excessively thin the cementitious film so that it would tend to drain off the individual fibers, rather than to provide a coating on each individual fiber, which is the condition desired.

The cement coated fibers coated in accordance with the procedure just above mentioned are packed into the forming frame so as to obtain as uniform a distribution throughout the mold as possible, but no attempt is made to orient the fibers in any direction, and then the packed mass is compressed from its original thickness of about 4" to the desired thickness of approximately 1", and the then compressed mass is placed in the mold and subjected to a final compression as has been previously described.

Particularly in order that uniformity of specimens might be obtained for the purpose of comparative testing, but, such, however, comprising the preferred curing of the specimens, the specimens were allowed to remain in the mold over night (approximately 16 hours), were then removed and placed into a high humidity chamber for a period of not less than 1 day nor more than 5 days. Following the subjection of the specimens to humidification the specimens were then, in order that drying might be accelerated, dried in an oven at approximately 60° C. for 16 hours, although it is to be understood that equivalent air drying might be used. In connection with the preparation of test samples a standardized curing procedure was adopted according to which the specimens were humidified for 3 days and then air dried for 2 weeks before testing.

Cured specimens were tested for dry bending strength in cross-bending as simple beams with center loads and supports 16" on center. For degree of swelling in water specimens 4" x 8" x 1" were cut from the molded boards (across the 8" width) and soaked in water for 20 hours; a chrome metal plate was placed on each side of the specimens and the overall width (specimen plus metal plates) measured by vernier calipers before soaking and after soaking; after the specimens were measured they were tested (for wet bending strength) in cross-bending as a simple beam with a center load and supports 6" on center.

Boards which were made with gypsum as the binder were found to be considerably weaker than mineralized boards made from either the high-early-strength Incor Portland cement or ordinary Portland cement, but, other than that they had somewhat lower strength characteristics, such boards were otherwise entirely satisfactory.

It was found that the addition of the cement to the fibers as a slurry formed a weaker board than when the cement was dusted on the wet fiber as a powder. A practical disadvantage of adding Portland cement as a slurry is that if the fibers are mineralized prior to the addition of the cement slurry it is necessary that, before the cement slurry is added, the fibers shall have been subjected to some drying to reduce their moisture content, so that the total moisture, that of the fibers and that of the slurry, shall not be sufficient to thin the slurry to the extent that it drains from the top fibers of the mass during the molding operation.

Five day old specimens made from high-early-strength Portland (Incor) cement were considerably stronger than five day old ordinary Portland cement specimens. However, this apparent greatly superior strength results from the ability of the Incor cement to reach its ultimate strength more rapidly than ordinary Portland. Upon aging, the difference in strength between boards made from these two cements, tends to decrease.

Poplar fibers formed stronger boards than any other type of fiber investigated. Boards made from mineralized ribbon poplar fiber (0.014" x 0.1" in section) were found to be about 20% stronger than boards made from mineralized coarse poplar fiber (0.014" x 0.187" in section). In addition, boards prepared from ribbon fiber are more porous than boards prepared from coarse fiber, resulting in greater sound absorption and heat insulation.

Mineralization of the fibers results in a board having increased strength over a board made from non-mineralized fibers, both when the board is in a dry state and after it has been soaked for a period of 20 hours without drying. In one series of specimens, the mineralized boards tested almost twice as strong in cross bending (dry) as the non-mineralized boards. In other tests, mineralized boards were found to be about twice as resistant to extreme heat as non-mineralized boards.

The addition of 5% ammonium hydroxide to the sodium silicate solution used in mineralization appears to increase the strength of the mineralized board. The function of the hydroxide is to form a firmer calcium silicate gel and thus prevent removal during the soaking operation.

The addition of 4% rosin size to the sodium silicate solution and the subsequent precipitation of rosin size and silicate with alum also appears to increase the strength of the board. However, the cost of this operation is considered too expensive to justify its use in view of the moderate increase in strength which it produces.

From results obtained it would appear that there is an economic optimum time of soaking the fibers in the sodium silicate solution prior to adding calcium chloride, of apparently two to five minutes. Boards mineralized by dipping the fibers in a silicate solution and then allowing them to drain before adding calcium chloride, do not differ appreciably in bending strength from boards mineralized by soaking the fibers directly in the silicate solution. It appears that a draining time of two to five minutes before the addition of calcium chloride is about optimum with respect to bending strength.

The quantity of mineralization appears to have considerable effect on the bending strength of cement-fiber board when amounts below 30 grams of sodium silicate (40° Bé.) per 250 grams of fibers are used. Above this amount, increasing quantities of mineralization do not appear to increase the bending strength substantially. While above 40 grams of such sodium silicate there is no substantial increase in the high-heat resistance of cement-fiber board, it is believed that 40 to 50 grams of 40° Bé. sodium silicate per 250 grams of fiber should be used during mineralization, to obtain satisfactory strength and heat resistance.

The curing of boards in steam, after removal from the mold, for 2 to 8 hours appears to produce a board that is lower in bending strength than boards cured in high humidity for several days. Although no definite trend was indicated by curing in a high humidity chamber, it appeared that increasing times of humidification beyond two or three days have no appreciable effect on the strength of the board.

As would be expected, air-drying (aging) improves the strength of cement-fiber board. The results obtained from the tests on the Incor cement boards were somewhat variable but, nevertheless, when compared to the tests on the ordinary Portland cement boards, it was noted that the difference in strength between the two types of boards steadily decreased as the period of aging increased. The modulus of rupture of ordinary Portland cement specimens of density 27 to 30# per cu. ft. increased from 560 lbs./sq. inch (5-days old specimens) to 624 lbs./sq. inch (33-days old specimens) in 28 days, as compared to an increase of 600 lbs./sq. inch (5-days old specimens) to 678 lbs./sq. inch (33-days old specimens) for Incor specimens in the same length of time.

Specimens were made varying the quantities of materials per square foot from 700 grams cement, 350 grams of fiber (cement-to-fiber ratio 2:1) to 700 grams of cement, 225 grams of fibers (cement-to-fiber ratio 3:1), and from 250 grams of fibers, 700 grams of cement (cement-to-fiber ratio 2.8:1) to 250 grams of fiber, 500 grams of cement (cement-to-fiber ratio 2:1). From tests of these specimens, the quantities of cement and fiber that should be used in order to obtain a balance among strength, density, sound-absorption and heat resistance are 250 grams of fibers and 700 grams of cement per square foot of one-inch thickness, or 550 lbs. of fiber and 1550 lbs. of cement per M square feet of one-inch thickness. The board made in accordance with the proportions just above given is found to have a density of approximately from 25 to 30 lbs. per cu. ft.

It was found that specimens (22" x 22") made from Incor cement had hardened sufficiently after 6 hours in the mold so that they could be removed and handled; while using ordinary Portland (Universal Atlas) cement this time was found to be 7 to 8 hours. However, by treating the cement-fiber mix with a calcium chloride solution (2% on the basis of the dry cement) it was found that this time could be reduced to 5½ hours. Using ordinary Portland (Lone Star) cement it was found that the molding time required was 6 to 7 hours.

In the drawing there has been more or less diagrammatically illustrated, apparatus for carrying out this invention on a commercial scale and wherein, Figure 1 represents that portion of the apparatus for treating the fibrous material, Figure 2 represents that portion of the apparatus for forming the treated material into web or sheet form and severing the same into suitable lengths, and Figure 3 represents a suitable means for compressing the severed portions into the desired thicknesses.

The excelsior is conveyed on the belt 2 so that it will be drawn through a trough or tank such as 3 of sodium silicate solution, there being illustrated a suitable means for causing submergence of the fibrous material in said solution and comprising a continuous belt 4 dipping into said tank and held down therein as by the plurality of hold-down rollers 5. The time of submergence in the silicate solution need be only long enough to allow the solution to come in contact with all of the fiber surface, approximately five to ten seconds.

From the silicate tank 3, the conveyor 2 proceeds to the top of an inclined and rotating cylinder 6 where the calcium chloride solution is sprayed on the silicated fibers as from the nozzles indicated at 7 so disposed as to direct the spray into the open end of the cylinder. Baffles indicated at 8 are provided interiorly of the cylinder to cause agitation of the fibrous material while being sprayed.

The conveyor 2 should preferably be inclined as indicated at 9 or fitted with a drainage trough which will return the excess silicate solution to the silicating tank 3 and the distance between said tank and the upper end of the cylinder 6 should be regulated in accordance with the speed of the conveyor 2 such that the silicate is allowed from two to five minutes to impregnate the fibrous material before entering said cylinder. The concentration of the silicating solution should be of the order of 3.5% total solids, since air-dry (approximately 10% moisture content) poplar fibers of the specified cross-section will retain the required amount of silicate for mineralization from this solution after draining two to five minutes; if the excelsior is wet (as coming directly from wet logs), correspondingly more concentrated silicate solutions must be used for impregnating the fibers.

The reaction between calcium chloride and sodium silicate is essentially instantaneous, wherefore the length of the inclined cylinder 6 need be only long enough to insure good mixing of the excelsior and that the chloride solution comes in contact with all of the fiber surface, this latter being materially aided by the internal baffles 8. A quantity of chloride solution in excess of the amount theoretically necessary, to precipitate all of the silicate, is used and the excess is drained away at the bottom of the cylinder into the drain 10.

The mineralized fibers must then be washed to remove the sodium chloride formed in the reaction and thus leave the precipitated calcium silicate as a coating on the fibers, and this may be done in many ways including the rotating screen conveyor, or inclined belt conveyor 11 with superposed water sprays shown at 12, the wash water and the sodium chloride being drained away as possibly into the aforesaid drain 10.

Following the washing operation, the fibers must be transported to a suitable mechanical means for applying the cement and in the illustration such a means has been shown in connection with the application of dry cement. To this end the fibers having thereon the precipitated coating of calcium silicate are conveyed by the belt 11 to the upper or head end of a second rotating inclined cylinder such as 13 fitted interiorly with baffle plates as shown to agitate the fibers therein. The inclination of this cylinder should be much that the fibers travel down its length at a rate equal to that at which the fibers are charged in to the cylinder by the belt 11.

Extending into the upper end of this cylinder is a suitable device carrying a relatively fine screen subject to oscillation or shaking action, such as shown at 14, and a chute 15 is provided by which the dry cement may be fed onto the upper surface of such screen. Thus the cement can be dusted onto the fibers in the cylinder 13 by the oscillatory or shaking movement imparted to said screen, and this dusting should take place over an area within the cylinder sufficient to allow all surfaces of the wet fiber to be exposed to the powdery cement as the fiber tumbles or cascades down the interior of the cylinder.

The fibers presumably will not carry enough water or be wet enough to wet the dry cement sufficiently to cover the fibers uniformly, and therefore there is provided a water spray 16 at the lower end of said cylinder 13, the water therefrom being in the form of a fine spray and uniformly added in the aproximate quantity of 135–155 lbs. per 1000 sq. ft. of board. The ultimate amount of water in the cement-fiber mix must be rather closely controlled as the strength and rate of setting of Portland cement is a function of the amount of water present. In addition, this amount of water forms a slurry of a consistency such that it will spread uniformly over the fibers as they are stirred or agitated as by the baffles in the cylinder. If found necessary, the cement treated fibers may be passed through an additional inclined rotating cylinder not shown but similar to the cylinder 13, in order to give the fibers sufficient tumbling and stirring to distribute a uniform cement coating over all of the fiber surface.

The cement coated fibers then pass from the cementing cylinders to a belt such as 20 operating in a horizontal plane and for example 26 or 27 inches in width, said belt cooperating with a deckle belt such as 21 on one side thereof and with a similar deckle belt 22 on the opposite side thereof, said deckle belts operating in a vertical plane as illustrated to thereby serve as side walls with respect to the belt 20. Thus it will be understood that the fibers coming onto the horizontal belt 20 may be distributed by an operator so as to lie substantially uniformly upon said belt, and then said belt will convey the mass of fibers to and between the side deckle belts 21 and 22 which prevent lateral displacement of such mass of fibers.

Also cooperating with the deckle belts is the horizontal belt 23 lying thereover and operating parallel to the belt 20, wherefore the four belts 20, 21, 22 and 23 will form a rectangular enclosure substantially filled with the cement coated fibers, the purpose of the upper felt 23 being to press the mass of such fibers down to the thickness corresponding to the vertical dimension of the side deckle belts wherefore, if a two-inch thick web of fibrous material is desired then the side deckle belts will be two inches in vertical extent, but if a deeper web is desired then the deckle belts must be provided having a vertical dimension in accordance therewith. Hence it will be desirable to make the presser belt 23 adjustable in a vertical direction toward and away from the bottommost belt 20.

The cement coated fibers constituting the wet lap formed by these belts is then cut to suitable lengths automatically by a shear indicated at 24, and each successive cut length slid or dropped onto a greased steel plate 25 after which another similar plate is placed over such cut length of web and these plates lowered so that the uppermost plate will be in position to receive the oncoming web ultimately cut by the shear 24 when the desired length thereof is obtained. Alternatively the plate 25 with its supported and cut web sheet may be immediately removed and another plate placed on the supporting rollers 26 to receive the next cut web sheet.

In any event a stack is formed of a plurality of plates 25, with each plate having thereon a cut web sheet of this fibrous mass, and such a stack is placed in a press generally indicated by the numeral 27. As hereinabove stated these web sheets may be in any thickness desired but if, for example, the formed web is of two-inch thickness and the ultimate product desired is to be one inch in thickness, then one-inch channel irons are placed between the adjacent plates 25 as indicated at 28 in the press, said channel irons serving as sides of molds the top and bottom walls of which are said plates 25. Consequently, when the press is operated in a closing direction, the fibrous mass will be compressed to the thickness limited by the dimension of the channel irons, or in other words the entire mass will be compressed until the plates 25 come into contact with said channel irons.

When the plates are thus brought into contact with said irons the latter are forced sidewise by any suitable mechanism in order to give lateral compression to the fibrous web sheet and so form a firm edge area, and this lateral compression may be as desired though in practice it is found desirable to allow one inch per edge for lateral compression with respect to the dimensions of the web as formed by the belts 20, 21, 22 and 23. That is to say, if the finished fiber board is to be 24" x 60" x 1" then said belts should be of such dimensions and spacings as to form the web mat or web having a transverse section of 26" x 2", and controlling the action of the shear 24 so as to sever web sheets 62" in length.

The fibrous mass thus pressed is allowed to remain in the molds for from 5 to 8 hours in order that the cement may acquire a proper set to bond the fibers in position, it, of course, being understood that during such period the pressure upon the mass is maintained by means of suitable pressure applying mechanism such as through the application of pressure in a suitable press or by the use of suitable clamps. Following removal from the molds, the boards are stacked on a suitable support face-to-face, i. e., with no separators therebetween. Although the boards are firm they have not reached their full strength and are easily damaged at this point. Therefore, a special platform should be provided which will allow each board to be slid out of the mold and into its position in the stack on said support, with as little handling as possible. The stack of boards is then placed in a high humidity room for the necessary period for curing and preferably such room should be kept as near 100% relative humidity as possible. After curing they are removed and stacked for air drying.

The finished board should be porous so as to have a high degree of sound absorption and a low value of heat conductivity. The apparent density of the board should be between 27 and 30 lbs. per cubic foot, while the modulus of rupture of 8" specimens having an average density of 28.5 lbs. per cubic foot (oven dry) should not be below 500 lbs. per square inch when tested as a simple beam with supports 16" on center.

It is obvious that those skilled in the art may vary the steps and combinations of steps constituting the method by which this product is produced, as well as vary the details of construction of apparatus employed in carrying out such method, and further may vary the individual substances treated and the specific materials used for treating said substances, without departing from the spirit of this invention and therefore it is desired not to be limited to the exact foregoing disclosure except as may be required by the claims.

What is claimed is:

1. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying Portland cement to such precipitate-coating in the presence of moisture; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

2. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying Portland cement to such precipitate-coating in the presence of moisture and in such quantity as to provide a relatively thin coating of cement over the calcium silicate; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

3. The method of producing a cement-fiber mass which comprises wetting excelsior derived from the wood of trees of the poplar family with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying cement to such precipitate-coating in the presence of moisture and in such quantity as to provide a relatively thin coating of cement on the calcium silicate; forming the resultant mass to shape with intercommunicating voids between the cement-coated strands of excelsior and then subjecting the shaped mass to curing conditions while subjected to pressure.

4. The method of producing a cement-fiber mass which comprises wetting loosely assembled strands of excelsior with a solution of sodium silicate; subjecting such wetted and loosely assembled strands of excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating on the individual strands of such excelsior, and washing away the sodium chloride residue; applying Portland cement to such precipitate-coating in the presence of moisture and in such quantity as to provide a relatively thin coating of cement on the calcium silicate; mass to shape and then subjecting the shaped

mass to curing conditions while subjected to pressure.

5. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying cement to such precipitate-coating in the presence of moisture; mass to shape and then subjecting the shaped mass to curing in an atmosphere of high humidity while subjected to pressure.

6. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying dry Portland cement to the precipitate-coating while the latter is in wet condition, such application accompanied with agitation of the mass of excelsior; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

7. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; dusting dry Portland cement on the precipitate-coated mass of excelsior while the latter is in wet condition and in a state of agitation; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

8. The method of producing a cement-fiber mass which comprises wetting excelsior derived from wood of trees of the poplar family with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; mixing with agitation the precipitate-coated mass of excelsior and a slurry of cement, the latter in such quantity as to provide a relatively thin coating of cement on the calcium silicate mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

9. The method of producing a cement-fiber mass which comprises wetting excelsior with a solution of sodium silicate; subjecting such wetted excelsior to a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue; applying cement to such precipitate-coating in the presence of moisture, the cement-to-excelsior ratio being of the order of 2.8 to 1 by weight; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

10. The method of producing a cement-fiber mass which comprises passing loosely assembled pieces of excelsior through a solution of sodium silicate to thoroughly wet such excelsior therewith; spraying such wetted excelsior with a solution of calcium chloride to form a precipitate of calcium silicate as a coating thereon, and washing away the sodium chloride residue, such spraying accompanied with agitation of the excelsior; applying cement to such precipitate-coating in the presence of moisture; mass to shape and then subjecting the shaped mass to curing conditions while subjected to pressure.

11. A cement-fiber board comprising a mass of assembled excelsior strands, said strands having a relatively thin coating of cement bonded thereto by an interposed layer of calcium silicate, the cement-to-excelsior ratio being of the order of 2.8 to 1 by weight, said cement-coated strands formed into a set mass with intercommunicating voids therebetween.

12. The method of producing a cement-fiber mass which comprises wetting loosely assembled fibers with a solution of sodium silicate; subjecting such wetted and loose fibers to a solution of calcium chloride to form a precipitate of calcium silicate as a coating on the individual fibers, and washing away the sodium chloride residue; applying cement to such precipitate-coating in the presence of moisture and in such quantity as to provide a relatively thin coating of cement over the calcium silicate coating; forming the resultant mass of fibers to shape and subjecting the shaped mass to curing while such shaped mass is being subjected to pressure.

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