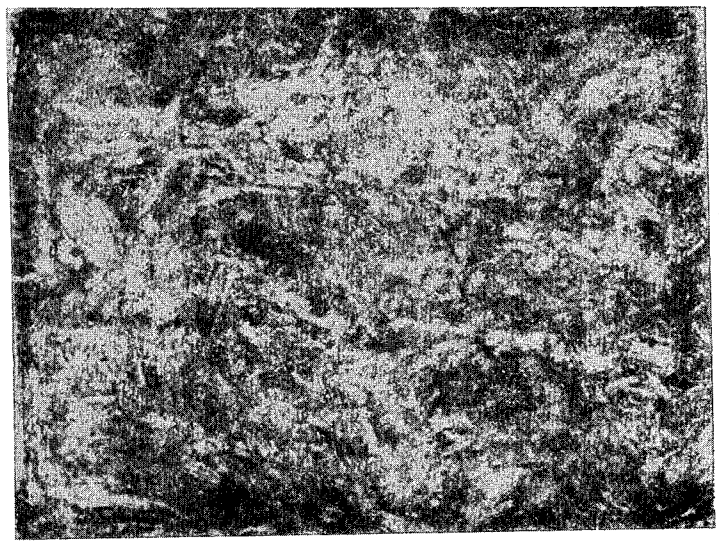
Dec. 11, 1951 C. ROMAN 2,578,489

ARTIFICIAL WOOD PRODUCT AND METHOD OF MAKING THE SAME

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Fig. 1



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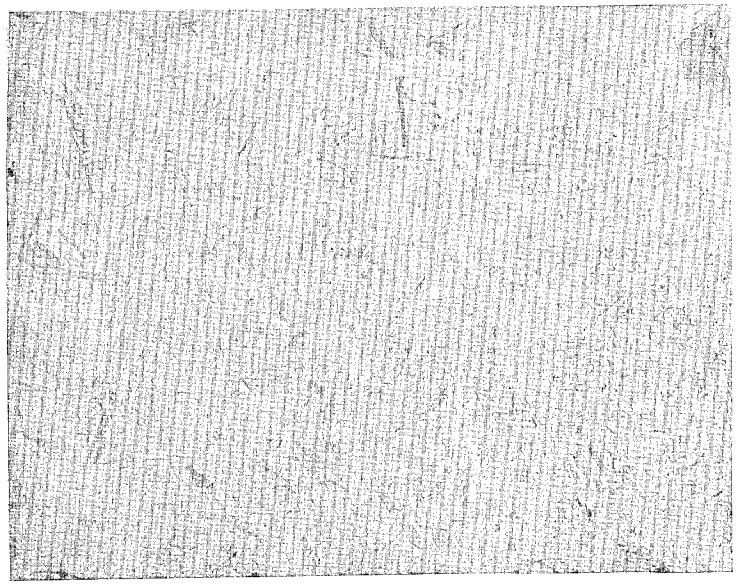
ARTIFICIAL WOOD PRODUCT AND METHOD OF MAKING THE SAME

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Fig. 2



Fig. 3



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ARTIFICIAL WOOD PRODUCT AND METHOD OF MAKING THE SAME

Charles Roman, Miami, Fla.

Application December 9, 1946, Serial No. 715,033

12 Claims. (Cl. 260—17.2)

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This application is related to my copending application, Serial No. 523,610 filed February 23, 1944 for a Composite Wood Product, which has issued as Patent No. 2,446,304, dated August 3, 1948, this application having in common with my aforesaid application the fact that its end result is the production of an artificial wood shape (such as a board, column, beam or other timber like article) comprising a base of a comminuted fibrous, cellulosic mass of heterogenously disposed pieces, said pieces being compressed into a molded mass and being united into a homogenous whole by so small a percentage of a binder of a thermo setting resin that the finished product is distinctly of the class of a wood. This is in contradistinction to many of the so called artificial wood products made by suspending comminuted wood in so large a proportion of a resinous plastic, thermo setting binder that the finished product partakes more of the character of a resinous mass than a woody mass. Many advantages of maintaining the woody characteristics of the product will be hereafter set forth. One important advantage lies in the fact that a truly woody product may be finished like wood and worked like wood, with wood working tools.

My aforesaid application, Serial No. 523,610, contemplated the use of hog fuel as the source of the comminuted wood base material.

The present invention contemplates the use of sugar cane bagasse as the base material. I use the raw sugar cane bagasse just as it comes from the sugar can mills, without such pulping or felting, as would interfere with the fluffing of the matted material; however, to prevent fermentation or mildew when the bagasse is to be stored before use I may run live steam through the bagasse to wash out sugar residue or other impurities. This use of raw bagasse facilitates the uniform dispersal of the binder through and into contact with the component pieces and particles of the bagasse, and brings about the heterogeneous projection of the bagasse particles in a multitude of directions and in interlocking relation throughout the mass; as hereinafter described.

Cold process

1½ lbs. raw, dry sugar cane bagasse are run through a picker or fluffer to loosen or separate the fiber aggregates as the bagasse comes from the crushers or from the compressed bales. The fluffed, dry bagasse is placed in a spiral mixer. While the mixer is in motion 3 oz. powdered urea formaldehyde glue, cold setting mix, plus 2 oz. white flour are slowly fed into the mixer through the feeding chute, and the dry mix of bagasse, powdered glue and flour are thoroughly mixed for five minutes or more to sift the binder (glue and flour) uniformly throughout the mass of bagasse. This dry mixing causes the fiber ag-

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gregates to be covered with a fine deposit of the powder mix. The flour being coarser and lighter in weight picks up the very fine resin dust and in this manner acts as an extender, carrier and disperser of the resin. When the flour becomes tacky from the subsequently introduced steam or water it retains the resin evenly in the mix until the pressure and heat complete the binding of the bagasse base into a dense, strong, shape, be it a board or otherwise.

After the uniform dispersal of the binder through the mass a slow fine spray of 4 oz. of an aqueous liquid such as water is injected into the mixer until the water is thoroughly dispersed throughout the dry mix. A steam spray may be employed as the dampening medium. The result is a mass of fibers which is just slightly damp to the touch. This damp (but not wet) mass is placed in a press mold consisting of top and bottom plates (cauls) enclosed with four edges. The mold is first dusted with a good moulding powder such as zinc stearate. Pressure of 150 pounds per square inch to 400 pounds per square inch is applied and maintained for twelve hours or more. The time allowed for setting under pressure will vary with the temperature of the room and the setting time of the resin glue. A variation of this method would be the injection into the mixer of a fine spray solution of water and glue. The dry mix method is the better method, however. After the board is removed from the press it should be air dried for several days. The boards should be stood on end and complete circulation of air allowed about the board. The boards must not be allowed to sag while curing, otherwise they will dry in that position.

As stated the mass of fibres is merely slightly damp and not wet. In this condition no water can be squeezed from the material by squeezing a ball of the same in the hand and the term damp but not wet is to be understood to mean substantially that degree of wetness which ensues when 4 ounces of water is evenly dispersed through a mass of 1½ pounds of raw, sugar cane bagasse, which mass has previously had sifted therethrough three ounces of powdered urea formaldehyde and 2 ounces of white flour.

Hot process

The hot process involves the placing into a hot plate press of the mass produced by the spiral mixer as related above under the cold process and causing faster setting through the application of heat, and water-cooling before removal from the press and while the mass is under pressure. This method is far superior to the cold setting process because less resin glue (urea formaldehyde for example) is needed, and curing or completion of the formation of the board is accomplished in a few minutes dependent upon the

thickness of the board. Under this process I may use as little as 1 ounce of urea formaldehyde or other thermosetting resin and 2 ounces of flour to 1½ pounds of the bagasse. No curing is needed after removal from the press except in the case of very thick boards. The resins may be any thermo setting resins in either dry or liquid form as long as complete dispersal of the resin throughout the bagasse mat is had.

Cooling of the press plates is necessary to reduce the steam head to avoid steam blisters, and for that reason the pressure plates are preferably water cooled after the curing of the boards. Thick boards should preferably be recured in the hot press a few days after the first forming to remove residual moisture. This re-curing consists merely of again subjecting the boards to further heat and pressure in the hot press.

Wet process

The product of this invention provides an artificial board presenting a grain or design of an ornamental and pleasing nature and one which may be varied by the amount of water used or the nature of the resin or by the degree of, or duration of the heat and/or pressure employed, as more fully pointed out in the discussion of the figures of the accompanying drawings.

By using a mat of elongated fibers extending in a multiplicity of directions and bound into board form by the use of a very small proportion of resin, as described, I produce a board which, as before stated, is more woody than resinous and consequently can be worked like wood, with wood-working tools and without damage to the cutting edges of the latter. The fact that the fibers extend heterogeneously in all directions makes the board strong in all directions. This is in marked contradistinction to any felted materials where the fibers all run in the same direction. Further, I avoid the use of any ingredient in the binder which would be injurious to the cutting edges of tools. Some of the binders heretofore employed contained silicate of soda and other minerals, which are markedly destructive of the cutting edges of tools. The board of this invention is capable of being machined on wood-working machinery, planed, sawed, glued, sanded nailed, and the like.

The variability of the density and grain which may be had by my method produces boards having many different artictic values adapting it for many uses in the furniture and building industry. It may be used as furniture core stock and it may be used in its natural form, that is, just as it comes from the press, for finished furniture stock, acoustic board, wall boards, table tops, floors, roofing sheets, boat hulls, etc. It is so highly artistic and can be made with such a hard, dense, and glazed surface, as to adapt it as a substitute for tile. Its characteristics are such as to adapt it to readily have veneer lumber, roofing paper, metal sheets of all types, plastic sheets, cloth, celluloid and other sheet materials glued to its surface, easily and yet very securely.

It is weatherproof and waterproof and the degree of these characteristics may be determined by adjusting the resin content of the binder. The product of this invention has less shrinkage and expansion than natural wood thereby providing a much superior core stock for veneered products and a much better material for the making of laminated products. The board of my invention can be finished in the same manner as real wood. Many color effects can be achieved by dispersing coloring matter throughout the basic mix, as will be hereinafter set forth, and the natural surface may be varied from a porous mat effect to a hard slick surface by varying the resin and moisture content of the basic mix. In any case the product has the finished effect without the usual cost of finishing. The use of the flour in the binder facilitates the thorough dispersal of the binder throughout the mat of bagasse and in such manner as to coat the bagasse fibers completely but only on the outer surface thereof.

It is to be understood that other extenders may be used as long as they act to facilitate the coating of a large mass of particles of fibrous materials with a relatively small quantity of resinous binder. The flour may be wheat flour or other cereal flours may be employed. The use of an extender manifestly reduces the cost of the binder but in the present case it goes further than to act as a mere extender and acts as a dispersal agent. Furthermore, the flour itself being of a starchy nature has of itself cementitious characteristics which aid in binding the mass into a homogeneous whole.

The forming of the material into boards or other compressed shapes is accomplished with pressure or pressure and heat as hereinbefore described. The pressure and heat cause complete coating of the fibers on the outside of said fibers and bring about a fusing of the binding agent and the joining together of the woody aggregates or fibers.

Most products of this nature are merely a suspension of fibers in a plastic, whereas, this product is a large number of woody particles cemented together with a completely dispersed but very small proportion of binder. The characteristics of the binder are almost completely lost due to the large percentage of woody aggregates. Other products of a similar nature do not possess this product's desirable characteristic because of their use of small, predigested fibers, case hardened surface, softness, or the use of a large percentage of binders which cause loss of woody characteristics and have detrimental effect on cutting tools.

It may be stated that the product of this invention results from the joining together of many large woody aggregates to form a board instead of a suspension of fine woody particles suspended in a large quantity of blinder.

The widely varying characteristics which may be secured as well as the highly ornamental effect which may be produced will be best appreciated by reference to the accompanying drawings, wherein the several figures represent boards having surfaces which range from one that is quite open and of dull and mat-like form, to one which is hard, dense, and highly polished.

The board illustrated in Figure 1 is one having a hard, dense and glassy surface; a board having these characteristics may be secured as follows: 2 ounces of a thermo setting resin, in this case a urea resin, was mixed with one ounce of white flour. The resin and flour, hereinafter referred to as a binder, were sifted and dispersed through the 1½ pounds of dry bagasse as a dry mix until the particles of bagasse were thoroughly coated upon their external surfaces with the binder. 4 ounces of water was then added and uniformly distributed throughout the mass by agitation in a mechanical mixer. The water is preferably added gradually and it may be supplied in the form of steam.

The damp mass was then placed in a press and compressed under a pressure of about 250 pounds per square inch at a temperature of 275° F. over a period of about ¼ hour or less. After the resultant panel or board was removed from the press it was permitted to cool off after which a coat of the same resin solution as was used in the binder was applied to the external surface of the panel or board, air dried, and the panel was then again cured in the hot press. The time of this second curing and the temperature employed may manifestly be varied within wide ranges, it being only necessary to adjust these elements in such a way as to bring about a complete bond of the external coating of the resin with the resinous material of the initial binder. Thus it will be seen that the finished product is not merely a board coated with a separate varnish-like substance which might peel off under use but that the product is a homogeneous one in which the glossy surface is bonded into the very fiber of the board itself. Thus when a product of this nature is used as a substitute for tile it can be expected to remain unimpaired and to retain its beauty over many years of use.

In preparing a board such as is illustrated in Figure 3, only 1½ ounces of the resin and 1½ ounces of flour were used, dispersed through the bagasse as described and compressed under the same conditions as in Figure 1. However, the product of Figure 3 was not coated and re-cured after it was taken out of the press. This product of Figure 3 was of a highly woody character employing very little resin.

The board of Fig. 2 was made in the same way as the boards of Figures 1 and 3 but in this case I used only 1 ounce of resin powder and 2 ounces of flour to 1½ pounds of the dry bagasse and yet the resultant product was one of great strength and stiffness and one having an ornamental surface sheen. Raw bagasse differs from the hog fuel of my co-pending application in that during the sifting and distribution of the binder therethrough it is more like a mass of matted material than hog fuel would be. Note from the right center of Figure 2 at "B" how the bagasse base comprises in part a mass of elongated flexible fibers which when dumped in a mixer extend heterogeneously throughout the mass of coarser particles to form finally a matted mass throughout which the binder has been so thoroughly distributed that, despite the small amount of said binder, it so permeates the mat as to cement all parts thereof into a hard mass when pressure or heat and pressure are applied, to mold the bagasse and binder into the finished solid shape. I have already stated that the flour facilitates the complete dispersal of a very small percentage of resin through the relatively large mass of bagasse.

I wish it to be understood that the invention is not limited to the precise proportions described, nor to the precise materials named. I have described the use of water and water is preferred, but I wish to retain the right to use any liquid of an aqueous nature as the same may prove to be valuable. Further, I wish to cover the use of any suitable thermo setting resin having the characteristics necessary to give the cementitious and water-proof results described as long as the said material comes within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. The herein described method of forming an artificial lumber product which includes agitating a fluffed dry, raw sugar cane bagasse to open

the interstices therebetween, sifting and dispersing through the mass of bagasse during such agitation a binder of dry thermo setting resin taken from the class consisting of urea formaldehyde and phenol formaldehyde, and a cereal flour extender of said resin, dampening the bagasse and said binder and extender with an aqueous medium to render it moist but not wet and then compressing said bagasse to squeeze all the portions of the same into intimate contact with each other, said extender being of a nature to not only serve as an extender but to serve, when dry to coat the particles of resin to reduce their coefficient of friction and to facilitate their dispersal throughout the interstices of the mat of bagasse when sifted thereinto, said extender being also of a cementitious nature after and only after having been dampened with such aqueous medium, the resin being present in amount of one part to 8 to 24 parts of bagasse.

2. The herein described method of making artificial wood shapes which includes taking fluffed raw sugar cane bagasse, continuously agitating the same, sifting uniformly throughout the bagasse during such agitation, a binder, dampening the whole mass with an aqueous medium, and compressing the mass with sufficient pressure to condense it into a hard board-like shape, the binder including a thermo-setting resin of the class consisting of urea formaldehyde and phenol formaldehyde in the proportion of from 1 to 3 ounces of resin to 1½ lbs. of bagasse and the amount of aqueous medium being in the equivalent of 4 ounces of water, which amount dampens but does not wet the mass of bagasse.

3. A method as recited in claim 2 wherein the binder includes as an extender, wheat flour in substantially the proportion of 2 ounces of the

4. The herein described method of making artificial wood shapes which includes taking flour to 1½ lbs. of bagasse.

fluffed raw sugar cane bagasse, continuously agitating the mass of bagasse, siftying uniformly throughout the bagasse mass in dry form during such agitation a binder consisting of an adhesive, thermo setting, water soluble, synthetic resin of the class consisting of urea formaldehyde and phenol formaldehyde and a wheat flour in the proportions of 1 ounce of the resin to two ounces of the flour and 1½ pounds of bagasse, the flour coating the particles of the resin and being brought into coating contact with all particles of the bagasse along with said resin, thereafter dampening the whole mass by the application of steam in an amount to merely moisten the same and promptly compressing the mass in a hot press.

5. The herein described method of making artificial wood shapes which includes taking fluffed raw sugar cane bagasse of commerce, continuously agitating the same, sifting uniformly throughout the bagasse mass during such agitation, a dry binder comprising a thermo setting resin of the class consisting of urea formaldehyde and phenol formaldehyde and a cereal flour, and wherein the proportions employed in the binder for 1½ pounds of the sugar cane bagasse range from 1 ounce to 2 ounces of thermo setting resin, one ounce to two ounces of cereal flour, dampening the whole mass with 4 ounces of water and then compressing the same in the presence of heat.

6. The method recited in claim 5 wherein the pressure employed is 250 pounds per square inch

at a temperature of 275° F. over a period of approximately fifteen minutes.

7. The herein described method of making artificial wood shapes which includes taking fluffed raw sugar cane bagasse, continuously agitating the mass of bagasse, sifting uniformly throughout the bagasse mass during such agitation a dry powdery binder consisting of an adhesive, thermo setting, synthetic resin taken from the class consisting of urea formaldehyde and phenol formaldehyde and a cereal flour in substantially the proportions of 1 ounce of the resin to two ounces of the flour and 1½ pounds of bagasse, the flour coating the particles of the resin and being brought into coating contact with all particles of the bagasse along with said resin, thereafter applying moisture in the form of steam which enters the interstices of the mass, said steam dampening the whole mass to render it pliable and compressible and moistening the binder of resin and flour to convert the whole to sticky cementitious form and subjecting the mass to such pressure and heat as to bind it into a dense and permanently hard and waterproof form.

8. An artificial wood product consisting of a hard, dense, waterproof body comprising the product of reaction of combining the following materials in substantially the proportions stated, to wit; 1½ lbs. of fluffed sugar cane bagasse with its particles heterogeneously intermixed and in the sizes in which it is delivered from the mills, a binder which includes from 1 to 2 ounces of a glue of the thermo setting resin type of the class consisting of urea formaldehyde and phenol formaldehyde, and wherein this small proportion of the glue is so evenly distributed through the mass of bagasse as to surface coat all of the particles of the baggasse and adhesively unite them and a cereal flour extender in substantially the proportions of two ounces of flour to one ounce of the thermo setting resin.

9. The herein described method of forming an artificial wood product which consists of separating the particles of sugar cane bagasse of the form in which it comes from the mills, agitating the mass of bagasse to continuously open up fresh spaces between the particles of bagasse, slowly discharging a cementitious binder in finely divided form, upon and into the bagasse during such agitation dampening the whole with an aqueous medium and thereafter compressing the mass of bagasse to the desired shape until the binder sets, said binder comprising as its most essential element a thermo setting resin taken from the class consisting of urea formaldehyde and phenol formaldehyde.

10. The herein described method of forming an artificial wood product which consists of separating the particles of sugar cane bagasse of the form in which it comes from the mills, agitating the mass of dry bagasse to continuously open up fresh spaces between the particles of bagasse, slowly discharging a dry cementitious binder in finely divided form, upon and into the bagasse during such agitation, dampening the mass with an aqueous medium and thereafter compressing the mass of bagasse to the desired shape until the binder sets, said binder comprising as its most essential element a thermo setting resin of the class consisting of urea formaldehyde and phenol formaldehyde.

11. The herein described method of forming an artificial wood product which consists of separating the particles of sugar cane bagasse of the form in which it comes from the mills, agitating the mass of bagasse to continuously open up fresh spaces between the particles of bagasse, slowly discharging a cementitious binder in finely divided form, upon and into the bagasse during such agitation, dampening the whole with an aqueous medium and thereafter compressing the mass of bagasse to the desired shape until the binder sets, said binder comprising a thermo-setting glue powder admixed with a dry extender that is slippery and free flowing when dry, and sticky and adhesive when dampened, said extender and glue after such compressing and when dried jointly forming with the bagasse particles a hard and highly waterproof artificial wood shape, the extender mixing with the glue powder and facilitating its movement into the mass of bagasse and wherein the proportions employed are 1½ lbs. of bagasse, 1 to 2 ounces of the glue powder and approximately 4 ounces of the aqueous medium.

12. The herein described method of forming an artificial lumber product which includes agitating a fluffed, dry, raw sugar cane bagasse to open the interstices therebetween, sifting and dispersing through the mass of bagasse during such agitation a binder of a dry thermo setting wood bonding glue resin and an extender of said resin, dampening the bagasse and said binder and extender with an aqueous medium to render it moist but not wet and then compressing said bagasse to squeeze all the portions of the same into intimate contact with each other, said extender being of a nature to not only serve as an extender but to serve, when dry to coat the particles of resin to reduce their coefficient of friction and to facilitate their dispersal throughout the interstices of the mat of bagasse when sifted thereinto, said extender being also of a cementitious nature after and only after having been dampened with such aqueous medium, the resin being present in amount of one part to 8 to 24 parts of bagasse.

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