ABSTRACT OF THE DISCLOSURE

An automatic plywood layup line is disclosed which is comprised of a plurality of vertically spaced generally horizontal in-line conveyor surfaces, each having an input end and output end. Several conveyor surface loader systems are laterally spaced from the conveyor surfaces and are adapted to spread selected veneer sheets with glue and place them over the input ends of the respective conveyor surfaces. At the output ends of the conveyor surfaces are a pair of sheet positioners which serve to position each individual sheet over a layup station as it is motivated outwardly from the end of the central conveyor system. At the output end of the layup station two men may be provided for guiding the veneer sheets onto the stack of forming panels and also to visually scan each individual sheet in order to minimize rejects.

BACKGROUND OF THE INVENTION

This invention relates generally to a machine which sequentially conveys and then stacks individual thin sheets such as wood veneer. More particularly, the invention relates to an automatic plywood layup line that conveys individual veneer sheets selectively spread with glue to a layup station where plywood panels are formed.

Plywood is, as those skilled in the art know, comprised of a plurality of wood veneer sheets glued together with adjacent veneer sheets having their respective grains running in transverse directions. Generally, a plywood panel is formed by sequentially stacking the individual veneer sheets one atop the other with the appropriate glue lines in place. For example, in a three-ply panel an individual back veneer is positioned on a surface and then an individual core or cross band sheet is placed atop the back and finally the face sheet is placed atop the core. It will be appreciated that a coating of glue can be applied to either of the surfaces which come in contact with one another. For example, both sides of the core veneer could be coated with glue. After the three sheets of veneer are sequentially arranged, the panel is pressed and the glue is allowed to cure.

In the formation of plywood having more than three plies, for example, a five-ply panel and all odd ply panels, an additional sheet or sheets of veneer is utilized. In forming a five-ply panel a back would first be laid, then a core veneer sheet, then a center sheet, then another core sheet and finally the face sheet atop the second sheet of core veneer. Again, appropriate glue lines are established between adjacent veneer sheets. The general formation of plywood panels is well understood by those skilled in the art and a further description of plywood formation is not deemed necessary to an understanding of the present invention.

The prior art offers many automatic layup machines capable of forming plywood panels without the old utilization of the normal manual labor. Several examples of prior art automatic layup machines can be seen by referring to the U.S. patents issued to C. C. Clapp et al., 3,312,327 and U.S. Patent 3,247,042 issued to E. B. Denton et al. Both of these cited patents are assigned to the same assignee as is the present invention.

SUMMARY OF THE INVENTION

Briefly stated, the present invention is practiced in one form by providing a plurality of horizontal conveyor surfaces positioned generally in line and spaced apart, one atop the other. In addition, conveyor loaders are provided at the input ends of each conveyor surface and they sequentially position a sheet of veneer on the input end of the respective conveyor surface. Glue line applicators are positioned between the conveyor loaders and their respective conveyor surfaces and as an individual sheet of veneer is motivated from the conveyor loader to the conveyor surface, it receives a glue line on one surface. Finally, a layup station is provided at the output ends of the conveyor surfaces to receive the individual veneer sheets as they are conveyed off of their respective conveyor surface and onto a forming stack. At the layup station, two men are positioned opposite one another and on either side of the output ends of the conveyor surfaces in order to scan each individual veneer sheet as it falls onto the forming stack.

FIG. 1 is a simplified schematic representation of the several conveyor surfaces together with the attending conveyor loaders, glue applicators and layup station. FIG. 2 is a side elevation view of the central conveyor system showing the face loader and also the layup station.

FIG. 3 is a plan view looking straight down showing the several conveyor loader areas together with the floor plan of the central in-line conveyor system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. 1 the present invention will be described in general terms according to the layout of the elements of the plywood layup machine. Before proceeding it should be appreciated that the ultimate object of
any plywood layup machine is to produce plywood panels having a predetermined number of plies which are of sufficient quality and integrity to meet minimum industry standards. During the accomplishment of this object, the only physical change occurring to the veneer sheets is that selected sides are coated with a layer of glue so that when the veneer sheets are laid up to form the panels the proper adhesive quantity and quality will be present to join the veneer sheets together.

The conveyor system is generally indicated as 1 and is comprised of a plurality of horizontally extending in-line conveyor surfaces positioned one atop the other and indicated respectively, from top to bottom, as 2, 3 and 4. Each of the conveyor surfaces 2, 3 and 4 will be individually described in general terms in relation to the overall conveyor system 1. Additional details of the conveyor surfaces will be described when referring particularly to FIGS. 2 and 3.

The top conveyor surface 2 is comprised of a plurality of individual endless flat belts, each indicated as 5. Of course, it will be appreciated that the flat belts 5 are maintained in a fixed travel position by any suitable frame and train means. The endless flat belts 5 are likewise driven by any suitable drive means (not shown) such as a motor driven shaft about which the flat belts are trained. The primary requirement for the drive means is that it motivate the conveyor surface 2 and its flat belts 5 in a direction from left to right as indicated by the directional arrows in FIG. 1. Prior to taking up a description of the middle conveyor surface 3, it is to be noted that the entire top conveyor surface 2 moves up and down in order to engage a veneer sheet for proper conveyance. This feature will be more fully described later. In the embodiment shown, the top conveyor surface 2 is pivotally mounted at one of its ends.

Each conveyor surface has an input end and an output end with the input end of the top conveyor surface 2 being generally indicated at 6. The output end of the top conveyor surface is generally indicated at 7. Of course, it will be appreciated that the top conveyor surface 2 will be charged with a veneer sheet at its input end 6 and then conveyed to its output end 7 where it then is directed to a layup station 8.

Turning now to a description of the middle conveyor surface 3, it is positioned in line and vertically below the top conveyor surface 2. Conveyor surface 3 is also comprised of a plurality of endless flat belts indicated as 9 and the conveyor surface 3 may likewise be driven by any suitable means desired. The middle conveyor surface is generally horizontal such that there would be three conveyor surfaces ending generally at the same horizontal position. By using the pivotal portion 10 of the middle conveyor surface 3 as in the present embodiment, it is possible to save building material and also to eliminate additional elements at the layup station 8.

The bottom conveyor surface 4 is comprised of a plurality of axially spaced powered rollers each indicated as 13. The bottom conveyor surface 4 comprised of the powered rollers 13 also has an input end generally indicated as 14 and a corresponding output end 15 which is at the same horizontal position as the output ends of the top and middle conveyor surfaces. It will be appreciated that the powered rollers 13 may be driven by any suitable means such as a motor driving a continuous chain linking each powered roller 13. The powered rollers 13 are mounted in a suitable frame which may be seen when referring to FIGS. 2 and 3 and the supporting frame provides the flat horizontal nature of conveyor surface 4.

Before generally describing the device utilized to position each individual veneer sheet at the layup station 8, it should be mentioned that the composition of the several conveyor surfaces can be comprised of different elements. For example, top conveyor surface 2, instead of being comprised of a plurality of endless flat belts 5, could be comprised of a plurality of powered rollers just as conveyor surface 4. Likewise, conveyor surface 4 comprised of powered rollers 13 could be comprised of a plurality of flat belts. Any device that will convey a veneer sheet from an input end in a linear manner to its output end with sufficient momentum is within the scope of the generically termed conveyor surfaces.

Next to be described are the veneer positioners which are generally indicated at 16 and are adapted to cause a veneer sheet to be propelled away from the conveyor system 1 and properly aligned for stacking at the layup station 8. A top sheet positioner 17 is positioned between the end of the pivotal portion 10 of the middle conveyor and the layup station 8. The input edge 18 of the sheet positioner 17 is generally in the same horizontal plane as the output edge 19 of the top sheet positioner 17. A curvilinear surface is provided extending a suitable distance axially to an output edge 19. From this description, it is readily apparent that as individual veneer sheets are motivated along the top and middle conveyor surfaces 2, 3 and then to the common pivotal portion 10, the individual sheets will be propelled across the curvilinear surface of the top sheet positioner 17. As previously mentioned, the drive means for the conveyor surfaces are selected such that a sufficient amount of momentum is imparted to the individual sheets as they are propelled across the surface of the top sheet positioner 17. The ideal momentum is just enough to cause the trailing edge of an individual veneer sheet to leave the output edge 19 of the top sheet positioner 17. The details of the top sheet positioner 17 are fully described in a pending application having Ser. No. 128,779 entitled "Sheet Positioner" and on which a Notice of Allowance has been received from the Patent Office.

A bottom sheet positioner 20 is similarly arranged to accept veneer sheets from the output end 15 of the bottom conveyor surface 4. The details of the bottom sheet positioner 20 are not shown in FIG. 1, but rather are indicated in FIG. 2 and are in fact the subject of an issued U.S. Pat. 3,674,256 entitled "Thin Sheet Thrower" and assigned to the present assignee. The function of the bottom sheet positioner 20 is to accept the conveyed veneer sheets from the bottom conveyor surface 4 and then direct them to the proper position over the layup station 8. Although the details of the sheet positioner 20 as shown in FIG. 2 depict a sheet "thrower" assembly, it will be appreciated that the bottom sheet positioner may be comprised of a curvilinear surface similar to the top sheet positioner 17 without departing from the scope of the present invention.
It is apparent then that the intent of the sheet positioner area 16 is to direct in a sequential manner individual veneer sheets to a position over the layup station 6. At the layup station 6, two men positioned on either side thereof in order to catch the individual veneer sheets as they travel from the sheet positioners 17, 20 to the stack of veneer sheets 21 which is being continually built up thereby forming the sequentially arranged plywood panels. Their function is to guide the sheets from the position over the stack 21 provided by the respective conveyor surface and sheet positioner to the top of stack 21. The position provided by the conveyor surface and sheet positioners is generally in a horizontal plane disposed vertically above the top of the veneer stack 21. At this position, the two men will clutch the veneer sheet on either side thereof and guide it downwardly as it falls under the influence of gravity to the top of veneer stack 21. A fixed vertical surface or backstop 22 is provided as an additional positioning means for the stack being formed and the trailing edge of each veneer sheet is guided downwardly so that it abuts the backstop 22 thereby forming one straight side to the stack 21. An iron stop member 22a extends vertically upward adjacent the downstream side of stack 21 and is axially spaced therefrom a slight distance.

It is also the function of the two men to visually scan each veneer sheet as it comes from the sheet positioners 17, 20 for any defects which are serious enough to eliminate them from stack 21. By eliminating individual veneer sheets which are not suitable for plywood panels, it will be readily apparent that rejects are virtually eliminated prior to pressing and curing.

An additional characteristic of the veneer stack 21 is that it is being built up on a vertically adjustable flat bed 23. The vertical position of the flat bed 23 is adjusted as the veneer stack height increases in height, that is, as the stack continues to build up, the flat bed 23 will be lowered accordingly such that the two men will still be in a position to handle each veneer sheet and guide it to the top of stack 21.

The veneer stack 21 is built up of individual veneer sheets until a suitable number of pre-pressed panels are formed for final pressing and curing into plywood panels. After the press cycle, the normal procedure is to trim the plywood panels to their finished size in which the normal case is 4 feet by 8 feet.

The following is a general description of the conveyor system which means and their associated glue spreaders, it may be seen by referring to FIG. 3 that the conveyor surface loaders are laterally spaced from their respective conveyor surfaces. The purpose of each surface loader is to provide an individual veneer sheet at the input end of the respective conveyor surface.

The face conveyor surface loader, which is generally indicated at 24, may be of any suitable type known to the art. For example, one suitable mechanism for loading face veneer sheets may be seen by referring to the issued U.S. patent to C. C. Clapp et al. 3,312,327 and which is assigned to the assignees of the present invention. The disclosure relating to the vacuum pickup and transfer assembly is incorporated by reference herein. Although the mechanical face conveyor loader is not shown in FIG. 1, it is generally indicated in FIGS. 2 and 3. The details of the mechanical mechanism are not shown since they are not material to an understanding of the present invention, but they may be seen by referring to the aforementioned Clapp et al. patent. At the face loader station 24, a stack of face veneer sheets 25 is positioned adjacent to the input end 11 of the middle conveyor surface 3, with the longer dimension of stack 25 at right angles to the direction of sheet travel on the middle conveyor surface 3.

In addition to the stack of face veneer sheets 25 being worked, it is desirable to have a second stack of face veneer sheets 26 ready to take up the position of the working stack when it becomes exhausted. Ideally, as the last face sheet is loaded from the working stack of veneer sheets 25 the second stack 26 will automatically be conveyed into the working position directly adjacent the input end 11 of the middle conveyor surface 3 as the face loader 24 picks individual sheets off the top. By so adjusting the vertical position of stack 25 it is apparent that the top face sheet will always be in a proper horizontal position for loading onto the middle conveyor surface 3. Of course, the proper overall vertical position of the stacks of face veneer sheets 25, 26 can easily be provided by a raised platform indicated as 27.

Turning now to a general description of the center-back conveyor surface loader which is indicated at 28, it will be appreciated that its primary function is to position an individual back or center veneer sheet on the top conveyor surface 2 in the input end 6. The center-back loader 28 is generally on the same horizontal plane as the top conveyor surface 2 and is arranged and adapted to charge the input end 6 of the top conveyor surface 2 with an individual veneer sheet with its longer dimension perpendicular to its direction of travel as it is conveyed down the top conveyor surface 2 toward the top sheet positioner 17.

A portion of the center-back loader 28 is comprised of a center-back entrance conveyor surface indicated as 29. The entrance conveyor surface 29 extends outwardly from and at right angles to the top conveyor surface 2 and is positioned in a horizontal plane slightly above the top conveyor surface 2 when it is in its lower position prior to conveying the center or back veneer sheet. The entrance conveyor surface 29 is comprised of a plurality of powered rollers 30 which may be driven by any suitable means such as a motor and interconnected drive chain (not shown). It is to be noted that as the entrance conveyor surface 29 and its associated powered rollers 30 motivate an individual back or center sheet toward the input end of the top conveyor surface 2 it will generally position each sheet squarely over the several endless flat belts 5 comprising the input end 6 of the top conveyor surface. When each veneer sheet is positioned in such a manner the powered rollers 30 are stopped and the veneer sheet will be resting in a horizontal plane slightly above the top conveyor surface 2. When the proper sequential moment arrives the top conveyor surface 2 will move upward slightly in a pivoting manner about an axially spaced position from the input end 6.

Also provided as part of the center-back conveyor surface loader system 28 is an entrance conveyor surface charger means which is not shown in FIG. 1 but which is indicated by the reference numeral 31 in FIG. 3. Any suitable means is within the contemplation of the present invention that will, in the proper sequence, position a center or back veneer sheet on the entrance conveyor surface 29. Not only are mechanical means within the scope of the present invention but an individual person could readily position the veneer sheet over the entrance conveyor surface 29 in a suitable aligned manner. Suitable mechanical means may be adapted from the teaching of the aforementioned Clapp et al. patent.

From FIG. 1 it will be seen that the center-back conveyor surface loader system 28 is responsible for posi-
tioning both centers and backs over the top conveyor surface 2 through using the same entrance conveyor surface 4. When the proper section of the core is reached the bottom conveyor surface 4 pivots upwardly to pick the core veneer sheet off of the endless flat belts 41 from which position it can then be conveyed toward the layup station 8.

Although it is not absolutely necessary for the proper operation of the present invention, here again the core conveyor surface loader system 39 is shown utilizing two separate stacks 42 of core veneer sheets positioned on either side of the input end of the entrance conveyor surface 40. Again, any suitable means for transferring an individual core sheet from the stacks 42 to the endless flat belts 41 is within the contemplation of the present invention. If the double core stack arrangement is used or if a single core stack is utilized, it is desirable to position a secondary or replenishing stack 43 adjacent to the working stack for ready replacement when the working stack 42 becomes exhausted. Again the elevation of the top core sheet on the core stack 42 is maintained at the same vertical level as is the core entrance conveyor surface 40. A conventional adjustable scissors lift is provided under the stack 42 to accomplish this purpose. A properly elevated platform 44 is provided in order to properly position the scissors lift for the operation of the total conveyor system 1. The platform 44 is provided with enough plan area to allow the secondary core stack 43 to rest adjacent the working core stack 42. Appropriate openings are provided in each of the platforms 27, 34, 44 so that a fork-lift truck can deposit the secondary or replenishing stack of veneer sheet material adjacent each working stack.

Referring now particularly to FIGS. 2 and 3 and for reference to FIG. 1, the remaining details of the present invention will be described. First to be described in detail, will be the central conveyor system 3 which generally supports and provides the proper spacing for the plurality of in-line conveyor surfaces 2, 3, and 4. Basic support for the conveyor system 1 is provided by an outer frame generally indicated as 45 and which is comprised of spaced joined-together beams. Vertically displaced horizontally extending side beams 46 provide the proper positioning of the conveyor surfaces, as well as the vertical support. A plurality of vertically extending beams 47, of course, support the horizontal side beams 46 and allow the proper vertical spacing between beams 46.

Since the same portion 10 of the top conveyor surface 2 and the middle conveyor surface 3 is pivotally mounted in order to pick center and back veneer sheets off of the powered rollers 30, it is necessary to provide a rigid support frame 48 so as to properly support the plurality of endless flat belts 5 when they are engaged in the pivot motion. The frame 48 pivots about the laterally extending shaft 49 while the means to pivot the frame 48 may be provided by any suitable means, such as a side mounted hydraulic cylinder 50. The hydraulic cylinder is fixed to one of the horizontal side beams 46 but operates to turn a rotatable shaft 51 which in turn is connected mechanically to the frame 48. It will be appreciated that frame 48 will pivot about shaft 49 just enough to clear the highest vertical position on the center back entrance conveyor surface 29. The proper support and horizontal and vertical positioning for those powered rollers 30 which are within the horizontal beam members 46 is provided by a pair of laterally extending horizontal support members 52.

Since the output end 7 of the top conveyor surface is also pivotally mounted (the pivotal portion 10), it is necessary to provide the endless flat belts 53 of the pivotal portion 10 with a suitable rigid support frame 54 in a manner very similar to frame 48. A hydraulic cylinder 55 is fixedly mounted to an outer horizontal beam 46 where it is operable to turn a rotatable shaft 56 which is in turn mechanically connected to the pivotal frame 54.
The frame 54 pivots in a manner to sequentially communicate with the top and middle conveyor surfaces. The frame 54 pivots about shaft 57 which extends between the horizontal beams 46. Since the pivotal portion 10 is actually the output end of both the top conveyor surface 55 and the middle conveyor surface 53, it will be appreciated that there will be a smooth transitional surface between the end of the pivotal portion 10 and the input edge 18 of the top sheet positioner 17, so that as the individual veneer sheets move from one surface to the other, they will not be caught by a protruberance. As previously mentioned, the bottom conveyor surface 4 is also pivoted mounted in order to pick core veneer sheets off the endless flat belts 41 which comprise the entrance conveyor surface 40. Since the powered rollers 13 of the bottom conveyor surface are pivotal it will be appreciated that a support frame 58 will be necessary to provide the support means for the powered rollers. The pivotal support frame 58 is motivated by any suitable means such as a hydraulic cylinder 59 which operates a rotatable shaft 60 which is in turn connected through suitable mechanical linkage 61 to the frame 58. Whereas the proper sequential moment is reached, the hydraulic cylinder 59 will cause the frame 58 to pivot upwardly about a stationary pair of bearings at 62 and in such a manner the core veneer sheet which has been conveyed into the conveyor system 1 from the core conveyor surface loader system 39 will be picked off the endless flat belt 63 is shown in FIG. 18 as being trained about each powered roller 13 in order to provide unitary action to rollers 13 when the bottom conveyor surface 4 is operating.

The sheet positioner area 16 will now be described in greater detail. As previously mentioned, the top sheet positioner 17 may be comprised of a piece of sheet metal having an upwardly curved surface to the output edge 19. Since the top sheet positioner 17 is utilized to position, back, center and face veneer sheets over the layup station 8 all of which have their respective grain directions running perpendicular to the direction of sheet travel on the conveyor system 1, it will be appreciated that if one of these particular veneer sheets was allowed to flex, the natural bending direction would be about a line parallel to the grain direction and perpendicular to travel. In order to properly position the center, back and face veneer sheets, it is necessary to provide the top sheet positioner 17 with the proper angle; that is, an angle extending from a horizontal plane through the input edge 18 upward to a line directed from the input edge 18 through the output edge 19 of the top sheet positioner. In order to produce the proper amount of flexure in these veneer sheets as they are thrown outwardly from the output edge 19 it has been found that the ideal angle, indicated as \( \alpha \) in FIG. 2, is on the order of 20°-35°. Of course the proper momentum must be provided for each sheet as it travels over the sheet positioner 17 and it is provided by a selected speed of the independently controlled pivotal portion 10. It has been found through experiment that the proper conveyor surface speed is on the order of 610 feet/min. It will be appreciated that the parameters just mentioned should be taken by way of example only and that other suitable parameters may be utilized depending upon veneer sheet size or the like.

The bottom sheet positioner 20 as shown in FIG. 2 is comprised partially of a laterally extending sheet thrower 64. As previously mentioned, the sheet thrower 64 is the subject of a separate patent. Sheet thrower 64 could be replaced by a sheet positioner similar to the curvilinear surface of top sheet positioner 17 and thus a full detailed description of thrower 64 will not be made here. However, a brief general description of the details of the bottom sheet positioner 20 will be given in order to establish an operational conveyor system 1 as depicted in the figures. Briefly, the sheet thrower 64 has a holding area 65 which also extends laterally across the full length of the thrower and is adapted to receive sheets of core veneer when the thrower 64 is in its retracted position as indicated by the phantom lines of FIG. 2. A hydraulic cylinder 66 is firmly attached to a laterally extending beam of frame 45 and extends toward the bottom portion of the sheet thrower 64. The opposite end of the hydraulic cylinder is attached to the sheet thrower 64 and thrower 64 is necessarily adapted to pivot about a point 67 through an angle of approximately 40° when hydraulic cylinder 66 actuates the thrower 64 from its retracted position to its fully extended position which is the position indicated by solid lines in FIG. 2. The hydraulic cylinder 66 motivates the sheet thrower 64 with sufficient momentum so that a core veneer sheet which has been loaded into the holding area 65 is thrown outwardly from the end of the conveyor system 1 to a suspended airborne position over the layup station 8. A pivotal tibble 68 is provided which operates in conjunction with the stationary backstop 22. The purpose of the pivotal tibble 68 is to support the core veneer sheet to fall into the holding area 65 of the sheet thrower 64 and then to clear the top of backstop 22. As a core veneer sheet is conveyed toward sheet positioner 20 by the bottom conveyor surface 4, the core veneer sheet will keep the pivotal tibble 68 in an extended horizontal position and the thrower will be in its extended position. The core veneer sheet is given enough momentum such that it flies horizontally forward from the bottom conveyor surface 4 over the curved surface 64 of the thrower 64 and hits the stationary backstop 22. The thrower 64 then retracts and the sheet falls into the holding area 65. Just prior to the actuation of the hydraulic cylinder 66 to position the core sheet over the veneer stack 21 the pivotal tibble 68 is automatically moved upward through an angle of approximately 40° such that the core veneer sheet will just clear the vertical top of the backstop 22. A laterally extending open area 69 allows each core veneer sheet which has its grain running parallel to its direction of travel to be thrown clear of the end of the conveyor system 1 and out over the layup station 8.

As each sheet of veneer comes from the conveyor system 1, the two men on opposite sides of the veneer stack 21 will lightly clench the sheet and allow it to fall onto the top of the stack 21. The backstop 22 serves as a guide means in order to form at least one straight side to the veneer stack. After a sufficient number of individual veneer sheets are stacked together which form the pre-pressed plywood panels, the stack is removed from the flat bed 23 and taken to the plant press area.

OPERATION OF THE INVENTION

Although the operation of each element of the instant invention was explained when describing the particular element a short description of the operation of the conveyor system will be made in relation to the formation of three and five ply plywood panels.

As previously mentioned a three-ply panel is comprised of a back veneer sheet with the grain running in the direction of its longer dimension, a core veneer sheet with the grain running parallel to the shorter dimension and a face veneer sheet again with the grain running parallel to the longer dimension. In a three-ply panel the back and core veneer sheets each receive a coating of glue on their upper sides prior to their entry into the central conveyor system. At the layup station where each sheet is sequentially stacked to form the panels it will be appreciated that a back, core, and face sheet is received and that this sequence is repeated until a predetermined number of panels are formed at the layup station. In the formation of three-ply panels center sheets are not utilized.

First to be conveyed toward the layup station is an individual back veneer sheet. A single back sheet is taken from its stack and positioned over the input end of the top conveyor surface by the action of the center-back con-
veyor surface loader system. Through this operation the back veneer sheet will be coated with a surface of glue on its top surface. At about this same time an individual core veneer sheet is taken from the top of its stack and through the action of the core conveyor surface loader system is positioned over the input end of the bottom conveyor surface. In a similar manner to the back veneer sheet the core veneer sheet has a coating of glue on its top surface as it passes through the softroll glue spreader. At this point an individual face sheet is taken from the top of its stack and through the action of the face conveyor surface loader is positioned on the input end of the middle conveyor surface.

With all of the conveyed surfaces and with their respective veneer sheets the sequential operation of the overall conveyor system is ready to begin. First, the top conveyor surface frame pivots upward to pick up the back sheet off of the center-back entrance conveyor surface. At the same time the pivotal portion of the middle conveyor surface is in its upper position to receive the back veneer sheet from the top conveyor surface. The endless flat belts are then powered and the individual back veneer sheet travels to the output end of the top conveyor surface where it is given sufficient momentum to be conveyed over the top sheet position and out over the table bed at the layup station. As the back veneer sheet is in the air, the two men clutch it lightly and as it gravitates downwardly they position it against the fixed back stop.

In the next sequence the bottom conveyor surface pivots upwardly picking off an individual core sheet from the core conveyor surface. The bottom conveyor surface is then powered and a core sheet travels horizontally toward the layup station where it runs into the fixed back stop and falls into the holding area of the bottom sheet thrower. The hydraulic cylinder then is actuated which causes the sheet thrower to throw the core sheet outwardly over the fixed back stop and over the layup station where it is similarly clutched and allowed to gravitate downwardly where it is positioned against the fixed back stop on top of the previously positioned back veneer sheet.

Finally, the face veneer sheet is ready to be conveyed. In the meantime the pivotal portion of the middle conveyor surface has returned to its horizontal position and the middle conveyor surface is now in a direct horizontal surface to the top sheet positioner. The flat belts of the middle conveyor surface are then powered and the face veneer sheet travels horizontally and is given enough momentum to propel it over the top sheet positioner such that it is thrown outwardly and over the layup station where it is similarly clutched and allowed to gravitate downwardly to be positioned over the core veneer sheet. This sequence is then repeated with the next back veneer sheet having a glued top surface being positioned over the face veneer sheet of the already formed three-ply panel.

Briefly, if it is desired to form a four-ply panel which is comprised of a back, two adjacent core sheets and a face, it is a simple matter to sequentially position an additional core veneer sheet in the formed panel. Thus, prior to a face sheet being conveyed the bottom conveyor surface and bottom sheet positioner will discharge two core veneer sheets over the layup station in order to form the center portion of a four-ply panel. Then in a similar manner to three-ply formation the face sheet is positioned atop the two core veneer sheets.

In the formation of five-ply panels, it is necessary to utilize a center veneer sheet. As previously mentioned a five-ply panel consists of a back veneer sheet, core veneer sheet, center veneer sheet, another core veneer sheet, and a face veneer sheet, each sequentially stacked at the layup station. The operation of the conveyor system in forming five-ply panels is very similar to the formation of three-ply panels, however after the first back sheet and core sheet are conveyed to the layup station a center veneer sheet is picked from the top of its stack and given a layer of glue on its top surface as it passes through the glue spreader. In a like manner the center veneer sheet is then conveyed down top conveyor surface and over the top sheet positioner and horizontally outward where it gravitates downwardly to be positioned atop the first core sheet. In the meantime the core conveyor surface loader system has charged the bottom conveyor surface with a second core sheet and it is then conveyed and positioned for placement atop the glued center sheet. Finally the fifth-ply or in this instance the face veneer sheet is ready to be conveyed and positioned atop the second core sheet, thereby forming the five-ply panel. The pivotal portion of the middle conveyor surface is, of course, its horizontal mode for conveyance of the face sheet. It will thus be appreciated that in the five-ply formation cycle the center-back and core conveyor surface loader systems each are responsible for charging the top and bottom conveyor surfaces with two individual veneer sheets. In the case of the top conveyor surface they are the back and center sheets and in the case of the bottom conveyor surface two core sheets are positioned thereon during a single cycle.

It will be understood by those skilled in the art, that plywood panels comprising additional plies may be readily formed by the central conveyor system by simply controlling the sequential operations of the several loader systems and the conveyor surfaces. For example, seven and nine-ply panels can be readily formed by the addition of a second center sheet and third core sheet in the case of seven-ply panels and a fourth core sheet and third center sheet in the case of a nine-ply panel.

In brief summary, it will be appreciated that a vertically extending horizontally in-line central conveyor system has been described with appropriate loader systems such that individual veneer sheets are conveyed to a layup station where plywood panels are formed. The floor space required for the plan of this machine is less than that of the prior art. Rejects are minimized by the utilization of two men who serve to scan each veneer sheet as they come from the sheet positioners.

While a specific example of the preferred apparatus has been described, it will be apparent that many changes and modifications may be made without departing from the spirit of the invention. It should be understood that the appended claims include within their scope all such changes and modifications.

What is claimed is:

1. A thin sheet layup machine for making sequentially arranged bonded panels, each having at least three plies of thin sheets, comprising:
   a plurality of generally horizontal conveyor surfaces disposed vertically above one another and in line thereto, each having an output end and thereon means to sequentially activate and control said surfaces,
   a layup station positioned adjacent the output ends of said conveyor surfaces arranged and adapted to accept thin sheets as they are transferred individually from the output ends of said conveyor surfaces, thin sheet positioning means in operative communication with the output ends of said conveyor surfaces each arranged and adapted to transfer the thin sheets individually from said conveyor surfaces to a position over said layup station, first conveyor loading means arranged and adapted to sequentially position a thin sheet on one of said conveyor surfaces, second conveyor loading means arranged and adapted to sequentially position a thin sheet onto another of said conveyor surfaces, third conveyor loading means arranged and adapted to position a thin sheet on one of the plurality of conveyor surfaces, and means to apply an adhesive surface over at least one
of the faces of at least two preselected thin sheets as they are conveyed from their respective conveyor loading means over their respective conveyor surfaces to said thin sheet positioning means.

2. A thin sheet layup machine as in claim 1 wherein said layup station is comprised of a generally horizontal, vertically adjustable flat bed and at least one vertically extending airlift member arranged so that each thin sheet as it falls toward said flat bed can be aligned against said airlift member thereby allowing a uniform stack of thin sheets to form.

3. A thin sheet layup machine as in claim 1 wherein said adhesive applying means are positioned between their respective conveyor loaders and conveyor surfaces.

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