Feb. 8, 1966 E. B. DENTON ETAL 3,233,891

STACKER

Filed Jan. 17, 1963 2 Sheets-Sheet 1

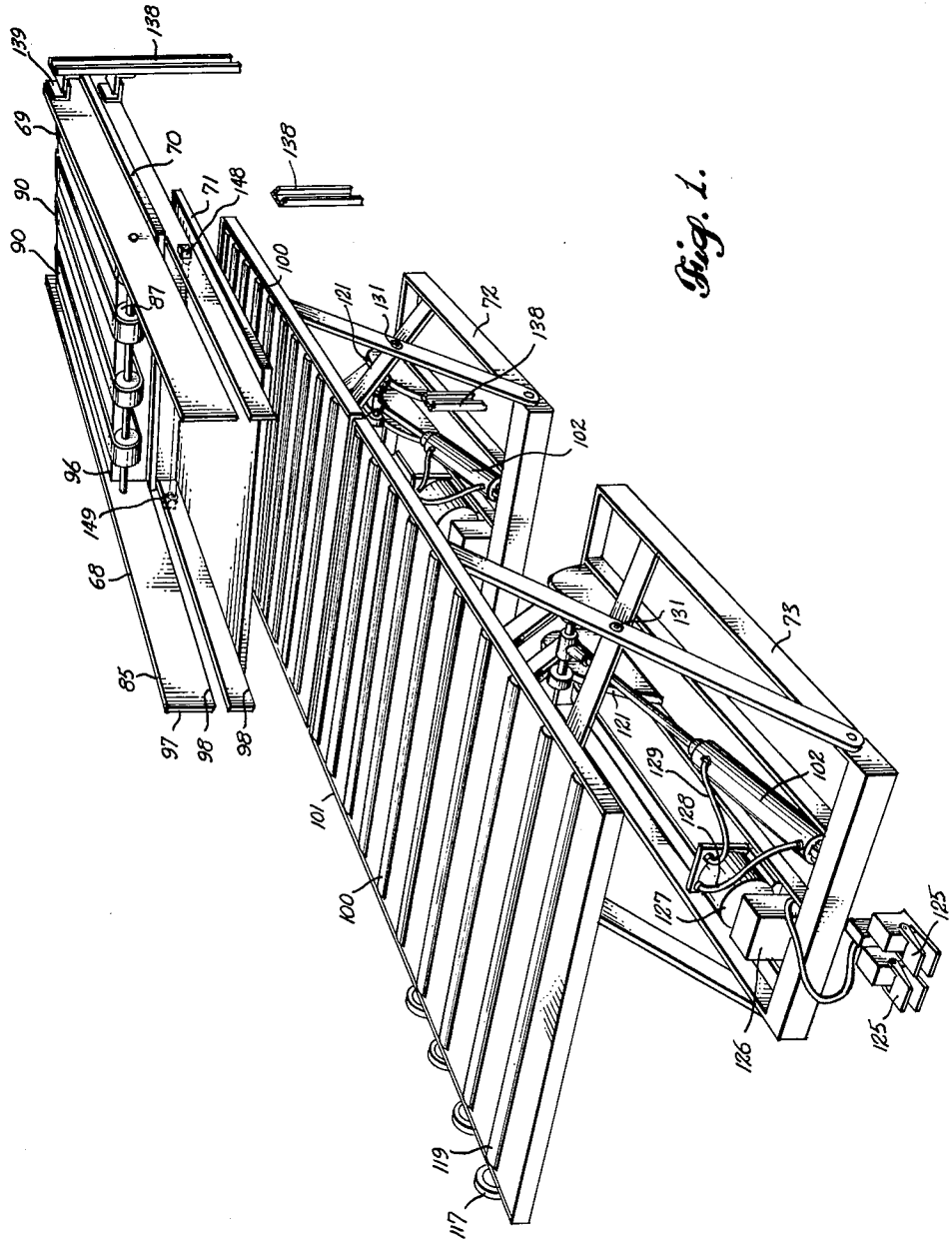


Fig. 1.

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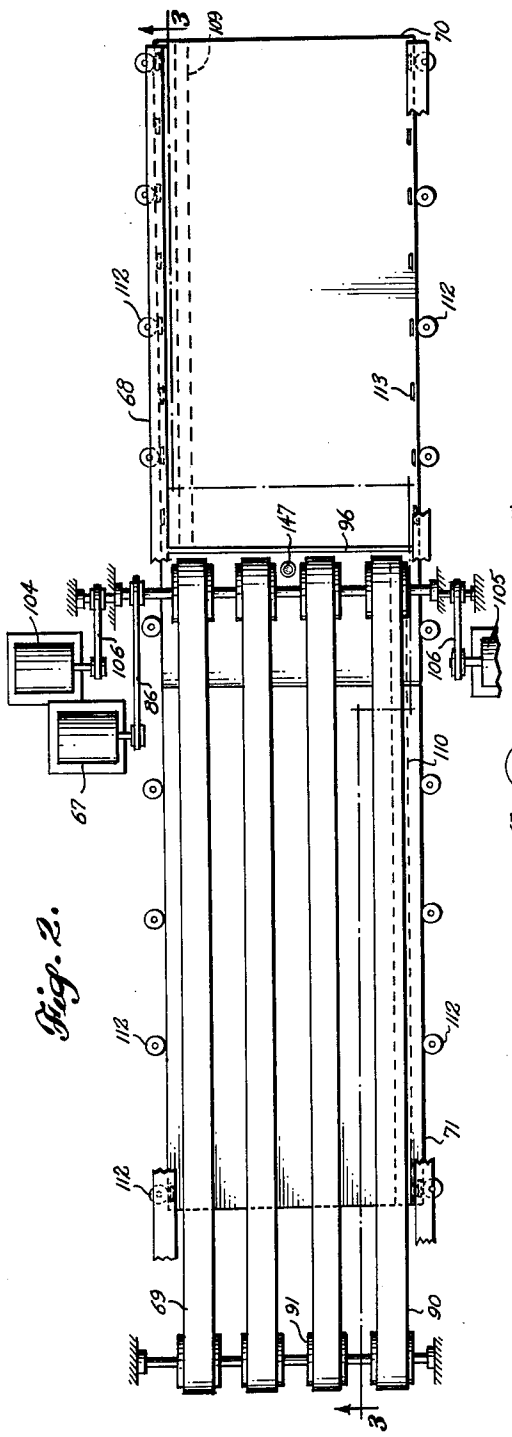


Fig. 2.

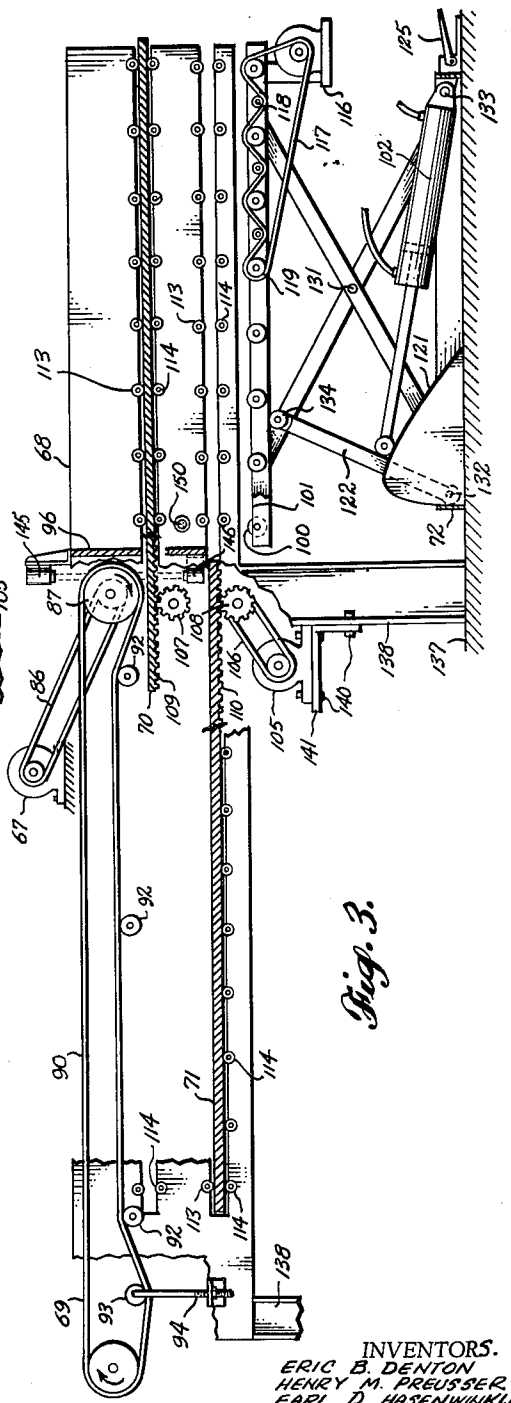


Fig. 3.

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STACKER

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7 Claims. (Cl. 271—77)

This invention relates to handling units of stackable materials leaving or about to leave continuously operating production machinery.

The purpose of the invention is to provide a method and equipment to remove, without interruption of the unit flow, selected stacked quantities from the production machinery.

The method and equipment, briefly described, comprise accelerating stackable units on a powered belt or roller conveyor operating at a speed higher than the speed of the production machinery; ejecting each accelerated unit clear of the accelerator conveyor; retarding and positioning the ejected and cleared unit on a receiving tray monitored to synchronously meet the ejected and cleared unit; dropping the positioned unit onto a stack by quickly withdrawing the receiving tray at an acceleration rate causing the unit to substantially fall freely while restricting the units sidewise and rearward movements by positioned abutments; interposing a supplemental interim stacking tray to temporarily receive units falling freely from the withdrawing initial receiving tray thereby creating an interim stack; withdrawing the initial stack from beneath the interim stack by using powered means such as powered roller lift tables; dropping the interim stack to replace the initial stack by quickly withdrawing the supplemental interim stacking tray at an acceleration rate causing the interim stack to substantially fall freely while restricting the unit's sidewise and rearward movement by positioned abutments; keeping the supplemental interim tray retracted until the follow on stack reaches a pre-selected size which is monitored as stackable units fall freely from the withdrawing initial receiving tray, and repeating these several steps in sequence, changing the timing as necessary, to control the size of stacks cleared from beneath the interim stacking tray.

The invention is applicable to the manufacture of many products which are stacked for economical purposes before shipping, subsequent handling and/or subsequent processing, following their manufacture or partial manufacture on a production line comprising continuously operating machinery. To highlight the successful practice of the invention the method and equipment is described and illustrated in detail in conjunction with the wet web production of plywood moduli described in copending application, Serial No. 219,410, filed August 27, 1962.

In this wet web production of plywood, components of wood travel along one or more conveyor lines and join together with wet adhesive webs becoming moduli of selected configurations traveling at a selected uniform speed, one after the other, continuously or spaced apart. Generally additional processing is required using the moduli in various ways to form plywood sheets of various plys. Stacks are formed of various plywood sheets. Finally, stacks are removed from the production machinery locale without interfering with the oncoming plywood components.

This invention provides the method and equipment used to handle one or more of these last-stage steps occurring after the conclusion of the uniform speed manufacturing run of the plywood components. An embodiment of the equipment is illustrated in the drawings wherein:

FIGURE 1 is a perspective view of the equipment, accelerator-stacker-unloader, while not in use, with portions removed or omitted to reveal the essential components;

FIGURE 2 is a top view of the components shown in FIGURE 1, omitting one table of the unloader; and

FIGURE 3 is a section view taken along broken section line 3—3 of FIGURE 2.

The equipment illustrated in these figures is located at the termination of that portion of a production line wherein units of stackable material are advancing at a constant speed. The equipment in operation receives and stacks the units quickly and conveniently without interrupting the oncoming flow of stackable material.

The equipment 85 includes an accelerator 69 to separate one oncoming unit from another (not shown), such as a four by eight wood panel modulus. If the units are previously separated, the separation may still be increased. Sufficient separation must occur establishing a time interval in which a unit can be stacked above another without delaying production. The accelerator 69 has an electric motor 67 with a belt transmission drive 86 powering rollers 87 moving conveyor belts 90 over roller 91 and 92. The belts 90 are tightened by positioning roller 93 using the threaded means 94. The accelerator conveyor belt speed must be sufficient to cause units, upon leaving the accelerator, to fall freely to a receiving tray 70 which is synchronously projected to meet each ejected unit. The synchronous movement of the tray 70 is initiated as the leading edge of the leaving unit interrupts the vertical orientated light beam photocell 145 and light 146 system 147 (mounting supports of the system 147 are not shown).

Immediately and automatically after the unit's capture by the receiving tray 70, the tray 70 is rapidly withdrawn from beneath the unit of stackable material while the unit is restrained by an abutment 96. This abutment 96 is part of frame 97 which includes guide means 98—98 confining the movement of the retractable trays 70 and 71. Upon withdrawal of the receiving tray 70, the unit again falls freely, landing, during the major portion of the operating time, on some movable receiving means such as the essentially standard X-frame lift table 72 which is hydraulically actuated 102 and has rolls 100 along its top surface 101. Following units of stackable material are likewise accelerated, captured and dropped upon the immediately preceding unit, already located on the lift table 72.

As the number of units piled one upon another on the lift table 72 increase in number the lift table is gradually and automatically lowered, eventually receiving its selected or maximum load. When this occurs, the retracted receiving tray 71 is moved out into position to receive following units while lift table 72 is unloaded.

Movement of feeding trays 70 and 71 occurs when electric motors 104 and 105, respectively, power the belt drives 106—106 rotating pinion gears 107 and 108 which in turn drive gear racks 109 and 110 secured to the bottoms of the respective receiving trays 70 and 71. At all times the receiving trays 70 and 71 are confined and guided, preferably by roller bearing devices inclusive of side 112, the top 113, and bottom 114 bearings, arranged along the stackable material guide means 98—98.

The lift tables 72 and 73 are essentially standard commercially available material handling accessories. Both tables have a similar top 101 equipped with similar rollers 100 including powered rollers 119 which are driven, as a motor 116 drives a belt or sprocket chain 107 passing around idler sprockets 118 and over the powered rollers 119. The table top height of both lift tables 72 and 73 is adjustable by operating a hydraulic actuator 102 to follow cam surfaces 121 causing pivotal movement of a lifting arm 122 which in turn raises or lowers the table top 101. Automatic or foot controls 125 through elec-

trical means 126 operate a hydraulic pump 127 supplying hydraulic fluid to the actuator 102 through the lines 128 and 129.

The automatic controls causing the lift table 72 to lower uniformly are initiated by the response of a horizontal orientated light beam photocell 148 and light 149 system 150. When stackable units interrupt the horizontal light beam, the lift table 72 is lowered until the light beam again reaches the photocell 148. The mounting supports of the system 150 are not shown.

When table 72 has been lowered to receive a selected quantity of stackable material and when the retractable tray 71 has been placed in position to commence the interim stack, lift table 73 is adjusted to match the elevation of lift table 72. Thereafter, by driving the powered rolls 119, the accumulated stack of units is removed from table 72 to table 73. From this position the stack is handled by other means (not shown), using the power rolls 119 of table 73 and its actuator 102 if the stack is moved, for example, to the flat bed of a vehicle. The utilization of a second lift table, such as table 73, may not be necessary where unloading facilities such as a vehicle were on schedule to take the load being removed from lift table 72. However, utilization of two end-for-end lift tables or some such receiving means provides the necessary tolerance required to avoid any stoppage of the continuous unit flow of the entire production machinery. Also, two end-for-end lift table provide the more convenient means to transfer stacked units to other conveyors, especially where there is a difference existing in the conveyor levels.

The standard structure of the X-lift tables 72 and 73 includes the pivoting connection 131 of each X supporting frame, the pivoting connection 132 of the raising arm 122 and the pivoting connection 133 of the hydraulic actuator 102. Also, rollers 134 and 135 are used in each lift table actuating system to increase its mechanical effectiveness, in like manner to the use of roller bearings throughout the retractable tray guides 98—98.

The entire stacking means 68 is preferably supported above the floor 137 by stanchions 138 using spacing members 139, as necessary, to clear the receiving trays 70 and 71.

Essentially all of the other components can be mounted on brackets secured to this basic structure of the powered stacking means 68 supported on the stanchions 138. Such a mounting is indicated in FIGURE 3. Motor 105 is secured by bolts 140 to a bracket 141 which in turn is bolted to stanchion 138. Other such mountings are not illustrated, thus avoiding unnecessary confusion in the illustrations. Instead, brief diagonal lines indicate that the equipment is supported in like manner from this common structure.

In summary, the equipment, a powered stacking means, comprises three main components: accelerator, stacker, and unloader. The accelerator provides means for quickly advancing a unit of stackable material permitting its subsequent handling without interfering with oncoming units. The stacker provides means for continuously stacking units while selected stacked quantities are withdrawn. The unloader provides means for clearing selected stacks from the equipment for subsequent handling by other equipment (not shown).

We claim:

1. A method of handling units of stackable materials leaving continuously operating production machinery comprising:

(a) receiving on a conveyor means a stackable unit delivered from the production machinery;

(b) accelerating the stackable unit by operating the conveyor means at a speed greater than the delivery speed of the production machinery;

(c) ejecting the accelerated stackable unit clear of the accelerating conveyor means;

(d) retarding and positioning the ejected stackable unit on a receiving tray;

(e) dropping the positioned stackable unit onto a stack of units by quickly withdrawing the receiving tray while restraining the stackable unit against an abutment causing the stackable unit to fall freely downwardly;

(f) interposing intermittently an interim stacking tray to temporarily receive units falling freely downwardly from the initial receiving tray level creating an interim stack of units;

(g) withdrawing the initial stack from beneath the interim stack of units by using handling equipment;

(h) dropping the interim stack to replace the initial stack of units by quickly withdrawing the interim stacking tray while restraining the interim stack against an abutment causing the interim stack to fall freely downwardly from the interim tray level;

(i) keeping the interim tray retracted until the following stack increases to a selected size as stackable units are deposited from the initial receiving tray; and

(j) repeating these several steps in sequence, changing the timing, as necessary, to control the size of stacks cleared from beneath the interim stacking tray.

2. A method of handling plywood-like moduli leaving continuously operating, substantially uniform speed conveyors, comprising:

(a) advancing on an accelerator the modulus leaving the uniform speed conveyor;

(b) positioning the advanced modulus leaving the accelerator by moving a receiving tray under the advanced modulus to stop the advanced modulus over a stacking position clear of the accelerator;

(c) dropping the advanced modulus to a stacking position by withdrawing and receiving tray;

(d) repeating steps (a), (b) and (c) with following moduli until the stack reaches a selected height, then;

(e) intercepting the dropping advanced moduli by moving an interim stacking tray under a selected modulus and holding the stacking tray to intercept other moduli, while;

(f) withdrawing the initial stack of moduli from the stacking position;

(g) dropping the interim stacked moduli to the vacated stacking position by withdrawing the stacking tray; and

(h) repeating steps (a), (b), (c), (d), (e), (f), (g).

3. A stacker assembly for removing stackable units leaving a substantially uniform speed conveyor production line, comprising:

(a) an accelerator of stackable units, one at a time, comprising: powered conveyor means operating at a higher speed than the uniform speed of the conveyor production line; mounting means positioning the accelerator conveyor means at a level substantially the same as the level of the conveyor production line, and a power means to move the accelerator conveyor means;

(b) a stacker comprising a moving tray, traveling in one direction to intercept, hold and position an accelerated stackable unit and retracting in the opposite direction to clear the positioned stackable unit causing its free fall to a stacking place; mounting means on and above the floor placing the moving tray below the accelerator and power and guide means on the mounting means to drive and control the moving tray.

4. A stacker assembly as claimed in claim 3, comprising: a second moving tray and its power and guide means to move the second tray below the first tray, periodically to collect following stackable units while the initial stack is removed from below the second moving tray.

5. A stacker assembly as claimed in claim 4, comprising: an X-frame lift table having powered means to raise and lower its table surface and having powered roller means on its surface for receiving free falling positioned

stackable units and periodically discharging the stack of units by operation of the powered rollers and returning to an elevation to receive following stackable units first from the second lower tray and then from the higher tray.

6. A stacker assembly as claimed in claim 5, comprising: a second X-frame lift table, similar to the first X-frame lift table, lowered to receive the stackable units from the first X-frame lift table and thereafter adjusted to a height matching the load bed of a vehicle used to carry the stack away and upon matching the level transferring the stack upon operating of the powered rollers.

7. A stacker assembly for receiving the unitized output of stackable units leaving a substantially uniform speed production line, comprising:

(a) an accelerating means to space apart the departing stackable unit;

(b) an arresting means to receive the accelerated stackable unit over a stacking location, having a power means to move the arresting means into contact with the accelerated stackable unit and to retract the arresting means allowing the stackable unit to fall freely;

(c) an interim stacking means to intercept periodically the free falling stackable units, having a power means

to move the interim stacking means below the arresting means to collect the stackable units to be dropped by the arresting means and to retract the interim stacking means allowing the interim stack to fall freely to the initial stacking location; and

(d) adjustable height stacking equipment means with self-contained surface power means to handle the removal of stacks from beneath the interim stacking means and on to additional places of storage.

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