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UNITED STATES PATENT OFFICE.

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HARD GRAINLESS FIBER PRODUCTS AND PROCESS OF MAKING SAME.

No Drawing. Application filed September 18, 1925. Serial No. 57,252.

My invention relates to hard, grainless fiber products and process of making same.

Ligno-cellulose materials, such as wood, and the like are adapted for use in making my improved products.

The principal object of the invention is the production from natural wood, usually waste pieces from saw mills, of coherent grainless, hard, dense, stiff and strong products having practically all the characteristics of natural wood, but of increased density, and remade so as to be without grain and free from the weakness which natural wood has "across the grain."

Other objects will appear in connection with the following description of my new product and the process of its making.

The raw material, such as wood in small pieces or chips, is first converted into fiber. The fiber is preferably prepared by explosion from a gun through a constricted outlet or outlets under high pressure, preferably steam pressure of about 275# to 1000# per sq. in., but the wood may be ground or transformed into fiber in other ways, so long as practically all the constituents are disintegrated into substantially fibrous state and the fibers are not unduly chopped or shortened. Chemically digested fiber from which the lignins have been substantially removed is not adapted for the purposes of my invention, practically all, or at least the larger part of the natural lignins present in the wood or woody material being necessary to be retained and incorporated in my product in order to obtain thorough cohesion throughout the fibrous body. Fiber made by explosion as described is particularly well adapted for making a hard, grainless product because the resulting fiber contains practically all the original substance of the wood or woody material in a good state of subdivision, including subdivision of a portion of such material into its ultimate fibers, and the remainder into bundles of such fibers, which bundles, however, are finely shredded and well adapted for water penetration and softening, and which substantially fibrous material is adapted for becoming effectively bonded or welded together when dried by application of heat and pressure as hereinafter described. With such fiber, refinement as by beating or the like is not essential, and if there is any further refinement, same is preferably not extensive.

The fiber is preferably formed into sheet form from a water bath, which may contain materials for making the product more waterproof or fire resistant, or both. Complete uniformity in sheet thickness is not always essential, as the material is somewhat plastic, and when products of special forms are to be produced, the material need not necessarily be first made into sheet form.

Some of the excess water may be eliminated, as by passing through squeezing rolls. This is, however, largely a matter of convenience, and use of squeezing rolls may be dispensed with, if desired.

In the formation in water into sheet or the like form, the fibers and fibrous bundles are softened and become criss-crossed in various directions, so that the resulting product will be grainless and will have substantially like strength and stiffness in all surface directions.

The moist fibrated material is dried under heat and pressure and consolidated into a firmly coherent body, the fiber sheet being first cut into lengths as desired, and the cut sections introduced into a heated press, as, for example, between steam heated press platens, pressure and is maintained continuously and preferably without diminution in the press during solidifying and so as to follow up the product being pressed as shrinkage takes place. To obtain best results no material release of pressure should take place until the drying and solidification of the product is substantially complete.

Pressures of from 200# to 700# per sq. in. give very satisfactory results in producing a hard, dense product, but variations in pressure above and below these amounts may be resorted to, if desired. In extended commercial practice of the invention, pressures of approximately 300# per sq. in. have been found to give best all-round results. Extremely high pressures, such as 1500# per sq. in. or more, are preferably to be avoided because products made under such pressures are relatively brittle. Drying takes place rapidly, the water being quickly reduced to a low proportion by the squeezing during the closing of the press, and close contact being made with the hot press platens under the pressures used. The press platens are heated to a temperature sufficient with the pressures used to produce a hard, coherent body of fibrous material. With steam heated press

platens, which are preferably used, while fairly satisfactory results can be obtained with lower temperatures, to secure best results, the steam for heating the press platens is preferably at a pressure over 70# per sq. in., and considerably higher temperatures, as, for example, temperature of steam at 100# per sq. in. may be used, so long as overheating and charring is avoided. Some charring along the edges is not necessarily objectionable, as the product is ordinarily trimmed.

Moist fiber sheets which are about ¾" thick, for example, as they come from the squeezing rolls, after being dried and solidified in the manner described, are about ⅛" to $\frac{3}{16}$" thick when removed from the press, are of substantially permanent gage dimension, dense, stiff and strong, and have all the qualities characteristic of natural wood in the direction of its grain in as great or greater degree than the wood, with the difference that the product is grainless and has no direction of weakness corresponding to that of wood "across the grain".

Such products can be trimmed or worked with ordinary wood-working tools, but ordinarily need no planing or other surfacing, being a true reproduction of the press platen surface, which may be plane or may be of various forms so as to produce moldings, panels, casings and the like.

The product made in the manner described is very dense, the density being practically uniform throughout its thickness, has a specific gravity of approximately one, and is resistant to absorption of water, and with addition of size additional resistance to water penetration can be obtained.

I attribute the high degree of homogeneity, hardness, denseness and stiffness to the continuous application of pressure and heat to the fibrous mass softened by moisture and containing all or practically all of the original wood or woody constituents until substantially dry, resulting in what may be termed a thorough cohering, coalescing, bonding or welding together of the component parts of the original wood or woody material.

The absence of disruptive action upon releasing the pressure on the hot press is an indication that the product after pressing is so thoroughly dry as to be free from practically all moisture, which if present would be converted into steam with disruptive effect at the high temperatures used, and it is in this sense that I make use of "practically completely freed from moisture in making" and equivalent expressions in certain of my claims. Such expressions are not to exclude some taking up of moisture at a later time as referred to above.

It is of advantage, particularly in securing rapid drying and solidification of the product, to lay the sheet or the like in the press on a screen, as of copper wire mesh or the like, which remains in the press during the operation of drying and solidifying the product. Such a screen affords added opportunity for escape of moisture in the form of steam, and products dried and solidified on such a screen, in addition to taking a shorter time than without the screen, are usually lighter in color, not only on the surface next to the screen, but all the way through, and on the opposite surface from that exposed to the screen. Use of such screens is, of course, not desirable where a product is desired to have smoothly finished surfaces on both its faces.

My product in its best embodiment is free of binders, fillers and the like from extraneous sources, but, obviously, these may be included to some extent, so long as my described process is carried out and a product obtained having substantially the described characteristics.

Cognate subject-matter not claimed herein is embraced in my following co-pending applications: Ser. No. 38,356 filed June 19, 1925; Ser. No. 57,521 filed Sept. 18, 1925; Ser. No. 90,167 filed Feb. 23, 1926; Ser. No. 91,447 filed Mar. 1, 1926.

I claim:

1. An article of manufacture consisting of a coherent, grainless, hard, stiff and strong body of wood or woody material which had been disintegrated into substantially fibrous state, said body being denser than, and comprising practically all the substance of, the original wood or woody material, and practically completely freed from moisture in making.

2. An article of manufacture consisting of a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material which had been disintegrated into substantially fibrous state, said body comprising practically all the substance of the original wood or woody material and being of specific gravity approximately one, and practically completely freed from moisture in making.

3. An article of manufacture consisting of a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material which had been exploded into substantially fibrous state, said body being denser than, and comprising practically all the substance of, the original wood or woody material.

4. An article of manufacture consisting of a coherent, grainless, homogeneous, hard stiff and strong body of wood or woody material which had been exploded into substantially fibrous state, said body comprising practically all the substance of the original wood or woody material and being of specific gravity approximately one.

5. An article of manufacture consisting of

a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material, which had been disintegrated into substantially fibrous state, wet, and dried from moist state under consolidating pressure and heat until practically completely freed from moisture, said body being denser than, and comprising practically all the substance of the original wood or woody material.

6. An article of manufacture consisting of a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material, which had been disintegrated into substantially fibrous state, wet, and dried from moist state under consolidating pressure and heat until practically completely freed from moisture, said body comprising practically all the substance of the original wood or woody material and being of specific gravity approximately one.

7. An article of manufacture consisting of a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material, which had been exploded into substantially fibrous state, wet, and dried from moist state under consolidating pressure and heat, said body being denser than, and comprising practically all the substance of the original wood or woody material.

8. An article of manufacture consisting of a coherent, grainless, homogeneous, hard, stiff and strong body of wood or woody material, which had been disintegrated into substantially fibrous state, wet, and dried from moist state under consolidating pressure and heat until practically completely freed from moisture, said body comprising practically all the substance of the original wood or woody material, and being of specific gravity approximately one.

9. A grainless, hard board composed of wood which had been disintegrated into substantially fibrous state, and which is denser than and comprises substantially all the substance of the original wood, and practically completely freed from moisture in making.

10. A grainless, hard board composed of wood which had been transformed by explosion into substantially fibrous state, and which comprises substantially all the substance of the original wood, and has a specific gravity of approximately one.

11. A grainless wood product comprising fiber of exploded wood redistributed without grain or order, and caused to cohere by application of heat and pressure to the fiber in moistened condition until substantially dry.

12. A hot pressed grainless wood product comprising fiber of exploded wood rearranged without grain or order, and coalesced or welded together.

13. A hot pressed grainless ligno-cellulose product comprising fiber of exploded ligno-cellulose material rearranged without regard to grain or order, and coalesced or welded together.

14. The process of making a hard, grainless body of wood or woody material which comprises the steps of disintegrating wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, supplying moisture to said substantially fibrous material, and drying same under consolidating pressure and heat to such extent that the product is not disrupted upon opening the press while still highly heated.

15. The process of making a hard, grainless body of wood or woody material which comprises the steps of exploding wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, supplying moisture to said substantially fibrous material, and drying same under application of consolidating pressure and heat.

16. The process of making coherent, grainless sheets of wood or woody material which comprises the steps of disintegrating the wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, soaking said fibrous material with water, forming into sheets and subjecting the sheets of fibrous material to consolidating pressure and heat following up the application of pressure during shrinkage and until practically completely freed from moisture to such extent that the product is not disrupted upon opening the press while still highly heated.

17. The process of making a hard, grainless body of wood or woody material which comprises the steps of exploding the wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, soaking said fibrous material with water, and subjecting the most fibrous material to heat and pressure following up the application of pressure during shinkage and until substantially dry.

18. The process of making a grainless wood product, which consists in fibrating wood by discharging from pressures in excess of 275# per sq. in., compressing under temperature equivalent to the heat of steam at over 70# per sq. in., at a pressure of about 200#–700# per sq. in., and continuing the application of pressure until the fibers are formed into a substantially homogeneous grainless product of high density, strength and specific gravity.

19. The process of making a grainless wood product, which consists in fibrating wood by discharging from pressures in excess of 275# per sq. in. through a constricted

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outlet or outlets, compressing under temperature equivalent to heat of steam at over 70# per sq. in., at a pressure of about 200#–700# per sq. in., and continuing the application of pressure until the fibrous material is formed into a substantially homogeneous grainless product of high density, strength and specific gravity.

20. The process of making a hard, grainless body of wood or woody material, which comprises the steps of disintegrating wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, soaking said fibrous material with water, and subjecting the moist fibrous material to pressure of the order of 200#–700# per sq. in. while heating to a temperature of the order of the temperature of steam at approximately 70# per sq. in. or over following up the pressure during shrinkage and until practically completely free from moisture.

21. The process of making a hard, grainless body of wood or woody material, which comprises the steps of exploding the wood or woody material into substantially fibrous material comprising practically all the substance of the original wood or woody material, soaking said fibrous material with water, and subjecting the moist fibrous material to pressure of the order of 200#–700# per sq. in. while heating to a temperature of the order of the temperature of steam at approximately 70#–100# per sq. in. following up the pressure during shrinkage and until substantially dry.

22. The process of making grainless, hard board of wood, which includes disintegrating wood into substantially fibrous material containing practically all the substance of the original wood, soaking and forming in sheets in water, whereby the fibrous material is moistened and softened, cutting into lengths and hot pressing the sections until dry under application of approximately 200#–700# per sq. in. pressure and heat of approximately 70# per sq. in. or more of steam, and with wire mesh material in contact with at least one side of the sheet being pressed whereby escape of steam and other gases is facilitated.

23. In the process of making hard, grainless board, the step of drying and consolidating moist sheets of wood or woody material, which had been substantially fibrated and comprising substantially all the substance of the original wood or woody material, under application of heat and pressure sufficient to secure practically complete freedom from moisture and to produce a product of higher density than the original wood or woody material.

24. The process of drying and bonding together substantially fibrous material containing practically only and practically all the substance of wood, which comprises applying heat and pressure to such material in initially moist condition until practically completely free from moisture and permanently bonded together.

25. Process of pressing fiber from wet state between platens heated above the boiling point of water with a wire mesh screen interposed between press platen and at least one face of the body of fiber and continuing the application of heat and pressure until a hard product is produced practically completely free from moisture.

26. A hard, dry fiber product containing substantially all the lignins and other constituents of wood which had been disintegrated to fibrous state and coalesced together under heat and pressure and having on at least one face thereof a wire-mesh-impression surface.

In testimony whereof, I have signed my name hereto.

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CERTIFICATE OF CORRECTION.

Patent No. 1,663,505. Granted March 20, 1928, to

WILLIAM H. MASON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 112, claim 17, for the word "most" read "moist"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of May, A. D. 1928.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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