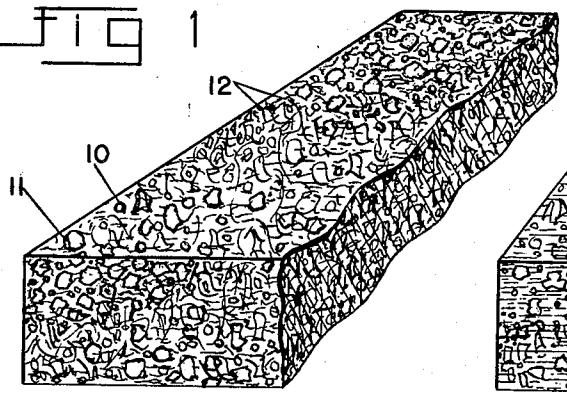
Aug. 18, 1953 C. U. GRAMELSPACHER 2,649,034

PULP WOOD PRODUCT AND METHOD OF MANUFACTURING

Filed Sept. 17, 1949 2 Sheets-Sheet 1

Fig 1



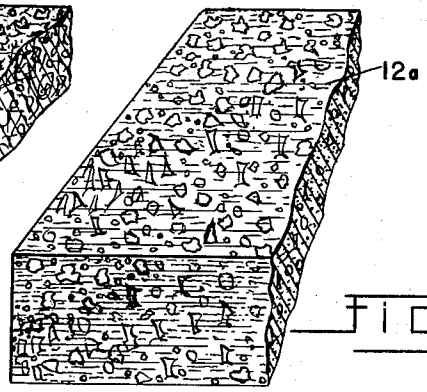
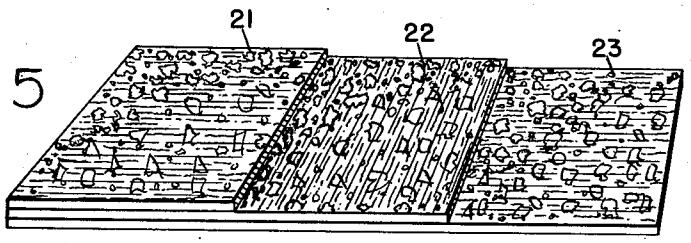


Fig 2

Fig 5



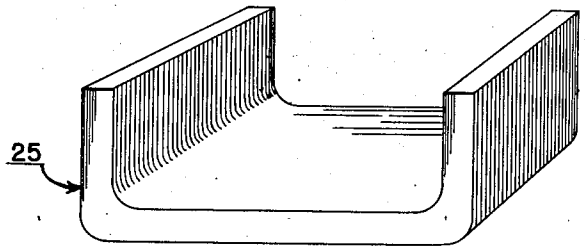


Fig 6

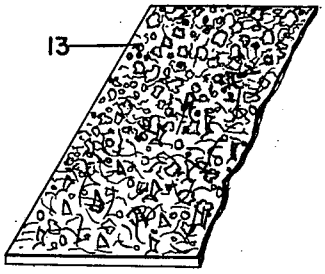


Fig 3

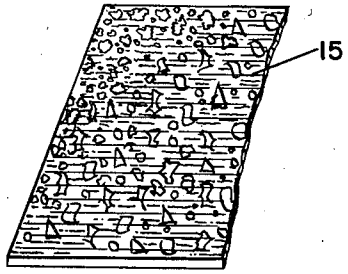


Fig 4

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PULP WOOD PRODUCT AND METHOD OF MANUFACTURING

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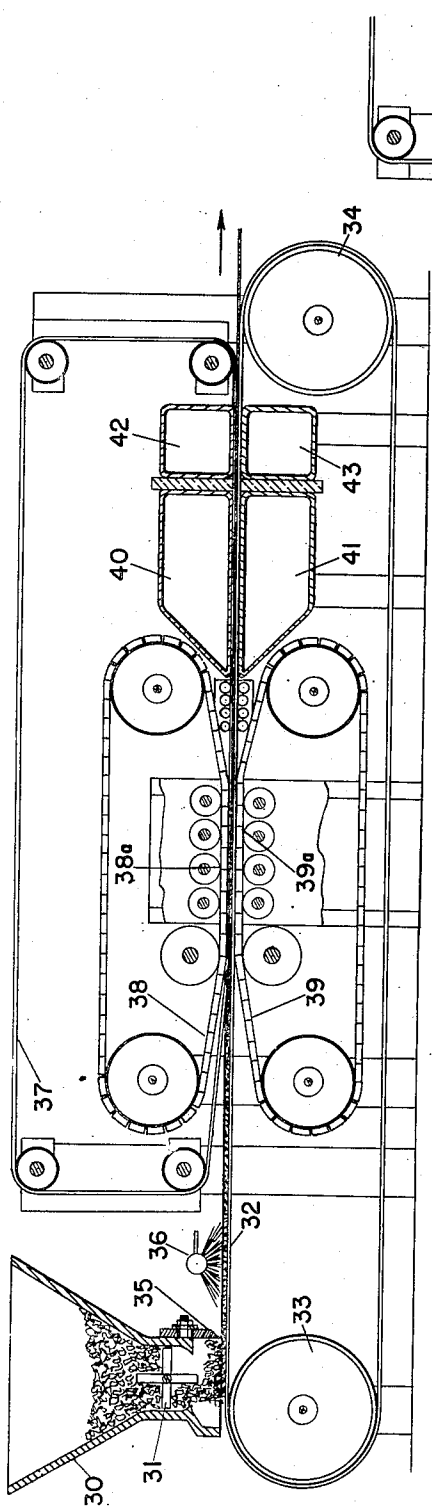

Fig. 7

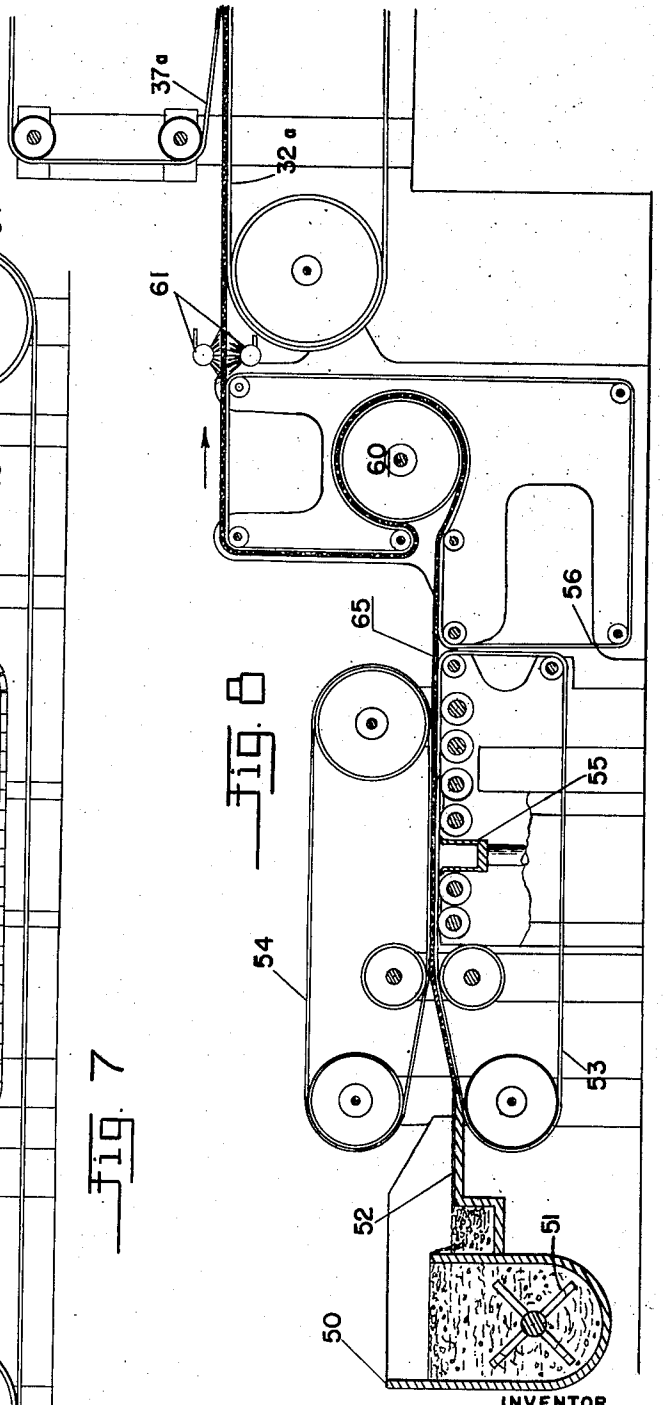

Fig. 8

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PULP WOOD PRODUCT AND METHOD OF MANUFACTURING

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Application September 17, 1949, Serial No. 116,294

3 Claims. (Cl. 92—40)

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This invention relates to a wood product veneer sheet or a wood product board and a method for making the same.

It is generally recognized that the existence of first-class logs for the manufacture of wood veneer is rapidly decreasing. Such wood species as poplar, gum, birch, maple and others, which are commonly used in the manufacture of wood veneer, are becoming difficult to obtain in first-class logs that can be used in machine-turning of veneer.

However, there is much second and third class wood of the above-mentioned species that is unsatisfactory for the manufacture of wood veneer, yet the characteristics of the second and third class logs are the same as those of the first-class logs, but due either to size or slight imperfections in the wood, they cannot be used in making machine-cut veneer.

It is therefore an object of this invention to provide a method of making a wood product veneer sheet, and a new product of manufacture of a veneer sheet by which second and third class hard wood logs, scraps and sawdust as well as soft woods such as pine and others, can be incorporated into a wood product that simulates wood veneer, and which can be used in the manufacture of plyboard as well as in the manufacture of articles produced in molds.

It is another object of the invention to provide a wood product consisting of sawdust, wood chips and wood pulp suitably bonded together under pressure to form veneer sheets or molded articles of manufacture.

It is another object of the invention to provide a wood product that is highly water-resistant, and is not subject to warping or grain-cracking.

It is still another object of the invention to provide a wood product consisting of sawdust, wood chips and wood pulp bonded together with a binding agent in which a grain is imparted to the product.

Another object of the invention is to provide wood product like that set forth in the foregoing objects that can be formed or shaped after its initial manufacture to alter the form or shape of the product, for example, die-forming wood product sheets.

It is still another object of the invention to provide a method of producing a wood product or a wood product veneer sheet having characteristics referred to in the foregoing objects.

Further objects and advantages will become apparent from the drawings and the following description.

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In the drawings:

Figure 1 is a wood product made in accordance with this invention;

Figure 2 is a grained wood product made in accordance with this invention;

Figure 3 is a wood product veneer sheet made in accordance with this invention;

Figure 4 is a grained wood product veneer sheet;

Figure 5 is a plyboard made from a plurality of grained veneer sheets illustrated in Figure 4;

Figure 6 is a view of a die-formed product made from the wood product of this invention;

Figure 7 illustrates diagrammatically a machine for carrying forward a method of producing the products of Figures 1 and 3;

Figure 8 illustrates diagrammatically a machine for carrying forward a method of making the products illustrated in Figures 2 and 4.

The manufacture of high quality wood veneer is becoming more difficult each year as a result of an increasing scarcity of first-class logs that can be used in machine-cutting of veneer. However, there is a large quantity of lower grade logs and limbs as well as scrap materials of the veneer species such as poplar, gum, birch, maple, magnolia, etc. that are sound as far as their wood characteristics are concerned so that the wood characteristics could be carried forward into wood veneer sheets made of these veneer species under suitable conditions.

In this invention the low-grade logs of the veneer species as well as limbs, scrap and sawdust are utilized in the making of a wood product veneer that can be used in the same way as machine-cut veneer, and in fact will have improved characteristics in that the wood veneer of this invention will not warp or grain-crack, and is highly water resistant.

While the wood grain of machine-cut veneer is not reproduced in the wood product veneer of this invention, yet the color tones of the wood species from which machine-cut veneers are made are reproduced, so that natural wood tones of gum, birch, maple, walnut and others can be obtained in the wood product veneers produced according to this invention.

In addition, the wood product veneer, or wood product made according to this invention, whether it be a veneer sheet or a product of manufacture, has a new decorative appearance in that a mottled effect is given to the wood product.

With different species of woods incorporated into the wood product, different color tones can

be obtained by the rate at which the wood species absorb color stains, thus giving to the wood product a color variation which enhances its decorative effect.

The wood product of this invention can be made either as a grained or a non-grained product depending upon the particular nature of its manufacture under certain circumstances. The grained product is particularly useful when incorporating the wood product into plywood so as to increase the strength of the plyboard.

Primarily, this invention consists of making a wood product either in veneer sheet form or in formed products of manufacture from sawdust, wood chips and wood pulp that is bonded together by a suitable resin which may be either thermoplastic or thermosetting in character. The use of wood chips in the wood product gives a mottled appearance to the surface of the sheet or wood product made from the materials. If this mottled effect is not desired, the wood chips can be omitted and the product made from sawdust and wood pulp bonded with a resin binder.

Also, depending upon the final use of the wood product, either a thermosetting or a thermoplastic resin can be used in bonding the sawdust wood chips and wood pulp together. If it is desired to die-form sheets of the wood product into articles of manufacture after the sheet has been given its initial manufacture, then it would be desirable to use a thermoplastic resin to bond the materials together in the wood product so that the sheet could be formed under heat and pressure to any desired configuration. On the other hand, if such subsequent forming is not desired, then preferably a thermosetting resin would be used to bond the materials of the wood product together since such thermosetting resins are unaffected by normally encountered temperatures.

In the group of resins satisfactory as thermosetting resins there are the phenolformaldehyde resins, phenolfurfural resins, and others such as ureaformaldehyde which would be satisfactory for use in bonding the materials of the wood product of this invention. If thermoplastic resins are desired for use, such resins as polystyrene are satisfactory as well as the vinyl chloride acetate resins and the various cellulose resins which can be used according to the heat conditions under which they will finally be used since most of these resins soften in temperature ranges of from about 150° F. to 300° F.

In Figure 1 there is illustrated a wood product board that is composed of sawdust particles **10**, wood chips **11** and wood pulp fibers **12**. These materials are bonded together by either a thermosetting or thermoplastic resin of a suitable type, depending upon the service to which the board will be placed. The sawdust, wood chips and wood pulp fibers are bonded together under heat and pressure until the bonding resin sets, and cools if the bonding resin is a thermoplastic material. The plyboard product of Figure 1 is one that does not present any grain structure since the wood pulp fibers **12** are interspersed at random throughout the body of the wood product in all directions.

In Figure 3 there is illustrated a wood product veneer sheet **13** that is made like the product illustrated in Figure 1 except that the veneer sheet may be as thin as 1/20", thus presenting a wood product veneer sheet of a thickness similar to that of machine-cut veneer so that it can be used in the same way and in the same places as machine-cut veneer.

In either of the products of Figures 1 and 3, the wood chips may be omitted if the mottled effect in the surface of the product is not desired.

In Figure 2 there is illustrated a wood product in the form of a board that is made in the same manner as the product illustrated in Figure 1, but the wood pulp fibers **12a** are arranged substantially parallel to one another whereby a definite grain is established in the product of Figure 2. This graining of the product can be obtained by correct handling of the wood pulp and of the mixture of sawdust, wood chips and wood pulp during the manufacture of the wood product, which will be hereinafter described.

In Figure 4 there is illustrated a wood product veneer sheet **15** that is grained in the same manner as the product of Figure 2, and is made in the same way and incorporates the same materials of sawdust, wood chips and wood pulp bonded with a suitable resin.

In Figure 5 there is illustrated a sheet of plyboard **20** that has the individual plys **21**, **22** and **23** each made from a wood product veneer sheet such as that illustrated in Figure 4. It will be noted, however, that the grained wood product veneer sheet constituting the plys of the plyboard **20** are laid so that the grain of the respective sheets is angular to the grain of adjacent sheets. Thus, by utilizing grained wood product veneer sheets, a plyboard of increased strength can be obtained in much the same manner as that now obtained in the use of machine-cut wood veneers that are plied in a like manner.

In Figure 6 there is illustrated an article of manufacture in the form of a U-shaped product **25**. The U-shaped product of Fig. 6 can be formed from a wood product plyboard such as that illustrated in Figs. 1 and 2 or from a wood product veneer sheet, such as that illustrated in Figs. 3 and 4, or from a plyboard such as that illustrated in Fig. 5 when the bonding resin of the wood product is a thermoplastic material. Under these circumstances, the wood product board, or veneer, or plyboard can be heated to a temperature at which the bonding resin again softens to re-form the sheet into the U-shaped product of Fig. 6, whereupon the sheet will be allowed to cool so that the resin will set and the sheet will retain its formed shape.

It has been found that the use of wood pulp fibers in the wood product produces a structure that is superior to a product in which sawdust or wood chips alone are used. The wood pulp fibers, even when incorporated in a wood product in percentages as low as 5 to 10% increase the strength of the wood product. This is believed to be the result of the longer wood pulp fibers projecting across the granules formed by the sawdust or the sawdust and wood chips when used together, and the matting effect produced by the pulpwood fibers throughout the mass of the wood product board or veneer.

The increase in strength of the wood product board or veneer is even more noticeable when the product is grained, as when the mixture is collected on an endless wire belt as in a Fourdrinier type paper-making machine. When the grained wood product veneer is plied, a plyboard is produced which is even more resistant to warping than plyboard produced from machined wood veneer as a result of the lack of continuity of fibers and particles over any substantial length of the veneer.

While a manufactured product, such as that disclosed in Fig. 6, can be made from a re-formed sheet of wood product veneer made according to this invention, yet such a manufactured product can also be made by placing a prepared mixture of the materials between male and female mold members and applying heat to the materials concurrently with pressure to obtain the desired density of material in the walls of the product and cure or set the resin which bonds the sawdust, wood chips and wood pulp together.

The properties of the wood product veneer depend on the specie of wood from which the sawdust, wood chips and wood pulp are made, or upon the mixture of species of woods used. It also depends on the percentage of wood pulp mixed with the sawdust or with the sawdust and wood chips since an increase in the amount of wood pulp incorporated in the product increases the strength of the product accordingly, and also increases the density of the product.

Further, the percentage of resin used to bind the wood particles together has a substantial effect on the strength of the product, this taken with the pressure applied to the wood particles and resin while bonding the resin to the wood particles. For example, a high pressure and a low percentage of bonding resin will produce a wood product veneer sheet of high density and high strength. When the resin content is increased, the pressure may be reduced, within limits, to obtain a product of a higher resin content and of substantially the same strength.

On the other hand, relatively low pressure applied to the wood particles and a low resin content produces a wood product veneer that has a porous structure without any great strength and as the resin content is increased the porosity of the structure is reduced but its strength is increased.

Thus, it will be seen that wood product veneer sheets, or manufactured wood products made in accordance with this invention can be given substantially any desired characteristics depending upon the species of woods used, the percentage of the various wood particles used relative to one another, the amount of resin used and the pressure applied to the materials during setting of the bonding resin.

The wood pulp used in the wood product veneer may be obtained by any conventional process such as in a hammer-mill or by mechanically abraiding wood pieces into pulp, or by chemical processes.

When making the wood product of this invention, sawdust and wood chips are prepared in the desired sizes. The so prepared wood chips and sawdust, or sawdust when used alone, is then dried, as is the prepared wood pulp. The wood pulp and sawdust or sawdust and wood chips are then mixed together in desired proportions while in the dry state. To this prepared mixture there is added a bonding resin which may be either in a dry condition or in a wet condition, depending upon the nature of the bonding agent which may be in the form of resin granules or in the form of a resin solution, or conventional water-soluble glues can be used. While it has been stated that the binding agent is a part of the prepared mixture, yet the binding agent can be applied to the mixture at a later step in the process.

In any event, the mixture of wood pulp and sawdust, or sawdust and wood chips, is placed upon a carrier in a uniform depth. If the mixture has not been dried previous to the time it is placed on the carrier, it can be dried while on the carrier, and in this way eliminate the predrying of the wood particles and fibers before they are mixed together.

When the wood particles and fibers are dry, resin can be added to the mixture of particles and fibers either by way of a dry mix or by way of a solution.

The so prepared mixture, with the bonding agent added, is then placed under pressure to compress the mixture to a predetermined thickness and density, depending upon the original thickness of material that has been uniformly distributed.

Heat is applied to the mixture concurrently with the application of pressure, which will cure the bonding agent if it is of the thermosetting type, and will dry the bonding agent if it is of a water soluble type. Should the bonding agent be of a thermoplastic type, the application of heat will cause the resin to flow into contact with the wood fibers and wood particles, and a subsequent step of cooling can be applied to the materials while still under pressure to set the thermoplastic bonding agent.

In Figure 7 there is illustrated a machine that performs a method of producing wood product veneer sheets like that disclosed in Figures 1 and 3. In this apparatus wood particles in the form of sawdust or sawdust and wood chips together with wood particles in the form of wood pulp fibers in a desired mix are fed into a hopper **30**. A paddle-type feeder **31** rotates in the bottom of the hopper **30** to feed predetermined quantities of the mixture of wood particles and wood fibers onto an endless belt **32** that extends between supporting and driving cylinders **33** and **34**. A doctor blade **35** is adjustable vertically relative to the belt **32** to level out the wood particles and fibers fed from the hopper **30** and to distribute them uniformly over the belt at a uniform depth.

The wood particles and fibers fed from the hopper **30** may also contain a bonding agent, the wood particles and fibers having been previously dried and the bonding agent added to the mix. However, if desired, the dried wood particles and wood fibers can be fed from the hopper **30** and the bonding agent be added to the so dried mix by means of a spray-head **36**.

An overhead endless belt **37** moving at the same linear speed as the endless belt **32** retains the mix with binding agent added between pressure belts **38** and **39**.

These pressure belts **38** and **39** consist primarily of a series of pressure shoes **38***a* and **39***a* that move the belts **32** and **37** toward one another and thereby compress the mix between them to give to the mix a predetermined compressed thickness.

The compressed mix between the belts **32** and **37** is then carried forward between the steam chests **40** and **41** that are spaced apart a distance to retain the mix at its compressed thickness. The mix between the belts **32** and **37** is thereby heated to a desired temperature according to the resin that is in the mix to set or cure the same. The time involved for setting the bonding agent is also determined by the type of bonding agent used.

From between the steam chests **40** and **41** the belts **32** and **37** pass between cooling chambers **42** and **43** to reduce the temperature of the veneer

sheet, and/or to set a thermoplastic resin, if such has been used as a bonding agent. Pressure is also retained on the mix during the cooling to prevent shrinkage of the material, and in fact the cooling chambers 42 and 43 can be set in spaced relationship that is slightly less than the spaced relationship of the steam chambers 40 and 41 if any shrinkage takes place in the material due to the particular materials used in the mix.

In Fig. 8 there is illustrated a machine for performing a method of producing a wood product veneer that contains a decided grain.

In the machine and method disclosed in Figure 8, wood particles consisting of wood pulp and sawdust or sawdust and wood chips are supplied to the pulp box 50 in which an agitator 51 retains the wood particles and wood fibers in uniform distribution in the percentages in which they were added to the pulp box. Overflow from the pulp box across the feeding ledge 52 causes the mix floated with a water carrier to be delivered upon an endless wire web 53, such as that as can be found in any conventional Fourdrinier type of papermaking machine. The wire web 53 in picking up the overflow from the pulp box 50 causes the wood pulp fibers to establish a definite grain in the mix which is parallel to the forward direction of movement of the wire web 53. Suitable deckle straps 54 control the width of the mix as it is applied to the wire web 53.

A suction box 55 is positioned near the forward end of the web 53 to remove the major portion of the water from the mix. As the mix forms a web, it is picked up by the fabric belt 56 and is carried over the surface of a drying cylinder 60 to dry the wood particles and wood fibers contained in the web 65.

The dried web leaving the drying cylinder 60 may then pass between spray-heads 61, that may be positioned on one or both sides of the web 65 to apply a bonding agent to the web of dried wood particles and wood fibers.

The web 65 with the bonding agent added is then carried to between belts 32*a* and 37*a* of a machine like that described in Figure 7 to thereafter compress the web 65 to a desired thickness and cure the resin to bond the wood particles and wood fibers together.

It will thus be seen that the machine and method of making a wood product veneer as disclosed in Figure 8 will produce a veneer sheet in which there is a decided grain in that a large percentage of the wood pulp fibers will lie relatively parallel with one another.

It will be understood that various modifications of the invention can be made without departing from the basic concept of the invention, and that the modifications that fall within the scope of the appended claims are intended to be included herein.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A rigid wood product veneer sheet consisting of a mixture of sawdust, wood chips and at least 5% wood pulp fiber with the wood pulp dispersed in the sheet to establish a grain therein extending in one direction throughout the sheet and bonded together with a synthetic resin.

2. A rigid wood product veneer sheet consisting of wood chips, sawdust, at least 5% pulpwood fibers and a resin binder, all bonded together under heat and pressure, said wood pulp fibers being dispersed in said sheet in such a manner as to establish a determined grain extending in one direction throughout the sheet by substantially parallel arrangement of the fibers.

3. The method for producing a rigid grained artificial wood veneer sheet that consists of, mixing together wood particles and wood pulp fibers in a liquid vehicle, floating the mixture onto a moving carrier in a manner causing rearrangement of the wood pulp fibers in the mixture into substantially parallel arrangement relative to each other to establish a flexible web grained longitudinally of the direction of movement of the web as deposited on the moving carrier, removing the liquid vehicle from the web and drying the same while flexible, applying a bonding agent to the web after drying thereof, moving the web thereafter in a planar condition while applying pressure to the web to compress the same to a predetermined thickness while wet with the bonding agent, and setting the bonding agent with the web in planar condition while pressure is maintained on the web until the bonding agent is set to retain the predetermined thickness.

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