This invention relates to conveyors. It pertains particularly to conveyors for transporting flat sheets one at a time past a plurality of processing stations.

It is the primary object of this invention to provide a conveyor which will transport plywood veneers or other sheets past successive operating stations and which will hold them precisely aligned during each processing operation.

It is another object of this invention to provide a conveyor which will convey and support readily breakable or splittable materials such as plywood veneers, without damaging them during a sequence of processing operations.

A further object of the present invention is the provision of a conveyor which will remove debris from the upper surfaces of the sheets, for example, knots and splinters from the upper surfaces of plywood veneers, without misaligning the sheets.

Still a further object of the present invention is the provision of a conveyor for conveying sheet material past successive operating stations which conveyor is well suited for use in an automated sequence.

Another important object of the invention is the provision of a conveyor drive comprising upstanding pushing lugs which are automatically retractable when no longer needed, thus permitting superimposing second sheets in lapped relation over first sheets without danger of mutilating or breaking the overlapped trailing portions of the second sheets by contact with the pushing lugs.

The manner in which the foregoing and other objects of this invention are accomplished will be apparent from the accompanying specification and claims considered together with the drawings, wherein:

FIG. 1 is a schematic plan view of an automatic plywood assembly line including the herein described conveyor.

FIGS. 2 and 3 are foreshortened fragmentary views in plan and side elevation, respectively, of the conveyor;

FIG. 4 is a transverse sectional view taken along line 4-4 of FIG. 2;

FIG. 5 is a detail transverse sectional view of a chain assembly employed in the conveyor, viewed from the underside;

FIG. 6 is a fragmentary view in side elevation illustrating the structure, manner of attachment and mode of operation of pushing lugs employed in the conveyor;

FIG. 7 is a transverse sectional view taken along line 7-7 of FIG. 6; and

FIG. 8 is a view of perspective of sheet location and guide means employed for guiding sheets onto the conveyor.

Broadly considered, the conveyor of our invention includes an endless chain arranged substantially horizontally. Guide means are positioned for guiding the chain. A suitable drive is connected to the chain for driving it at a predetermined linear speed.

Flights of substantial length are fastened transversely to the chain at spaced longitudinal intervals. Two rails are positioned one on each side of the chain, parallel to the chain and to each other. They are spaced laterally sufficient to support in sliding, bearing engagement the undersides of the flights.

Pivoting mounted, sheet-pushing lugs are connected to the chain at appropriate intervals. The lugs are over-balanced and arranged for sliding contact with a cam which elevates them into working position and lowers them to rest position as they enter and leave a working station, respectively.

Selected ones of the flights have upwardly extending spurs which engage the undersides of the sheets to insure that they will not slip.

Air jets are directed against the upper surfaces of the sheets along selected stretches of the conveyor. They blow debris from the upper surfaces of the sheets without disturbing the sheets.

Considering the foregoing in greater detail and with particular reference to the drawings:

FIG. 1 illustrates a typical application in which the conveyor of our invention may be used to advantage, viz., in the automatic assembling of plywood veneers.

In this application, the conveyor, indicated generally at 10, traverses a plurality of stations at which various operations are performed. At station 12, face veneers are placed one at a time on the conveyor. At station 14 the upper surfaces of the face veneers are coated with adhesive. At station 16 core veneers are superimposed. At station 18 the upper surfaces of the core veneers are coated with adhesive. At station 20 back veneers are superimposed. At station 22 the resulting threeply assemblies are accumulated, and transferred to a press 24.

To accommodate this sequence of operations, the conveyor must move the sheets past the various stations at a uniform production rate, must maintain the proper alignment of the sheets, must preserve the sheets against splitting, must trigger the operation of the various processing units, and must remove debris from underlying sheets so that other sheets may be overlaid effectively. The construction of the conveyor serving these functions is shown in detail in FIGS. 2-5.

Supported on transverse frames members 26 is a guideway 28 formed from a channel iron or other suitable structural member. It mounts a wear plate 29.

Guideway 28 and a companion guideway 28a on the underside of the frame, serve as races for an endless chain indicated generally at 30.

Chain 30 is driven at a predetermined but adjustable linear speed by a drive sprocket 32, fixed to a drive shaft 34 and connected to a suitable power source.

Chain 30 consists basically of a plurality of inner side plates 36, overlapping outer side plates 38 and inter-connecting pivot pins 40. This much of the chain is conventional.

However, to support and transport large sheets of fragile materials such as plywood veneers, the chain structure is modified to support a plurality of conveyor flights 42, 44.
These comprise straight bars of substantial length. The bars are mounted transversely of the chain at suitable intervals. To mount the flights, the appropriate ones of conventional outer chain side plates 38 are replaced with side plates 46. The latter are formed of two sections substantially at right angles to each other; a horizontal section which is riveted, welded or otherwise fixed to the underface of the flights; and a vertical section which serves as a chain side plate.

Flights 42, 44 have on their upper surfaces centrally located, spaced, guide tabs 48. These extend upwardly on the upper stretch of the conveyor and there they serve no function. However, on the lower stretch of the conveyor they extend downwardly and serve to guide the conveyor in the lower guideway of chain race 28a, FIG. 5.

Selected ones of the flights, i.e. flights 42, are provided with upwardly extending spurs 50. These preferably are mounted on the leading flights only. These are the flights which underlie the leading edges of sheets 52 as they move along the conveyor. The spurs serve to engage the undersides of the sheets and move them along positively, preventing their displacement during various processing operations, without presenting interfering projections above the plane of the sheet.

Because sheets 52 are wide, and flights 42 necessarily must span a substantial distance in order to underlie and support them, there are provided a pair of longitudinally extending rails 54. These also are mounted on transverse frame members 26 and lie parallel to each other, one on each side of chain 30, to which they also are parallel. The upper surfaces of the rails are provided with rounded heads of bearing material which underlie and support flights 42, 44 as they convey the sheets along the length of the conveyor.

Means are associated with the conveyor for imparting a positive thrust to the sheets and for insuring that they assume and retain their predetermined positions, particularly at the infeed end of the conveyor line. The means employed for this purpose is shown in FIGS. 6 and 7.

Selected ones of the links of chain 30 have special inner side plates 56 which mount outwardly extending angular brackets 58. The latter in turn mount fixed, laterally extending pins 60 each of which pivotally supports a push lug 62.

Each push lug is supported eccentrically on a pivot block 63 which journals pivot pin 60. A push plate 64 having a forward abutment surface which engages the trailing ends of sheets 52 is fixed to the block. A brace plate 66 having a lower edge 68 serving as a cam follower backs up plate 64, at right angles thereto.

In view of its eccentric mounting the lug, if unsupported, will fall to the position of the extreme left hand lug of FIG. 6 and thus be rendered inoperative. However, the lug may be moved to an upright, operative position by a suitably directed camming action.

Such an action is provided by cam member 70. This member consists of an elongated flat bar having a length commensurate with the length of the processing station at which it is desired to have the lug maintained erect. The leading end 70a of the bar is downwardly inclined sufficiently to engage the opposed cam follower surface 68 of lug 62.

Thus, as shown by the dotted line sequence of FIG. 6, as the only prone chain mounting lug 62 progresses toward cam 70, the lug is forced erect by contact with the cam and maintained erect by that member for the entire length of the cam. However, after the lug passes the station at which the cam is mounted, its counterbalanced construction causes it to swing downwardly to a prone, inoperative position.

This mode of operation is of the greatest importance in certain processing operations. For example, in the laying up of plywood veneers, it is necessary to overlay veneers one on top of the as they are carried by the conveyor past a sequence of stations. The core veneers applied at station 16 may not be cut precisely to length, since the finished assemblies will be trimmed at a subsequent station.

Where this is the case, the core veneers may be overlapped upon the face veneer. If the latter is pushed by a lug, the trailing ends of core veneers may be forced upwardly, and the upstanding lug and splintering will result. This may downgrade the resulting finished sheet of plywood and in any event will result in the production of splinters, snags and debris which will downgrade the product, catch on the processing equipment, and litter the premises.

It is possible by the application of the pivoting lug drive described above to avoid this problem since the lug may be used only at station 12 to impart to the underlying veneer its initial thrust. Thereafter spurs 50, previously described, which engage the leading end of the underlying veneer continue the forward drive.

Sheet locating and guide means cooperate with lugs 62 by locating the sheets with reference to the conveyor and guiding them onto the same as they are fed one at a time to the processing unit. Such means are illustrated in FIG. 8.

Indicated generally at 80, the sheet locating and guide means comprises a pan-shaped body formed of a least one angular side plate 82, a plurality of bottom plates 84 and a plurality of connecting bars 86. Bottom plates 84 are spaced vertically from the horizontal section of angular side plate 82 to form a guideway 88 for flights 42, 44. They are spaced apart horizontally sufficiently to form a longitudinal slot 90. This registers with chain 30 and accommodates lugs 62. It also registers with cam bar 70.

To prevent the sheet from floating, side plate 82 is apertured by cutting out rectangular openings on three sides only and bending the cut away material to provide vents 92. In addition, its leading end 94 is flared to lead flights 42, 44 into guideway 88.

The interior dimensions of combination sheet locating and guide means 80 are such that it will accommodate just a single one of sheets 52. Accordingly, in the operation of the conveyor, the sheets may be placed one at a time in the guide 80. At a predetermined time, one of push lugs 62 engages the inclined upstream end 70a of cam bar 70. It is swung upwardly to erect, operative position. It thereupon engages the trailing edge of sheet 52 in the combiner 42. The section is located and guided unit 80L and pushes it out of the open end of the unit, onto the flights of conveyor chain 30, onto spurs 50, and in proper alignment for subsequent processing.

Also associated with the herein described conveyor are air jet means for use in removing debris from the upper surfaces of the sheets. In the application of plywood veneers this is of particular importance because, in spite of all precautions, operation of the conveyor loosens knots and slivers. If these are permitted to remain on the upper surface of an underlying veneer, they will interfere with the proper positioning at a subsequent station of an overlying veneer. They also will cause the production of panel rejects resulting from pressing debris into the veneers in the plywood press.

The air jet means employed for removing letter of this and other categories is shown in FIGS. 1 and 2. It broadly comprises an air jet directed across a surface of the veneer sheet in such a manner that it will remove the litter without fluttering or otherwise disturbing the position of the sheet.

The air jet means employs a pipe 102 fitted with a plurality of spaced air jet heads 104. The pipe is supplied with compressed air from a suitable source and the heads are directed downwardly against the upper surfaces of the oncoming sheets. The result is to disperse the air jet as required to blow off the debris, but without disturbing the position of the sheets.
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OPERATION

The operation of the presently described conveyor is as follows: Sheets 52 are introduced one at a time at station 12 of FIG. 1 by placing them in combination sheet locating and guide means 89, FIGS. 1 and 8. A lug 62 on guide chain 30 is moved erect by contact with cam 70, FIGS. 6 and 7. Into its erect, operative position, it enters slot 90 of guide 89, engages the trailing end of the sheet and pushes it onto the broad flights 42, 44 of conveyor chain 30.

As it is pushed onto the flights, the upwardly extending spurs 50 of flights 42 engage the undersurface of the sheet, FIGS. 2 and 3.

The sheet is pushed by the lug past station 12 to the end of cam 70. Thereupon the lug falls to its prone, in-operative position since it no longer is supported by the cam. The sheet continues to move onwardly, remaining in its precise location partly through the actions of spurs 50 and partly because of gravitational effects.

The sheet is conveyed past the various processing stations, which may be actuated automatically by appropriately spaced limit switches engaging either the sheet itself, or suitably positioned bars 120 fixed to chain 30 at predetermined locations, FIG. 7.

As the sheet traverses the various processing stations, its upper surface is swept by the air jets supplied by units 100. The air jets are diffused as required to sweep the surface of the sheet free of debris without disturbing its position. Thus all of the processing operations may be carried on in sequence precisely, substantially automatically, and at high production rates.

It is to be understood that the form of our invention herein shown and described is to be taken as an illustrative example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of our invention.

Having thus described our invention, we claim:

1. A conveyor for conveying flat sheets past a plurality of processing stations, the conveyor comprising:
(a) endless chain means arranged in a substantially horizontal plane,
(b) guide means positioned for guiding the endless chain means,
(c) drive means connected to the endless chain means for driving it at a predetermined linear speed,
(d) flight means for supporting the sheets,
(e) means for connecting the flight means to the endless chain means at spaced longitudinal intervals,
(f) a pair of rails positioned one on each side of the endless chain means parallel thereto and spaced laterally therefrom, the tops of the rails being in sliding bearing engagement with the underside of the flight means,
(g) at least one sheet-pushing lug,
(h) pivotal mounting means mounting the lug at a predetermined location on the endless chain means for alternation between a pushing position in which the lug projects upwardly beyond the flight means and a rest position in which the lug is positioned below the flight means,
(i) cam means positioned at a selected station along the endless chain means, the cam means being positioned at the upstream end of the station to engage the lug below said pivotal mounting means for shifting the lug into its operative pushing position, and at the downstream end of the station to disengage from the lug for returning it to its rest position.

2. The conveyor of claim 1 wherein the pivotal mounting means is arranged eccentrically with respect to the center of gravity of the lug and wherein the cam means comprises a continuous bar extending the length of the station and contoured to shift the lug between its operative position and its inoperative position at the respective ends of the station.

3. The conveyor of claim 1 including spur means connected to the endless chain means, the spur means extending upwardly for gripping engagement with the under sides of sheets carried on the endless chain means.

4. In conveyor means arranged for transporting sheets past a processing station and including a conveyor chain having a sheet supporting surface and drive means therefor, the combination with the endless chain of:
(a) a sheet-pushing lug and pivotal mounting means mounting the lug at a predetermined position on the endless chain,
(b) the pivotal mounting means being eccentrically arranged with respect to the center of gravity of the lug, and
(c) continuous bar cam means extending the length of the station, positioned for engagement with the lug below said pivotal mounting means and contoured to shift the lug from an operative position at one end of the station in which the lug travels toward the sheet supporting surface of the conveyor chain to an inoperative position at the other end of the station in which the lug is positioned below the sheet supporting surface of the conveyor chain.

5. A conveyor for conveying flat sheets past a plurality of processing stations, the conveyor comprising:
(a) endless chain means arranged in a substantially horizontal plane,
(b) guide means positioned for guiding the endless chain means,
(c) drive means connected to the endless chain means for driving it at a predetermined linear speed,
(d) flight means for supporting the sheets,
(e) means for connecting the flight means to the endless chain means at spaced longitudinal intervals,
(f) a pair of rails positioned one on each side of the endless chain means parallel thereto and spaced laterally therefrom, the tops of the rails being in sliding bearing engagement with the underside of the flight means,
(g) a sheet-pushing lug on the endless chain means, and,
(h) sheet locating and guide means positioned above the conveyor for locating a sheet with reference thereto, the sheet locating and guide means being positioned for engagement of the sheet by the lug, which thereupon is operative to transfer the sheet from the sheet locating and guide means to the endless chain means.

6. The conveyor of claim 5 wherein the sheet locating and guide means comprises a pan having a bottom, at least one vented side wall, and a longitudinal slot extending the entire length of the bottom for reception of the lug.

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