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PLYWOOD MANUFACTURE WITH CONTROLLED GLUE SPREAD

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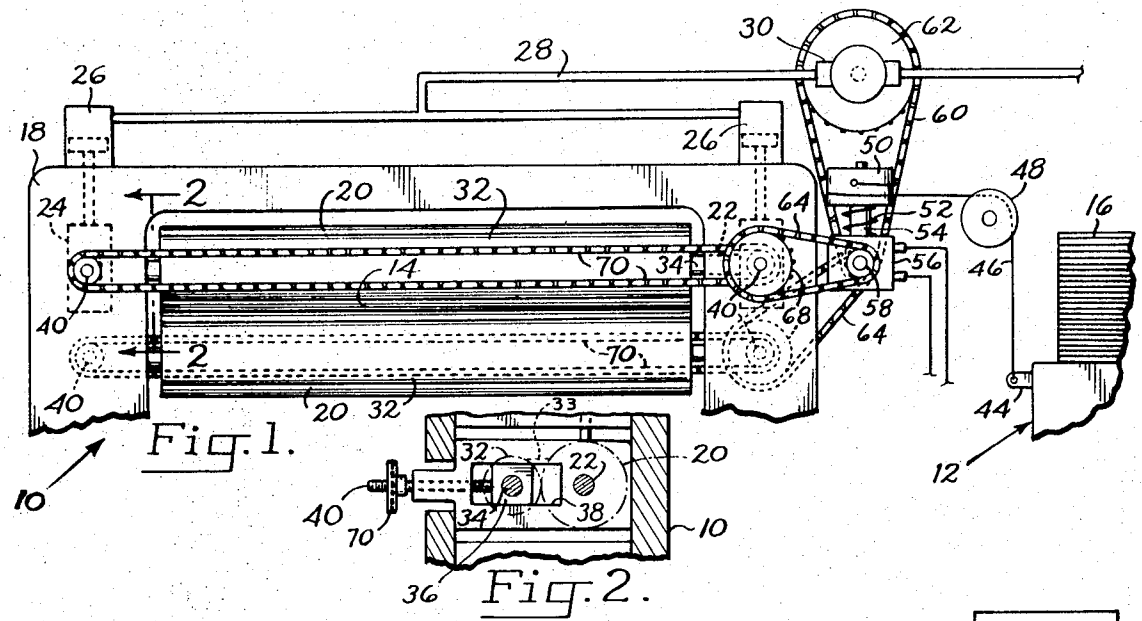



Fig. 1.




Fig. 2.

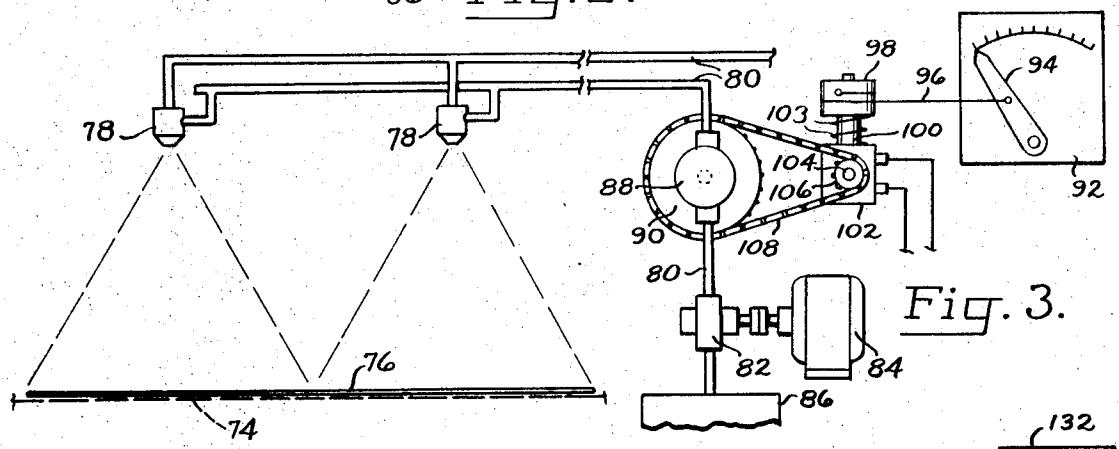



Fig. 3.

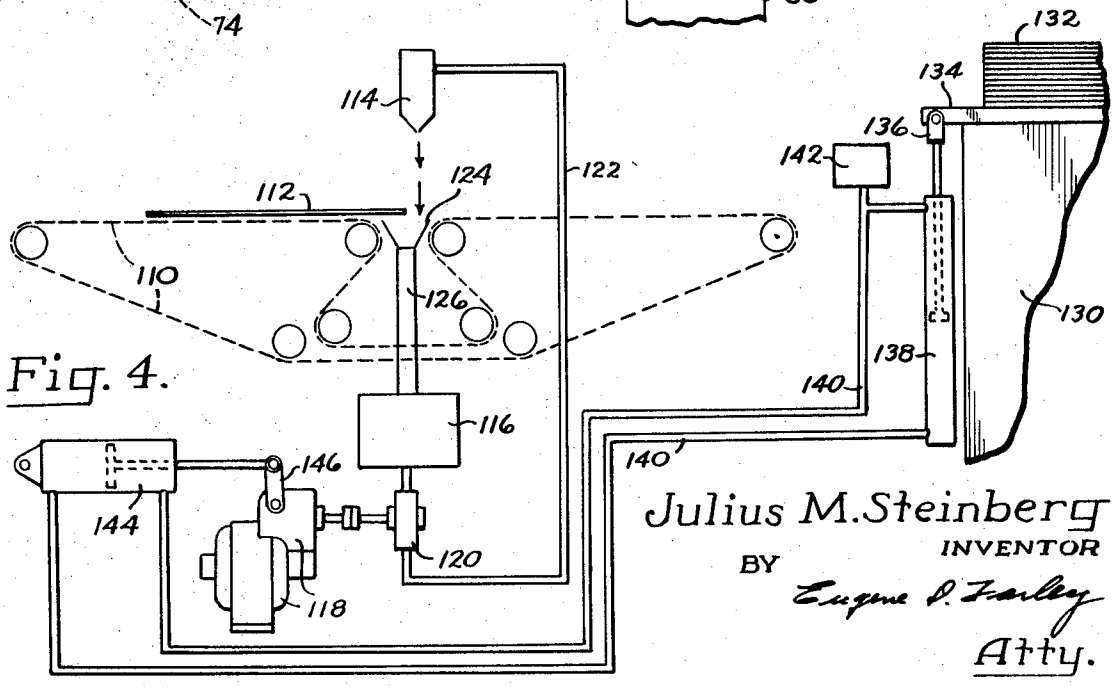



Fig. 4.

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# PLYWOOD MANUFACTURE WITH CONTROLLED GLUE SPREAD

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## ABSTRACT OF THE DISCLOSURE

Plywood is manufactured by spreading with glue the surfaces of a sequence of wood veneers. The spread veneers are assembled in plywood-forming assemblies. The assemblies are stacked sequentially as they are formed. During the spreading operation the amount of glue spread is altered progressively to apply to the successive veneers the optimum spread as determined by their assembly time. The resulting stack then is pressed to consolidate the assemblies and bond together their component veneers.

This invention relates to the manufacture of plywood.

In the manufacture of plywood, wood veneers conventionally are spread with selected glues in selected types of glue spreaders. The spread veneers are assembled in plywood-forming assemblies which are stacked sequentially as they are formed. When a stack containing the desired number of assemblies has been obtained, the stack as a unit is introduced into the press. There it is consolidated under conditions calculated to consolidate the veneers and bond them together into plywood.

A problem of long standing and of considerable consequence is that occasioned by the length of time the assemblies must remain in the stack preliminary to pressing, i.e. "the assembly time." In practice, this time varies from about 2 to 25 minutes.

During the assembly time, the applied glue tends to lose its solvent into the veneers to an extent which is directly proportional to the time. As a result, there is dry out of the glue at the bottom of the stack, where long assembly times prevail, and over application of the glue at the top of the stack, resulting in over penetration, where short assembly times prevail. Both of these conditions affect adversely the quality of the plywood bond.

In recognition of this problem, it currently is conventional practice in the plywood industry to apply an amount of glue which is an average amount. This in effect makes the best of a bad situation by over and under-spreading the veneers as little as possible.

For example, when spreading 1/10 inch core veneer in protein hot pressing, the common spread is 80 pounds per thousand square feet. This is an average value, since in actuality the bonding of the long assembly time veneers would be improved if the glue spread were increased by 10 pounds. Conversely, the bonding of the short assembly time veneers would be improved if a spread of from 10–20 pounds less glue were employed.

It is the general purpose of the present invention to provide method and apparatus for overcoming the foregoing problem and to apply to a succession of plywood veneers, to be assembled and stacked in plywood-forming relation, the optimum quantity of glue as determined by the assembly time.

It is another important purpose of the present invention to provide method and apparatus for achieving the before mentioned general purpose simply and without costly and complicated alteration of conventional plywood making apparatus or plant routines.

It is a further purpose of the present invention to provide method and apparatus for achieving the above mentioned general purpose irrespective of whether the glue is spread on the veneers by roll coating, spray coating, extrusion, or curtain coating methods.



In the drawings:

FIG. 1 is a fragmentary schematic view in side elevation illustrating plywood veneer roll coating apparatus in which the presently described improvement is incorporated in a first embodiment;

FIG. 2 is a fragmentary sectional view, taken along line 2—2 of FIG. 1; and

FIGS. 3 and 4 are schematic views illustrating plywood veneer spray coating and curtain coating apparatus, respectively, both incorporating the herein described improvement in second and third embodiments.

FIG. 1 illustrates the application of the invention to a plywood manufacturing system including a wood veneer roll coater indicated generally at **10** with associated stacking table, indicated generally at **12**.

It is usual practice to feed wood veneers **14** through the roll coater and to assemble the resulting glue-coated core veneers with an appropriate disposition of face veneers to form a stack **16** of plywood-forming assemblies on table **12**. For the convenience of the operator, the table is of such a construction that it indexes downwardly as the stack is built up. This keeps the upper surface of the stack at a convenient working level.

The essential components of roll coater **10** comprise a frame **18** which supports a pair of cooperating glue-spreading rolls **20** having shafts **22** mounted in bearings **24**. The bearings are mounted in a suitable vertical guideway, not illustrated, so that the rolls may be moved toward and away from each other by means of pneumatic cylinders **26**. The latter may be spring-pressed or double acting and are supplied with air under pressure by means of a pneumatic line **28**. Line **28** includes an air regulating valve **30**.

Rolls **20** serve the dual functions of applying glue to the veneers and of conveying the veneers through the unit. They are driven by a conventional drive, not illustrated.

Also included in the roll spreader are a pair of doctor rolls **32**. These have for their function loading spreader rolls **20** with glue **33**. They are mounted on shafts **34** supported on bearings **36** which are received in guideways **38**. Screws **40** are attached to the bearings for adjusting them, and doctor rolls **32**, which they support, inwardly and outwardly with respect to applicator rolls **20**.

It is the present concept to vary the amount of glue applied to successive veneers as they pass through the apparatus in a manner resulting in the application of the optimum amount of glue to each veneer as required to insure optimum bonding after the panels have been assembled, stacked, and pressed.

This may be accomplished by appliances which work on a unit basis, i.e. adjust glue spreads progressively with the number of units put through the spreader, or on a time basis, i.e. adjust spreads progressively with the time required to coat and assemble the veneers comprising stack **16**. This time is substantially a constant factor.

The arrangement illustrated in FIG. 1 utilizes the unit basis.

Stacking table **12** is provided with a bracket **44** to which is attached one end of a cable or other flexible link **46**. The cable is reeved about a pulley **48**. The other end of the cable is fastened to a rotatable drum **50** suitably biased by means of a spring **52**.

Drum **50** is fixed to the input shaft **54** of an electrically operated servo motor **56**. The latter may be any one of various standard makes all of which serve the general function of modifying a command power input, i.e. that fed into the mechanism by input shaft **54**, as required to produce a predetermined power output on an associated output shaft **58**.

If desired, a conventional electrical impulse generator, not illustrated, may be mounted on the shaft of pulley **48** and connected to the servo motor, replacing drum assembly **50**.

Power output shaft **58** carries three sprockets. The first drives a connecting chain **60** which meshes with a sprocket **62**. This adjusts air valve **30** and controls the air supply to cylinders **26** which adjust the spacing of glue applicator rolls **20**.

The other two sprockets on power shaft **58** drive chains **64**. These mesh with sprockets **68** fixed to screws **40**. The latter are arranged in pairs, two on each side of doctor rolls **32**, the sitting of which they adjust. The members of each pair of screws are interconnected by chains **70**.

The operation of the apparatus of FIGS. 1 and 2 is as follows:

As the stack of plywood assemblies **16** on table **12** is built up, table **12** is indexed downwardly to keep the top of the stack at substantially constant level. At the beginning of the operation, flexible cable **46** is wound about spring-biased drum **50** on shaft **52**. However, with lowering of table **12**, cable **46** unwinds and rotates shaft **52**. This in turn energizes servo motor **56** and drives power shaft **58**. This has two effects, either one of which may be used to achieve the desired result.

First, it drives chain **60** and sprocket **62** on valve **30**, adjusting the valve by progressively opening or closing it. In the usual situation valve **30** operates to apply greater air pressure to cylinders **26** with the result that spreader rolls associated with the cylinders are adjusted to positions in which they continually more closely approach each other. This has the effect of decreasing the spread of glue applied to veneers **14**.

Secondly, shaft **58** drives chains **64** which in turn drive all of screws **40**. In the usual case, these work to advance doctor rolls **32** with which they are associated so that they more closely approach spreader rolls **20** and decrease the amount of glue applied to the veneers.

There thus is obtained a progressive adjustment of the spreader rolls and doctor rolls to decrease the amount of glue applied to the veneers as stack **16** increases in height. As a result, increased amounts of glue are applied to the lowermost assemblies of the stack, which have the longest assembly time; progressively decreased amounts, to be superimposed assemblies. The least amount of glue then is applied to the upper assemblies which have the shortest assembly time. In this manner the optimum amount of glue may be applied to all of the assemblies.

The operation of the unit illustrated in FIG. 3 is similar, except that it illustrates application of the system to a spray coating apparatus, and utilizes a time control rather than a unit control.

As illustrated schematically in FIG. 3, a conveyor **74** conveys plywood veneers **76** past a spray station in which they are sprayed with glue by means of appropriately constructed and disposed spray heads **78**. The spray heads may be of either the airless or air categories and are supplied with glue under pressure through lines **80**. A pump **82** is driven by a motor **84**. It pumps glue from a reservoir **86** through conduit **80** and through a valve **88** to deliver it in controlled amount of spray heads **78**. Valve **88** is regulated by means of a shaft on which is mounted a sprocket **90**.

The latter sprocket and the valve which it operates are controlled by means of a timer or panel counter **92**. The indicator **94** of the timer is connected by means of a flexible cable **96** to a drum **98**.

Drum **98** of FIG. 3 corresponds in its operation to drum **50** of FIG. 1. It is fixed to a shaft **100** and biased to a wound-up position by means of spring **103**.

Shaft **100** supplies the input power to a servomechanism **102** having a power shaft **104**. The latter mounts a sprocket **106** which meshes with a drive chain **108**. The chain in turn meshes with sprocket **90** which regulates valuve **88**.



Since on a given plant schedule the time is known which is required to build up the stack of plywood assemblies comprising the predetermined press load, timer **92** can be set accordingly. Thus ts the spray unit operates, lever **94** of the timer moves clockwise, unwinding drum **98** against the force of spring **103**. This rotates servo motor power input shaft **100** which adjust valve **88** through the action of output shaft **104** and connecting chain **108**.

Normally the adjusting is made in the direction of continuously decreasing the quantity of glue fed to spray heads **78**. Since conveyor **74** moves at a constant rate, this has the effect of continuously diminishing the spread of glue applied to veneers **76** as time progresses.

As a consequence, the lower assemblies of the press load have an optimum heavy coat of glue while the uppermost assemblies, having the shortest assembly time, have a correspondingly lesser amount of glue as required to produce optimum bond in all of the component assemblies of the press load.

The apparatus illustrated in FIG. 4 illustrates the application of the herein described principle to the operation of a plywood veneer pressure feed or gravity feed curtain coater controlled by an actuator working on the unit principle, as is the case with the apparatus of FIG. 1, depicting the pressure feed type.

A conveyor **110** conveys plywood veneers **112** past a coating station which includes a curtain coater **114** of standard construction.

The curtain coater is supplied with glue from a reservoir **116**. The glue is pumped by means of a vari-drive motor **118** which, in turn, drives pump **120**. The vari-drive motor and pump unit thus serve a valving function, since the amount of glue circulated through the system is directly proportional to the speed of the motor.

Glue then is pumped through conduit **122** into curtain coater **114**. Surplus glue is collected in funnel **124** which return it to reservoir **116** through pipes **126**.

This much of the curtain coater assembly is standard.

As the veneers are coated, they are laid up into plywood-forming assemblies on stacking table **130** which corresponds to table **12** in FIG. 1. As a stack **132** of plywood assemblies is built up on the work table, the latter is indexed downwardly to keep the work surface level. This movement drives the mechanism which controls the rate of application of the glue to the veneers.

Work table **130** mounts a laterally extending bracket **134** to which is connected through a pin and clevis **136** the piston rod of a double-acting hydraulic cylinder **138**.

Cylinder **138** communicates through hydraulic conduits **140** with an oil reservoir **142** and with a cooperating double-acting cylinder **144**. The piston rod of the latter cylinder is coupled to the control lever **146** of vari-drive motor **118**.

Thus, as work table **130** lowers, cylinder **138** forces oil into cylinder **144**, the piston rod of which adjusts lever **146** commensurately. This in turn adjust vari-drive motor **118** and controls the amount of glue pumped by pump **120** to curtain coater **114**.

Hence in this case also, the amount of glue applied to the veneers may be altered progressively. Normally, as stack **132** builds up on table **130**, the result is progressively to diminish the amount of glue supplied to curtain coater **114** and hence applied to wood veneers **112**. In this manner the desired control of the amount of glue applied to the veneers is achieved.

Having thus described my invention in preferred embodiments, I claim as new and desire to protect by Letters Patent:

**1.** The method of making plywood which comprises:

(a) spreading with glue selected surfaces of a sequence of wood veneers,

(b) assembling the veneers in plywood-forming assemblies,

(c) stacking the assemblies sequentially as they are formed,

(d) adjusting the amount of glue spread on the veneers progressively to alter the amount of glue applied to successive veneers and thereby provide optimum glue spreads for all assemblies as determined by their assembly times, and

(e) pressing the stack to consolidate the assemblies and bond together their component veneers.

**2.** The method of claim **1** wherein the amount of glue spread on the veneers progressively is diminished.

**3.** For use in the manufacture of plywood, the combination of

(a) glue spreader means,

(b) conveyor means for conveying a sequence of wood veneers through the glue spreader means while spreading their surfaces with glue,

(c) stacking means for stacking the spread veneers in plywood-forming assemblies preliminary to pressing the stack as a unit; and

(d) control means operatively connected to the spreader means for altering the amount of glue applied to the veneers progressively with the time of assembling the veneers, as required to provide optimum glue spreads for the veneers as determined by their assembly times.

**4.** The combination of claim **3** wherein the glue spreader means comprises roll-type glue spreader means.

**5.** The combination of claim **3** wherein the glue spreader means comprises roll-type glue spreader means including a pair of cooperating glue spreader rolls and adjusting means for adjusting the spacing between the rolls, and wherein the control means is operatively connected to the adjusting means.

**6.** The combination of claim **5** wherein the control means comprises timing means operatively connected to the adjusting means.

**7.** The combination of claim **5** wherein the stacking means comprises a vertically indexable stacking table and wherein the control means comprises motor means connected to the adjusting means and link means interconnecting the motor means and the stacking table and operative to translate motion of the stacking table into energization of the motor means commensurately with the movement of the table.

**8.** The combination of claim **3** wherein the glue spreader means comprises roll spreader means including a spreader roll and associated doctor roll with adjusting means for adjusting the position of the doctor roll toward and away from the spreader roll and wherein the control means operatively is connected to the adjusting means.

**9.** The combination of claim **3** wherein the glue spreader means comprises glue spray means including a fluid circuit for circulating glue under pressure to the spray means, and including valve means in the circuit operative to control the amount of glue fed to the spray means, the control means being operatively connected to the valve means for altering the amount of glue applied to the veneers progressively with the time of assembly.



**10.** The combination of claim **3** wherein the glue spreader means comprises curtain coating means including a circuit for circulating glue under pressure to the curtain coater means, the circuit including valve means for controlling the flow of glue through the circuit, and wherein the control means operatively is connected to the valve means for altering the amount of glue supplied to the veneers progressively with the assembly time.

**11.** The combination of claim **3** wherein the stacking means comprises a vertically adjustable stacking table provided with drive means for adjusting its elevation progressively as the stack increases in height and wherein the control means comprises servo motor means having input and output shafts, first connecting means interconnecting the input shaft and the table, and second connecting means interconnecting the output shaft and the glue spreader means.

**12.** The combination of claim **3** wherein the stacking means comprises a vertically indexable stacking table incrementally shiftable as the work stack builds up upon it, the control means comprising a pair of hydraulic cylinders in hydraulic circuit with each other in series relationship, one cylinder being operatively connected to the table and the other cylinder being operatively connected to the glue spreader means for altering the amount of glue applied to the veneers progressively with the assembly time and in amount determined by the adjustment of the first cylinder by movement of the stacking table.

**13.** The combination of claim **3** wherein the control means comprises servo motor means having input output shafts, timer means connected to the input shaft for actuating the same, and connecting means interconnecting the output shaft with the glue spreader means for adjusting the amount of glue applied to the veneers commensurately with the lapsed time as determined by the time means.


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