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Oono et al.

[11] **3,723,227**

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[54] **APPARATUS FOR ASSEMBLY OF VENEER SHEETS IN PLYWOOD FABRICATION**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **156/557,** 156/570, 156/578, 198/209

[51] **Int. Cl.**.....**B32b 31/12,** B65g 29/00

[58] **Field of Search**.....156/556–557, 559, 156/563, 569–570, 578, 300, 566, 313; 198/178, 184, 209; 294/64 R; 271/68

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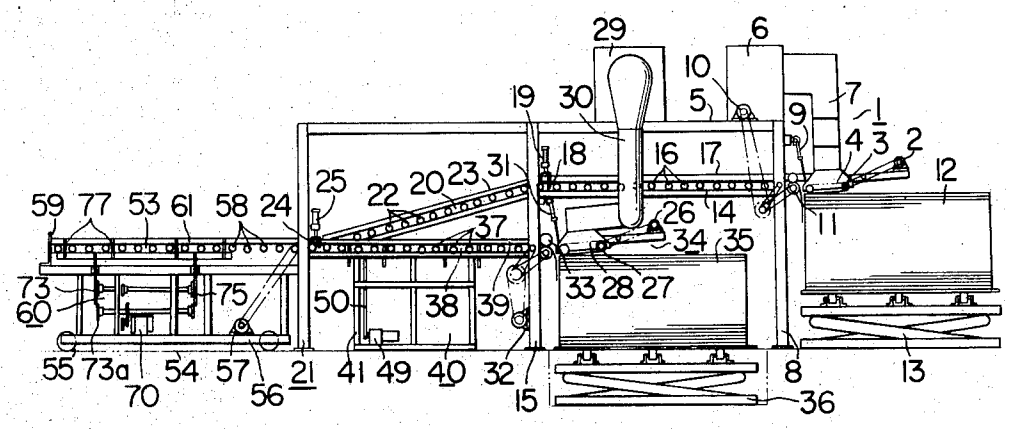
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Primary Examiner—Philip Dier
Attorney—Holman & Stern

[57] **ABSTRACT**

First and second pneumatic pickup means include a first and a second suction duct, respectively, thereby successively to pick up veneer sheets stacked up separately on first and second lifter means. First and second conveyor means extend in succession from the first pneumatic pickup means, whereas third conveyor means extend underneath the downwardly inclined second conveyor means from the second pneumatic pickup means to a point of termination of the second conveyor means, so that the veneer sheets picked up separately by the first and the second pneumatic pickup means are superposed one upon another as they reach fourth conveyor means, from which the veneer sheets are transferred onto a stand positioned on one side thereof. Veneer sheets to be glued are stacked up separately and are fed one by one into gluing means positioned on the other side of the fourth conveyor means and thence are carried over to the aforesaid stand by fifth conveyor means.

9 Claims, 11 Drawing Figures



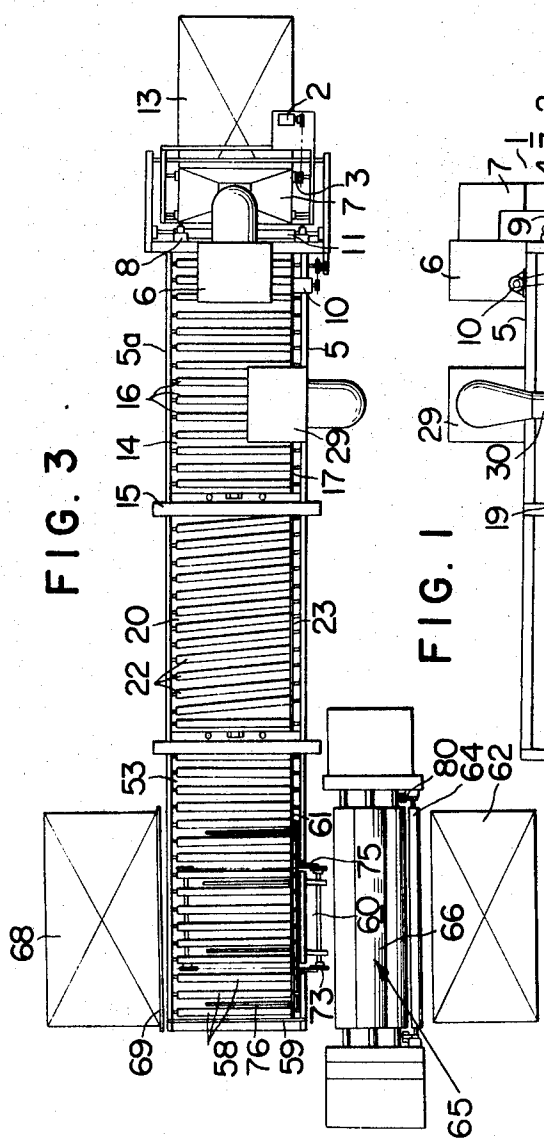


FIG. 3

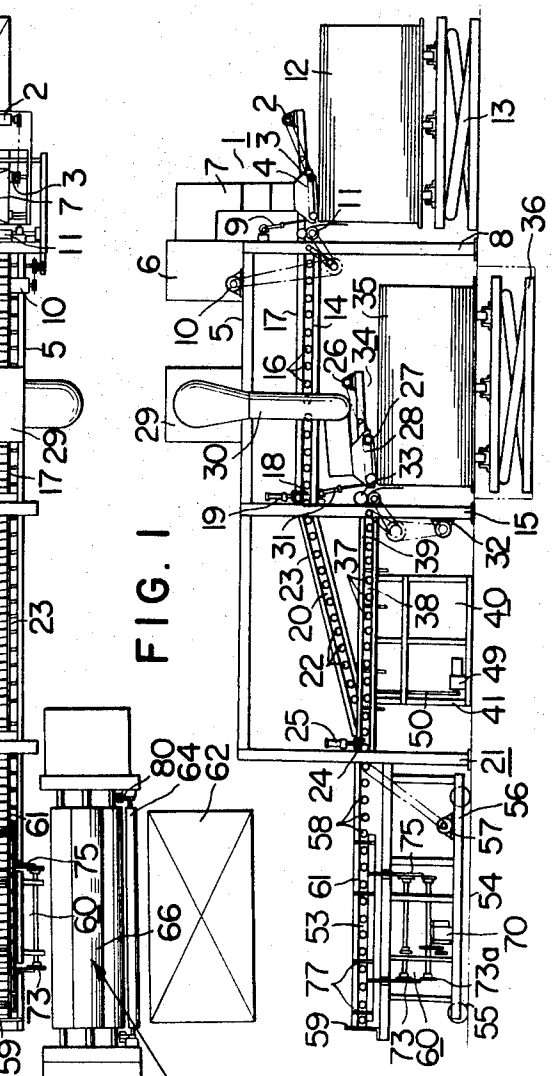


FIG. 1

FIG. 2

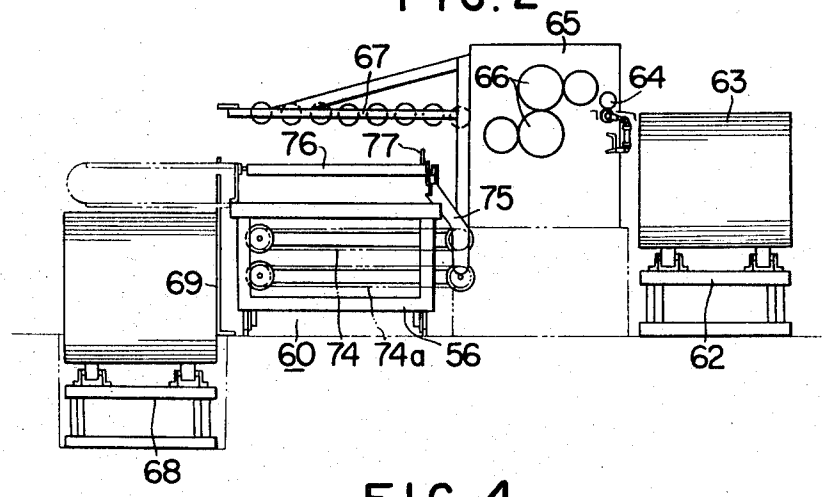


FIG. 4

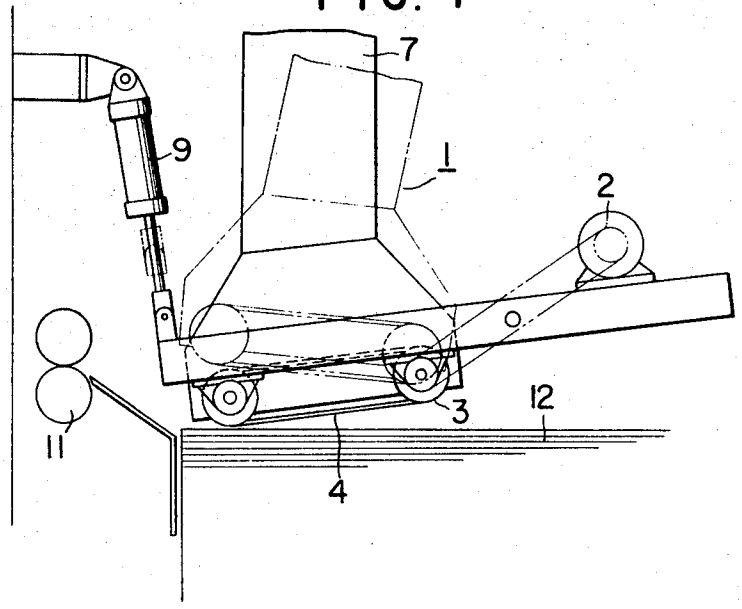


FIG. 5

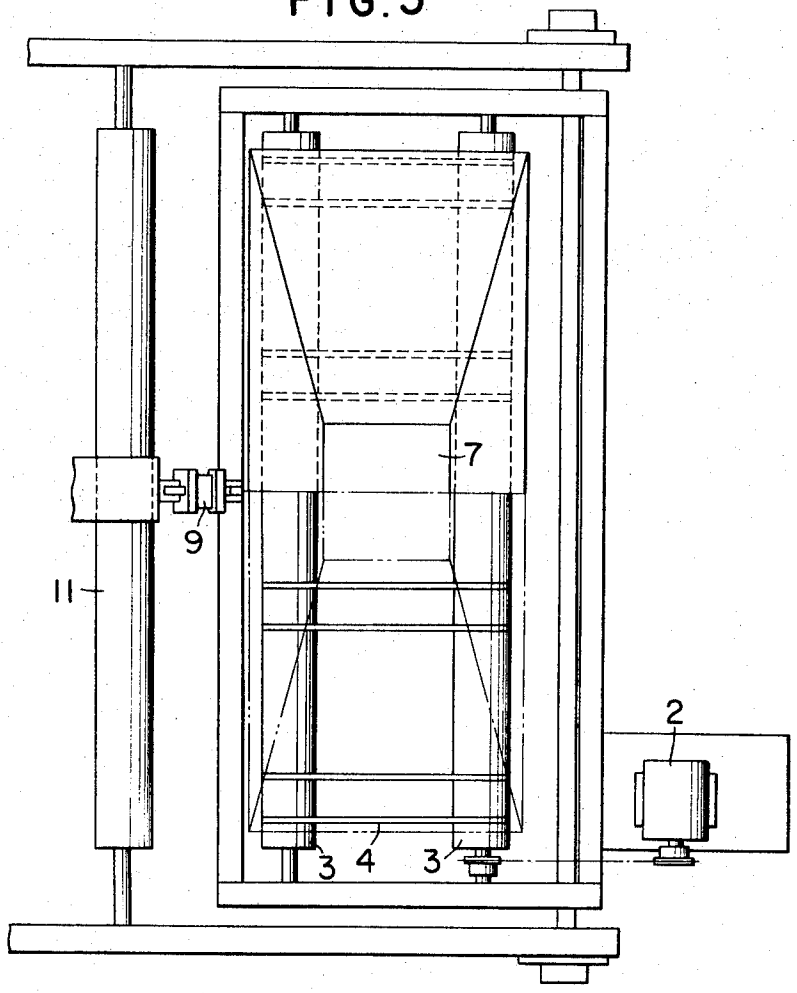


FIG. 6

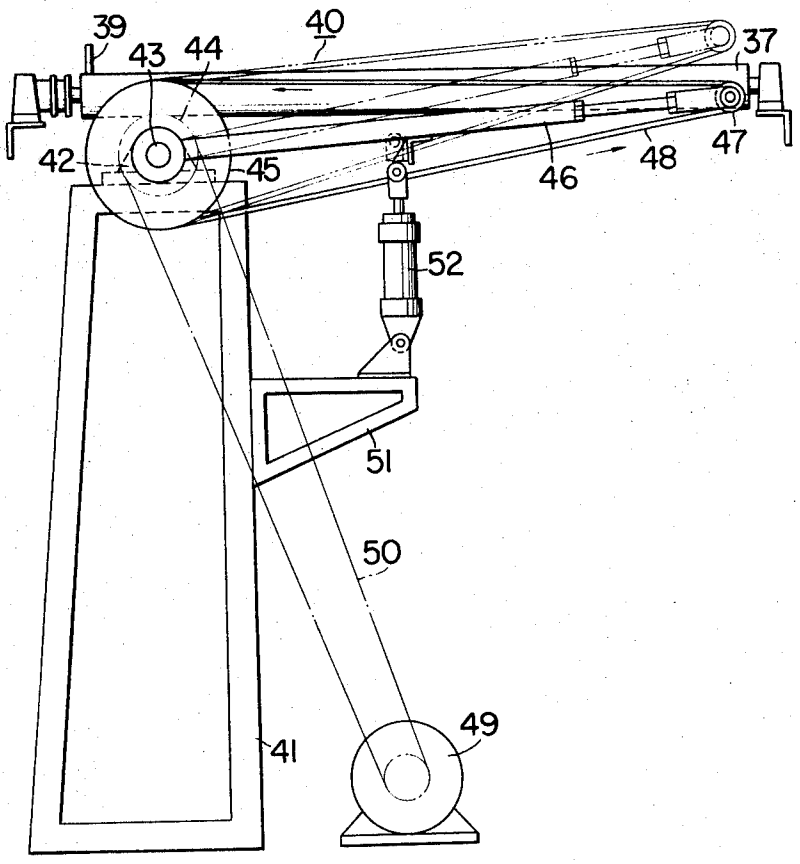
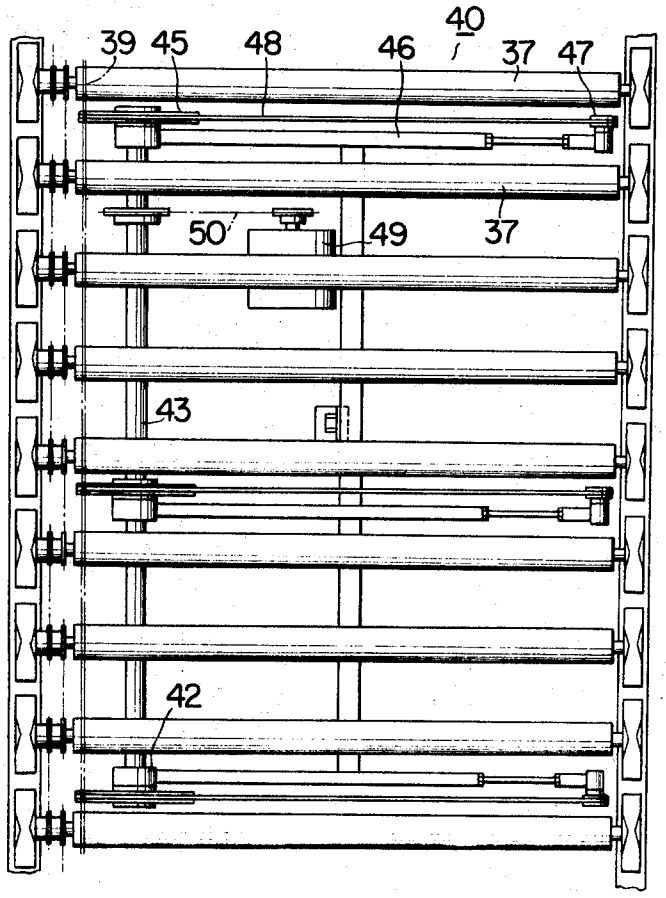


FIG. 7



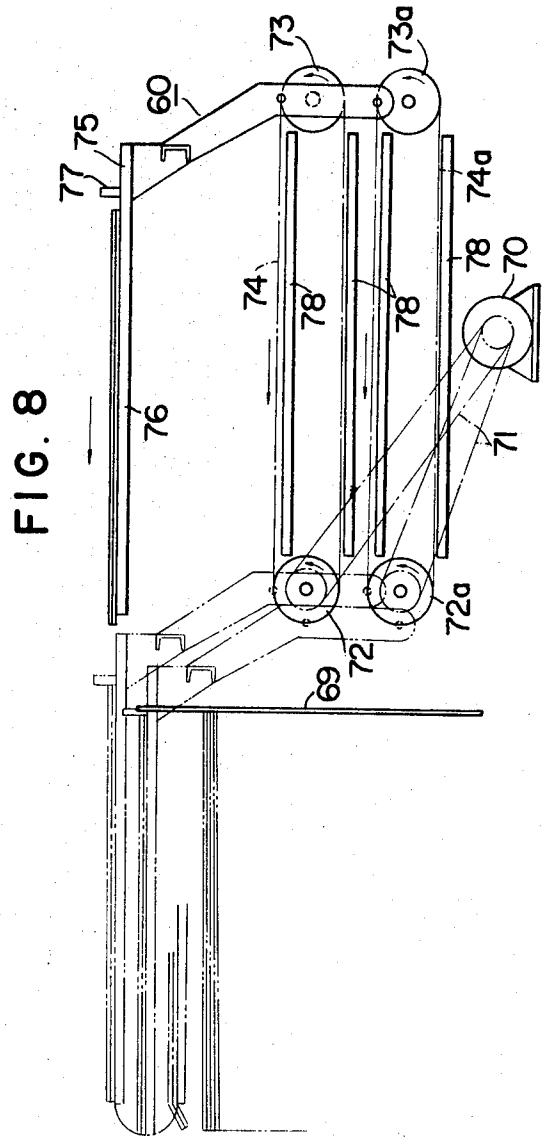


FIG. 8

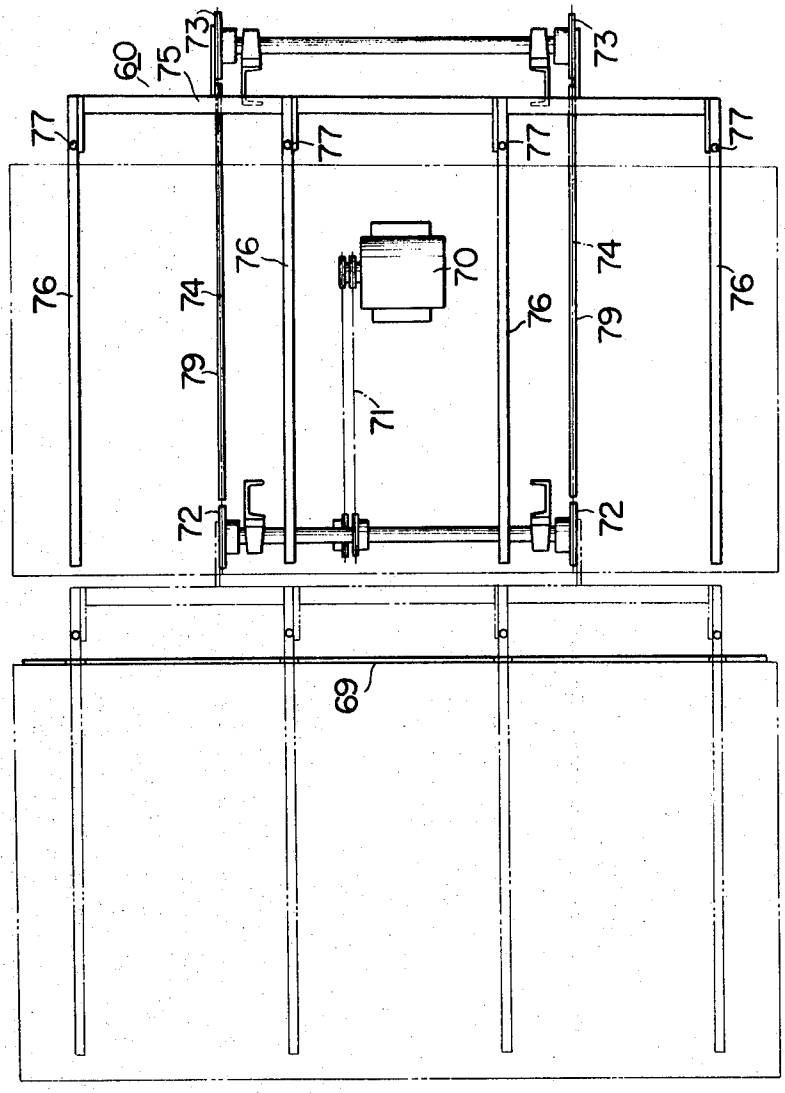


FIG. 9

FIG. 10

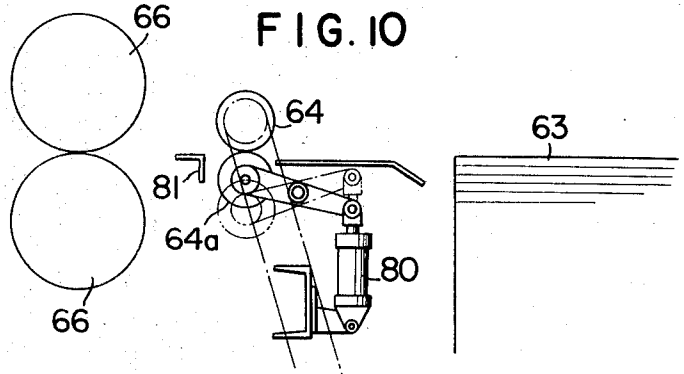
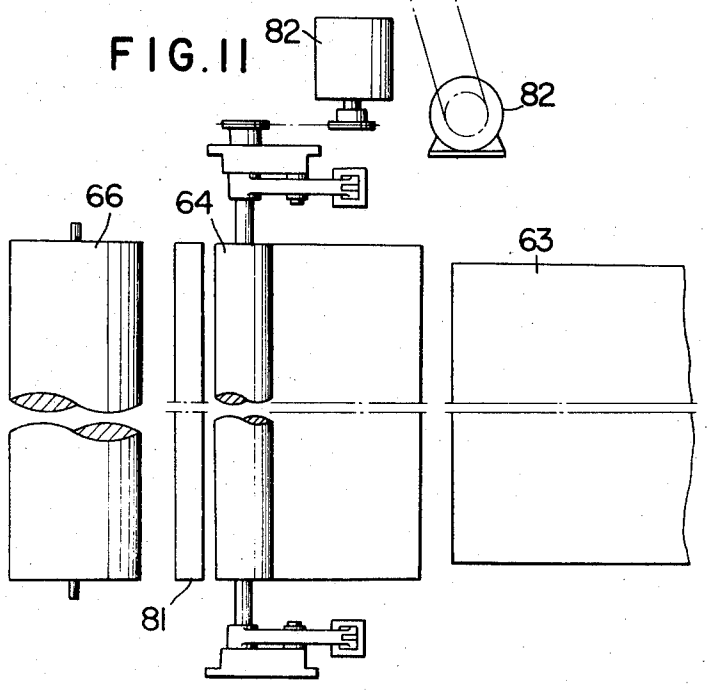


FIG. 11



APPARATUS FOR ASSEMBLY OF VENEER SHEETS IN PLYWOOD FABRICATION

BACKGROUND OF THE INVENTION

This invention relates generally to the fabrication of plywood and like laminated materials, and more specifically to a novel apparatus for automatic assembly of veneer sheets, both glued and nonglued sheets, into a form ready to be pressed together into plywood.

The assembly of glued and nonglued veneer sheets, usually in odd numbers, into a form ready to be pressed together into plywood has long been the "bottleneck" in plywood factories, necessitating at least three operators attending to each gluing machine. One of them may take charge of the glued veneer sheets fed out of the gluing machine, while at least two others handle nonglued sheets. Such heavy manual labor required heretofore has rendered the assembly job not only unduly inefficient but also highly dangerous. It has been accordingly impossible to carry out the operation over any extended length of time; moreover, the veneer sheets so handled manually have been inevitably liable to damage.

SUMMARY OF THE INVENTION

A principal object of the present invention, therefore, resides in the provision of apparatus capable of automatically and continuously performing the assembly of glued and nonglued veneer sheets into a form ready to be pressed together into plywood thereby to afford efficient and safe operation and a great saving in labor cost.

Another object of the invention is to provide apparatus whereby glued and nonglued veneer sheets can be automatically assembled in a neatly arranged form in accordance with almost any desired plywood construction.

A further object of the invention is to provide apparatus for the assembly of glued and nonglued veneer sheets such that the veneer sheets are securely guided to a final stand where they are assembled into a desired form so that they will not be damaged during operation of the apparatus.

All of these objects, as well as the additional objects and advantages of the invention hereinafter set forth, are accomplished by the present apparatus described succeedingly in terms of its preferred form illustrated by way of example in the accompanying drawings. 1

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a side elevational view showing a preferred embodiment of the present invention, exclusive of gluing means, a stand, and other parts;

FIG. 2 is a schematic, side elevational view showing gluing means, a stand, and other parts positioned on both sides of fourth conveyor means of the apparatus shown in FIG. 1;

FIG. 3 is a top view showing the preferred embodiment of FIG. 1 in combination with the various means shown in FIG. 2;

FIG. 4 is an explanatory, partial, relatively enlarged side view of first pneumatic pickup means of the apparatus shown in FIGS. 1 and 3;

FIG. 5 is a schematic, partial, relatively enlarged top view of the first pneumatic pickup means of FIG. 4;

FIG. 6 is an explanatory, relatively enlarged front view of the veneer sheet adjusting means of the apparatus shown in FIG. 1;

FIG. 7 is a relatively enlarged top view showing the veneer sheet adjusting means of FIG. 6 in combination with part of third conveyor means;

FIG. 8 is an explanatory, relatively enlarged front view of veneer sheet transfer means of the apparatus shown in FIGS. 1, 2 and 3;

FIG. 9 is an explanatory, relatively enlarged top view of the veneer sheet transfer means of FIG. 8;

FIG. 10 is an explanatory, relatively enlarged side view of means for supplying veneer sheets toward a pair of gluing rollers; and

FIG. 11 is a partially broken away, relatively enlarged top view of the means of FIG. 10.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. 1 and 3 which illustrate elevational and plan views of the overall configuration of a preferred form of the present apparatus, as well as to FIGS. 4 through 7 showing the various portions of the same in greater detail, reference numeral 1 generally designates first pneumatic pickup means. As illustrated in detail in FIGS. 4 and 5, the first pneumatic pickup means 1 include a first motor 2, a pair of rollers 3 with belts 4 wrapped thereon to be driven by the first motor 2, a first suction duct 7 coupled to an exhauster means 6 suitably mounted between beams 5 and 5a and adapted for creation of a partial vacuum in the first suction duct 7, a hydraulic cylinder 9 attached to the mid-part of a horizontal portion of a frame member 8 substantially in the shape of an inverted letter "U" for desired vertical movements of the first suction duct 7, and a pair of pinch rollers 11 driven by a second motor 10 mounted upon the beam 5. The first pneumatic pickup means comprising the foregoing essential components is used for the pickup and transfer, in a manner still to be described, of veneer sheets 12 stacked on a first lifter 13 which may be powered hydraulically.

The reference numeral 14 generally designates first conveyor means composed primarily of a number of rollers 16 supported by means of bearings transversely between the frame member 8 and another identically shaped frame member 15. the rollers 16 have a common guide 17 at one side thereof, these rollers 16 are driven by means of the second motor 10 upon the beam 5 in synchronism with the pair of pinch rollers 11 of the first pneumatic pickup means 1. A first stop 18 at the end of the first conveyor means 14 is adapted to be moved vertically by a hydraulic cylinder 19 secured to the frame member 15 thereby to permit or prevent the passage of veneer sheets carried by the first conveyor means 14.

Disposed in succession to the first conveyor means 14, second conveyor means 20 also include a number of rollers 22 which are supported by means of bearings transversely between the frame member 15 and still another identically shaped manner as the rollers 16 of the first conveyor means 14. The second conveyor means 20 as a whole inclines downwardly as seen in FIG. 1, and, as is clear from FIG. 3, all but the last of the rollers 22 are arranged out of the perpendicular to

the longitudinal direction of the second conveyor means **20** in order to urge the veneer sheet being conveyed thereby against a guide **23** at one side and hence to neatly reposition the same. A second stop **24** is provided at the end of the second conveyor means **20** and is adapted to be moved vertically by a hydraulic cylinder **25** secured to the frame member **21** thereby to permit or prevent the passage of the veneer sheet.

Below the first conveyor means **14** there is provided second pneumatic pickup means **34** composed primarily of a second suction duct **30**, a hydraulic cylinder **31** and a pair of pinch rollers **33**. The suction duct **30** is provided with a pair of rollers **27** with belts **28** passed therearound to be driven by a third motor **26** and is coupled to an exhauster means **29** suitably mounted on the beam **5** and adapted for creation of a partial vacuum in the second suction duct **30**. The hydraulic cylinder **31** is secured to the frame member **15** for causing desired vertical movements of the second suction duct **30**. The pair of pinch rollers **33** are driven by means of a fourth motor **32** secured to the frame member **15**. The second pneumatic pickup means **34** of the above described arrangement is also used for the pickup and transfer, in a manner still to be described, of a number of veneer sheets stacked on a second lifter **36** that may be powered hydraulically.

Below the aforementioned second conveyor means **20**, on the other hand, there is provided third conveyor means **38** comprising a number of rollers **37** which are supported by means of bearings transversely between the frame members **15** and **21** and which are driven by the fourth motor **32** secured to the frame member **15** in synchronism with the pair of pinch rollers **33**. In addition to a guide **39**, the third conveyor means **38** are provided with adjusting means **40** as illustrated in FIG. **1** and, in greater detail, in FIGS. **6** and **7**.

With reference now specifically to FIGS. **6** and **7** for a description of the adjusting means **40**, a wheel **44** and a plurality of large-diameter pulleys **45** are fixedly mounted on a common shaft **43** provided on a mount **41** via bearings **42**. A plurality of rods **46**, are interconnected with the rollers **37** of the third conveyor means **38** as seen in FIG. **7**, are each coupled at one end to the shaft **43** and provided at the other end with a small diameter pulley **47**, and a belt **48** is passed around the large diameter pulley **45** and the small diameter pulley **47** at the ends of each rod **46**. Those belts **48** are made to run in the same direction by means of a fifth motor **49** via a chain **50** extending from the output shaft of this fifth motor **49** to the wheel **44**. The rods **46** are each rendered rockable, i.e., made capable of changing the vertical position of the free end, by means of a hydraulic cylinder **52** on a fixture **51** secured to the mount **41**.

Further, in succession to the second and the third conveyor means **20** and **38**, there is provided fourth conveyor means **53** on a mount **56** movable on rails **54** by means of its wheels **55**. A common guide **61** and a number of rollers **58** of the fourth conveyor means **53** are adapted to be driven by a sixth motor **57** fixedly mounted on the movable mount **56**. The fourth conveyor means **53** is further provided with a stop **59** at the end thereof and veneer sheet transfer means **60** still to be described in detail with reference to FIGS. **8** and **9**.

Referring now to FIG. **2**, a stack of veneer sheets **63** on a third lifter **62** that may be powered hydraulically, and which is positioned on one side of the fourth conveyor means **53** (refer also to FIG. **3**) are fed successively by means of a pair of pinch rollers **64** toward a pair of gluing rollers **66** of gluing means generally designated by the reference numeral **65**. The veneer sheets **63** so glued are led out of the gluing means **65** by fifth conveyor means **67** provided therefor onto a stand **68** on the other side of the fourth conveyor means **53** in suitable combination with the nonglued veneer sheets fed by the transfer means **60** with the aid of a stop **69**.

The veneer sheet transfer means **60** shown somewhat incompletely in FIGS. **1** and **3** are illustrated in greater detail in FIGS. **8** and **9**. The transfer means **60** include a seventh motor **70** installed on the movable mount **56**, pairs of wheels **72** and **72***a* both driven by the seventh motor **70** via chains **71**, corresponding pairs of follower wheels **73** and **73***a* respectively driven by the wheels **72** and **72***a* via chains **74** and **74***a* extending therebetween, and forklift means **75** coupled to the chains **74** and **74***a*.

The forklift means **75** include fork tines **76** arranged in an interdigitated manner with the rollers **58** of the fourth conveyor means **53**, as seen in FIG. **3**, and upward projections **77** close to the roots of the fork tines **76** thereby to press the veneer sheets from the fourth conveyor means **53** onto the stand **68**. The chains **74** and **74***a* are provided with chain supports **78** to prevent them from dangling down during operation; further, the reference numeral **79** in FIG. **9** designates chain guides adapted for regulation of the running course of the chains.

FIGS. **10** and **11** illustrate the details of the gluing means **65** of FIGS. **2** and **3**. A hydraulic cylinder **80** is secured to the gluing means **65** for vertical displacement of the lower roller **64***a* of the pair of pinch rollers **64**. When the lower pinch roller **64***a* is lowered by the hydraulic cylinder **80**, as indicated by the dots and dashes in FIG. **10**, the passage of the veneer sheets **63** toward the gluing rollers **66** is blocked by a stop **81**. The upper pinch roller **64** is driven by an eighth motor **82**.

Proceeding now to the description of the operation of this preferred embodiment of the invention of the organization substantially as described hereinabove, it will be first assumed, for purposes of illustration, that the apparatus is operated for the fabrication of three-ply plywood, consisting of three layers of veneer. With reference to FIG. **1**, the uppermost sheet from the stack of veneer sheets **12** on the first lifter **13** is drawn up by the first suction duct **7**. Simultaneously, its rollers **3** rotate by being driven with the first motor **2**, while the first suction duct **7** itself together with the rollers **3** is raised by means of the hydraulic cylinder **9**, in such a manner that the veneer sheet is fed into the pair of pinch rollers **11** and thence onto the first conveyor means **14**.

The veneer sheet is thus carried along the guide **17** of the first conveyor means **14** driven by the second motor **10** in synchronism with the pinch rollers **11**, until it is stopped by means of the first stop **18**. Upon elevation of this first stop **18** by the hydraulic cylinder **19** secured to the frame member **15**, the veneer sheet is permitted to passage onto the downwardly inclined second conveyor means **20** and is carried thereon, while being

neatly readjusted due to the combined action of the rollers 22 and the guide 23 (refer also to FIG. 3), down to the second stop 24.

Substantially at the same time with the elevation of the first stop 18 by means of the hydraulic cylinder 19, the uppermost sheet from the stack of veneer sheets 35 on the second lifter 36 is drawn up by the second suction duct 30. Simultaneously, the pair of rollers 27 provided for this second suction duct 30 are started in rotation by the third motor 26, while the second suction duct 30 itself together with its rollers 27 is raised by the hydraulic cylinder 31 in such a manner that the veneer sheet picked up thereby from the stack 35 is fed to the pair of pinch rollers 33 and thence onto the third conveyor means 38 driven by the fourth motor 32 in synchronism with the mentioned pinch rollers 33. The veneer sheet is thus carried toward the second stop 24 while being subjected to the action of the adjusting means 40 in a manner described hereinbelow with reference to FIGS. 6 and 7.

The fifth motor 49 operates to rotate the shaft 43 via the chain 50 and the wheel 44, so that the belts 48 extending between the large diameter pulleys 45 and the small diameter pulleys 47 are caused to run as indicated by the arrows in FIG. 6. One of the ends of each of the rods 46, provided with the small diameter pulley 47, is raised by the hydraulic cylinder 52 up to a position also indicated by the dots and dashes in FIG. 6, so that the veneer sheet being carried by the third conveyor means 38 is neatly readjusted by being pressed against the guide 39.

Referring back to FIG. 1, the second stop 24 is then raised by the hydraulic cylinder 25, with the result that the fourth conveyor means 53 driven by the sixth motor 57 takes over the conveyance of the two veneer sheets, now in superposed form, that have been respectively carried by the second conveyor means 20 and the third conveyor means 38. The veneer sheets thus conveyed along the guide 61 of the fourth conveyor means 53 come to a stop as their leading ends contact the stop 59.

With relation to FIGS. 8 or 9, the seventh motor 70 now comes into operation to drive the wheels 72 and 72*a* via the chains 71, so that the chains 74 and 74*a* extending between these wheels 72 and 72*a* and the follower wheels 73 and 73*a* start to run. As a result, the fork tines 76 coupled to these chains 74 and 74*a* move as indicated by the arrow in FIG. 8 to a position represented by the dots and dashes in the same figure, while carrying the superposed veneer sheets neatly positioned thereupon by means of their projections 77. As the wheels 72 and 72*a* and the follower wheels 73 and 73*a* further rotate counterclockwise in FIG. 8, the overall forklift means 75 are returned to their initial position by the chains 74 and 74*a* while only the superposed veneer sheets are left upon the stand 68 with the aid of the stop 69.

The veneer sheets 63 to be glued are transferred on to the stand 68 via the gluing means 65 as described hereinbelow with reference to FIGS. 10 and 11, in particular. When the lower roller 64*a* of the pair of pinch rollers 64 is lowered by means of the hydraulic cylinder 80 into the position indicated by the dots and dashes in FIG. 10, the uppermost sheet of the stack of veneer sheets 63 fed into the gluing means 65 is blocked by the stop 81. It is accordingly necessary or at least preferable, by a photoelectric tube, a limit switch or some other appropriate means not illustrated in the drawings, to detect the completion of the mounting of the superposed veneer sheets on the stand 68 by the forklift means 75 and simultaneously to actuate the hydraulic cylinder 80 under the control of such detecting means. The lower pinch roller 64*a* is then raised to permit the passage of one of the veneer sheets 63 between the gluing rollers 66 of the gluing means 65. The veneer sheet thus glued is led out of the gluing means 65 onto the fifth conveyor means 67 and thence onto the superposed veneer sheets precedingly placed upon the stand 68.

Hence, by alternately placing two nonglued veneer sheets in superimposed position, a single glued veneer sheet and then two nonglued veneer sheets in superposition upon the stand 68, one of the two first-placed nonglued veneer sheets, the single second-placed glued veneer sheet and one of the two third-placed nonglued veneer sheets constitute the two faces and one core necessary for the fabrication of a desired three-ply plywood sheet.

For the fabrication of five-ply plywood, the following feeding of the veneer sheets are successively carried out in the same manner as that in the case of fabricating three-ply plywood. That is, a non-glued veneer sheet is fed unto the stand 68, a first glued veneer sheet is fed onto the veneer sheet placed on the stand 68, a nonglued veneer sheet is fed onto the first glued veneer sheet, a second glued veneer sheet is fed onto the nonglued sheet, and a non-glued veneer sheet is fed onto the second glued veneer sheet whereby a desired five-ply plywood consisting of two outside sheets a central sheet, and two sheets disposed respectively between the central sheet and the outside sheets is obtained.

The fourth conveyor means 53 and the transfer means 60 are provided upon the movable mount 56 for the sake of convenience in removal of glue or adhesive that may adhere to the fifth conveyor means 67 extending from the gluing means 65. Further, the operations of the hydraulic cylinders 9, 19, 25, 31, 52 and 80 are assumed to be carried out under the control of the aforementioned photoelectric tube, limit switch, or other suitable means (not shown) provided for the transfer means 60.

The preferred form of the present apparatus shown and described in the foregoing is meant only to illustrate and not to limit the invention. For instance, instead of the provision of the adjusting means 40 for the third conveyor means 38, the rollers 37 of the third conveyor means may be arranged out of the perpendicular to the guide 39 similarly as the rollers 22 of the second conveyor means 20, while the third conveyor means 38 as a whole are inclined downwardly also as in the second conveyor means 20. The above and other possible modifications of the apparatus which are readily apparent to those skilled in the art are contemplated as being within the scope of the present invention.

We claim:

1. Apparatus for assembly of veneer sheets into a form ready to be pressed togehther into plywood, comprising in combination:

first pneumatic pickup means including a first suction duct capable of picking up one-by-one veneer sheets
stacked on a first lifter provided under said pick-up means by virtue of a partial vacuum created therein:
first conveyor means comprising a number of rollers adapted for receiving and conveying the veneer sheet picked up by said first pneumatic pickup means, and first stop means provided at the end of said first conveyor means opposite to said first pneumatic pickup means and adapted for transferring the veneer sheet onto a following second conveyor means;
second conveyor means positioned in succession to said first conveyor means and inclined downwardly along the length thereof, said second conveyor means comprising a number of rollers adapted for receiving and conveying the veneer sheet supplied from said first conveyor means via said first stop means, and second stop means provided at the end of said second conveyor means opposite to said first conveyor means and adapted for transferring the veneer sheet carried by said second conveyor means onto a following fourth conveyor means;
second pneumatic pickup means positioned underneath said first conveyor means and including a second suction duct capable of picking up one-by-one veneer sheets stacked on a second lifter disposed under said second pickup means by virtue of a partial vacuum created therein;
third conveyor means positioned below said second conveyor means and comprising a number of rollers adapted for receiving and conveying the veneer sheet picked up by said second pneumatic pickup means, said third conveyor means terminating at substantially the same point as said second conveyor means so that said second stop means of said second conveyor means is used also for transferring the veneer sheet carried by said third conveyor means on the following fourth conveyor means;
fourth conveyor means positioned in succession to said second conveyor means and said third conveyor means and comprising a number of rollers adapted for receiving and conveying the veneer sheets supplied from said second conveyor means and said third conveyor means via said second stop means, and third stop means provided at the end of said fourth conveyor means opposite to said second and third conveyor means;
transfer means adapted to transfer the veneer sheets from said fourth conveyor means onto a stand positioned on one side of said fourth conveyor means;
a third lifter mounting thereon a stack of the veneer sheets and positioned on the other side of said fourth conveyor means;
gluing means provided between said third lifter and said fourth conveyor means and including a pair of gluing rollers and pinch rollers adapted to transfer a veneer sheet supplied from said third lifter into said gluing rollers and;
fifth conveyor means extending from said gluing means and comprising a number of rollers adapted to convey the glued veneer sheet led out from said gluing means onto said stand in such a relation that nonglued veneer sheets are superimposed on both glued surfaces of the glued veneer sheet.

2. The apparatus as claimed in claim **1**, in which said first pneumatic pickup means further comprises a hydraulic cylinder coupled to said first suction duct for moving the same, and a pair of belted rollers positioned at the open end of said first suction duct.

3. The apparatus as claimed in claim **2**, additionally comprising a pair of pinch rollers interposed between said first suction duct and said first conveyor means, whereby the veneer sheet picked up by said first pneumatic pickup means is fed onto said first conveyor means via said pair of pinch rollers.

4. The apparatus as claimed in claim **1**, in which said first stop means of said first conveyor means and said second stop means of said second and said third conveyor means are actuatable by means of hydraulic cylinders.

5. The apparatus as claimed in claim **1**, in which said rollers of said second conveyor means are arranged out of the perpendicular to a guide extending lengthwise at one side of said second conveyor means whereby the veneer sheet being conveyed by the same in urged against said guide and hence is neatly readjusted thereon.

6. The apparatus as claimed in claim **1**, in which said second pneumatic pickup means further comprises a hydraulic cylinder coupled to said second suction duct for moving the same, and a pair of belted rollers positioned at the open end of said second suction duct.

7. The apparatus as claimed in claim **6**, additionally comprising a pair of pinch rollers interposed between said second suction duct and said third conveyor means, whereby the veneer sheet picked up by said second pneumatic pickup means is fed onto said third conveyor means via said pair of pinch rollers.

8. The apparatus as claimed in claim **1**, in which said third conveyor means is provided with means for adjusting of the veneer sheet being conveyed thereby, said adjusting means comprising a plurality of large diameter pulleys fixedly mounted on a common shaft, a plurality of rods interconnected with the rollers of the third conveyor means, each of said rods being rockably coupled at one end thereof to said common shaft and provided at the other end with a small diameter pulley and belts respectively extending between said large and said small diameter pulleys, and adapted for urging the side edge of the veneer sheet on said third conveyor means against a guide extending lengthwise at one side thereof.

9. The apparatus as claimed in claim **1**, in which said transfer means comprise a plurality of first pairs of wheels, a plurality of second pairs of wheels respectively corresponding to said first pairs of wheels and being driven thereby via chains extending therebetween, and forklift means coupled to said chains so as to be movable along with the run thereof, said forklift means including fork tines arranged substantially in an interdigitated manner with said rollers of said fourth conveyor means and upward projections formed near the roots of said fork tines thereby to press the veneer

sheets onto said stand positioned on one side of the fourth conveyor means.

* * * * *