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[56]

References Cited

UNITED STATES PATENTS

1,298,510	3/1919	Kaas.....	143/157
3,292,783	12/1966	Quist et al.....	209/74

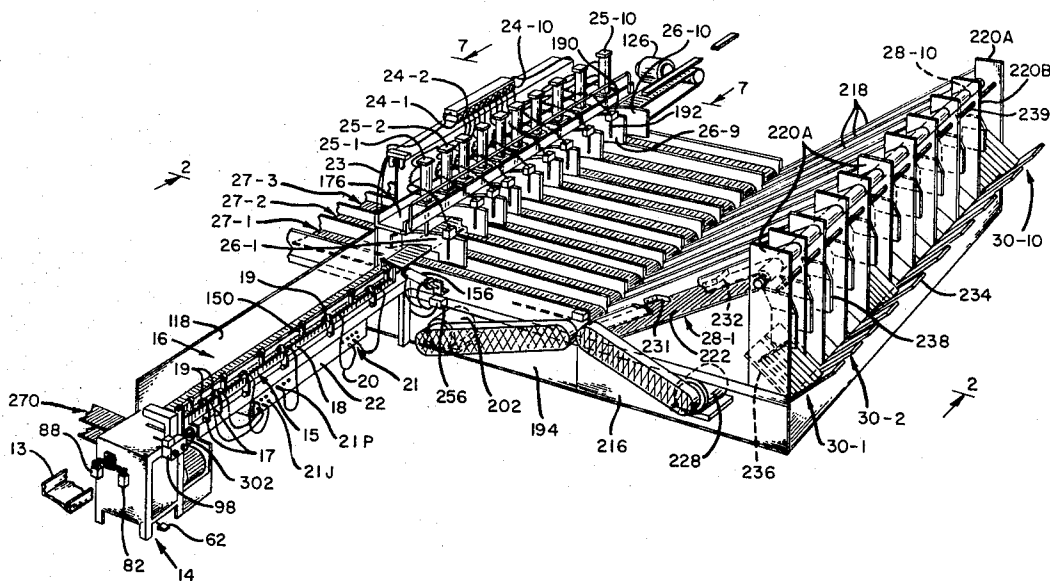
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[54] **LUMBER SORTING METHOD**
10 Claims, 11 Drawing Figs.

[52] U.S. Cl..... **144/312,**
143/157, 209/74

[51] Int. Cl..... **B27b 1/00**

ABSTRACT: A lumber cutting and sorting method wherein the lumber is cut into various predetermined lengths by abutting them against gage stops while making the cut. The gage stops have associated sensing means controlling downstream lateral deflector means for sorting the lumber by thickness, width, and/or grade. Crossed plural conveyors remove the cut lumber after sorting.



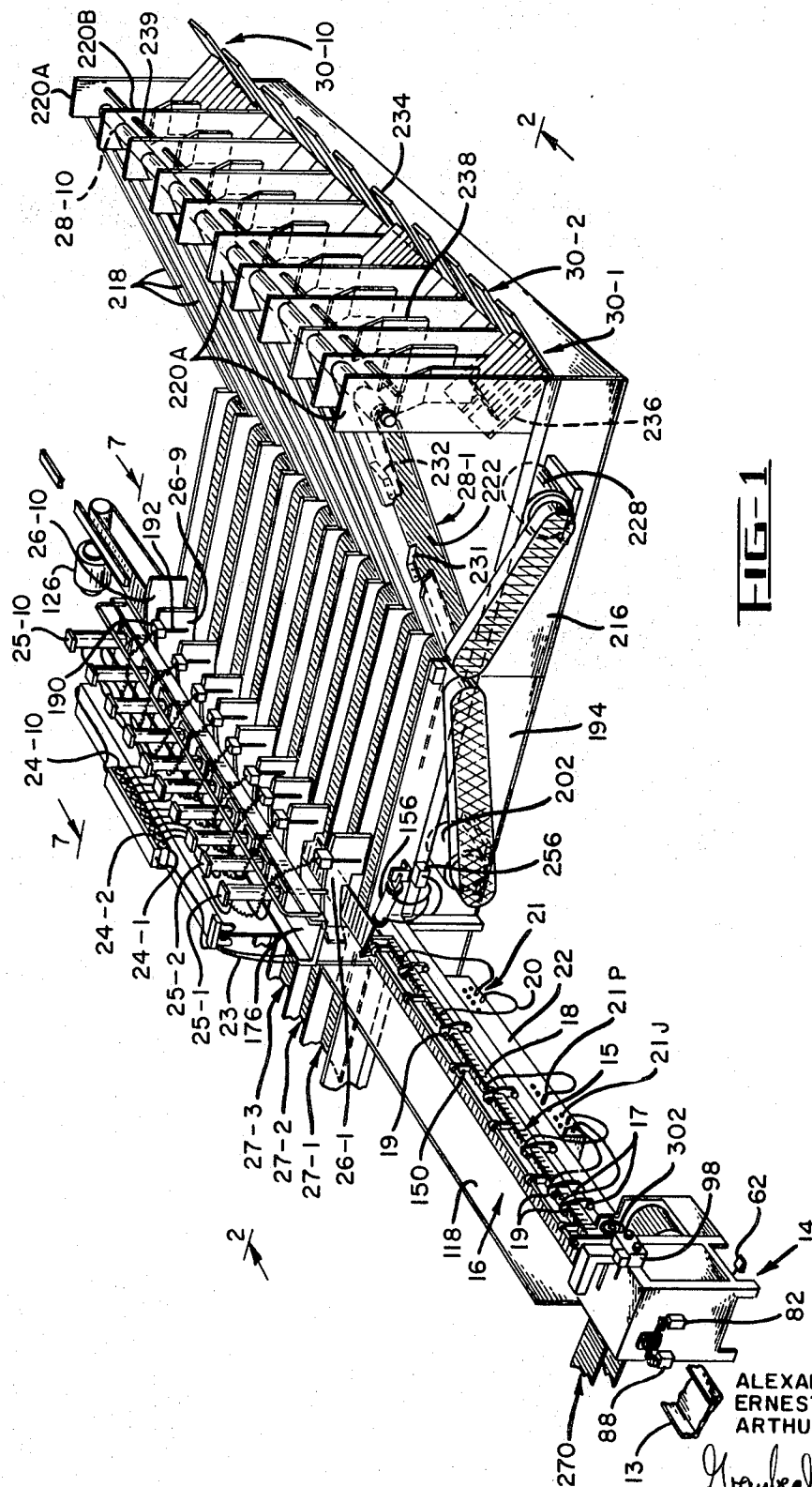


FIG-1

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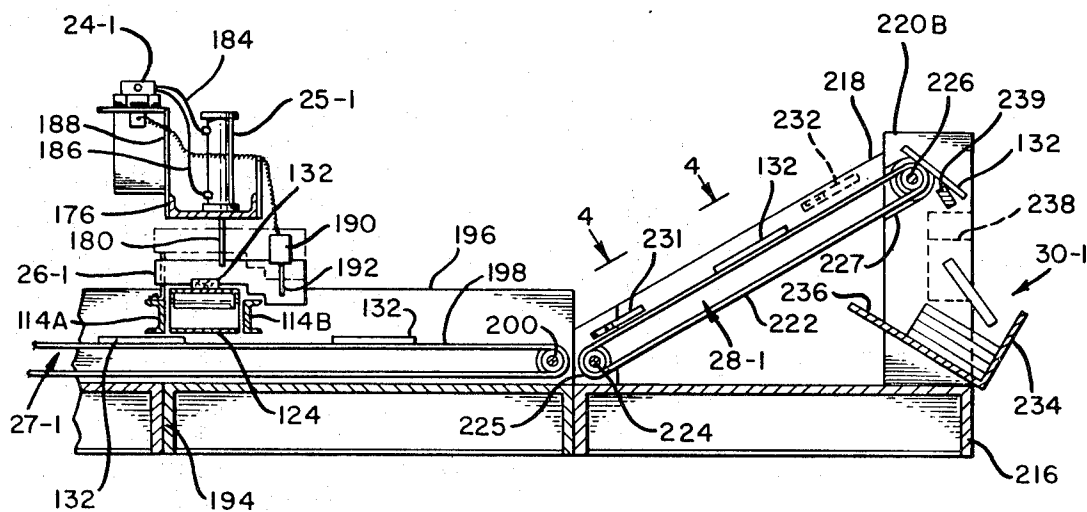
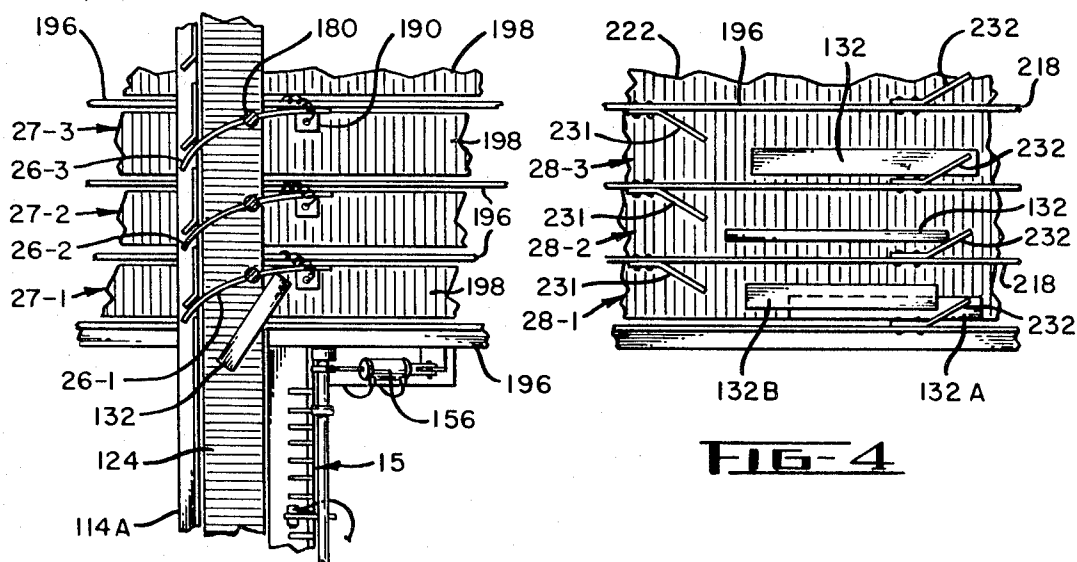
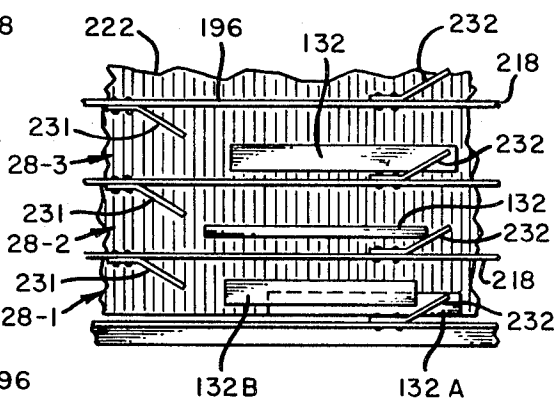


FIG-3

FIG-4

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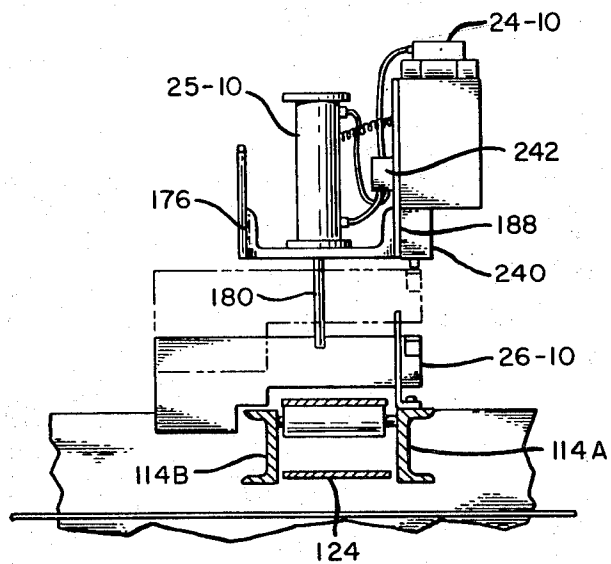


FIG-7

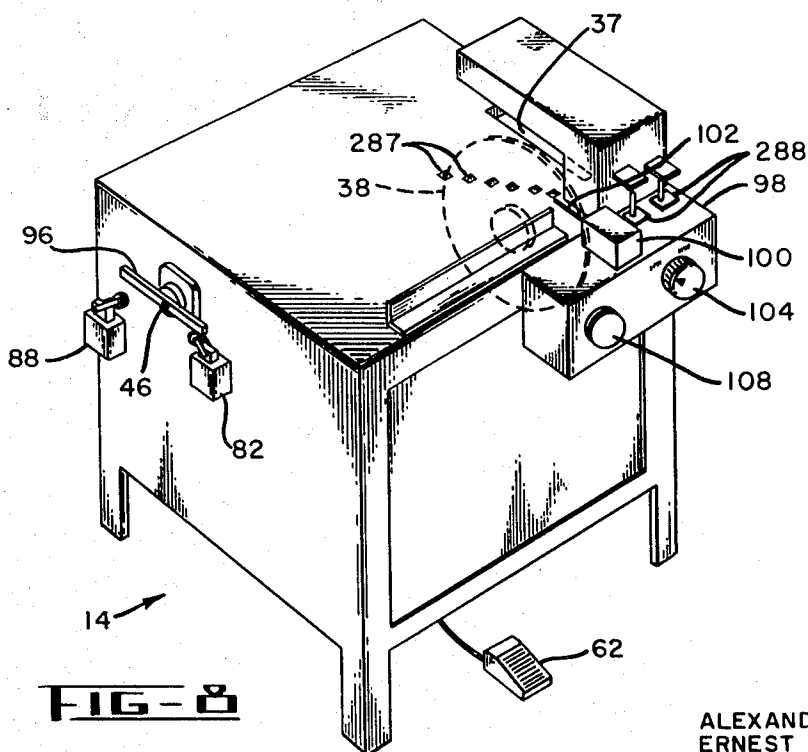
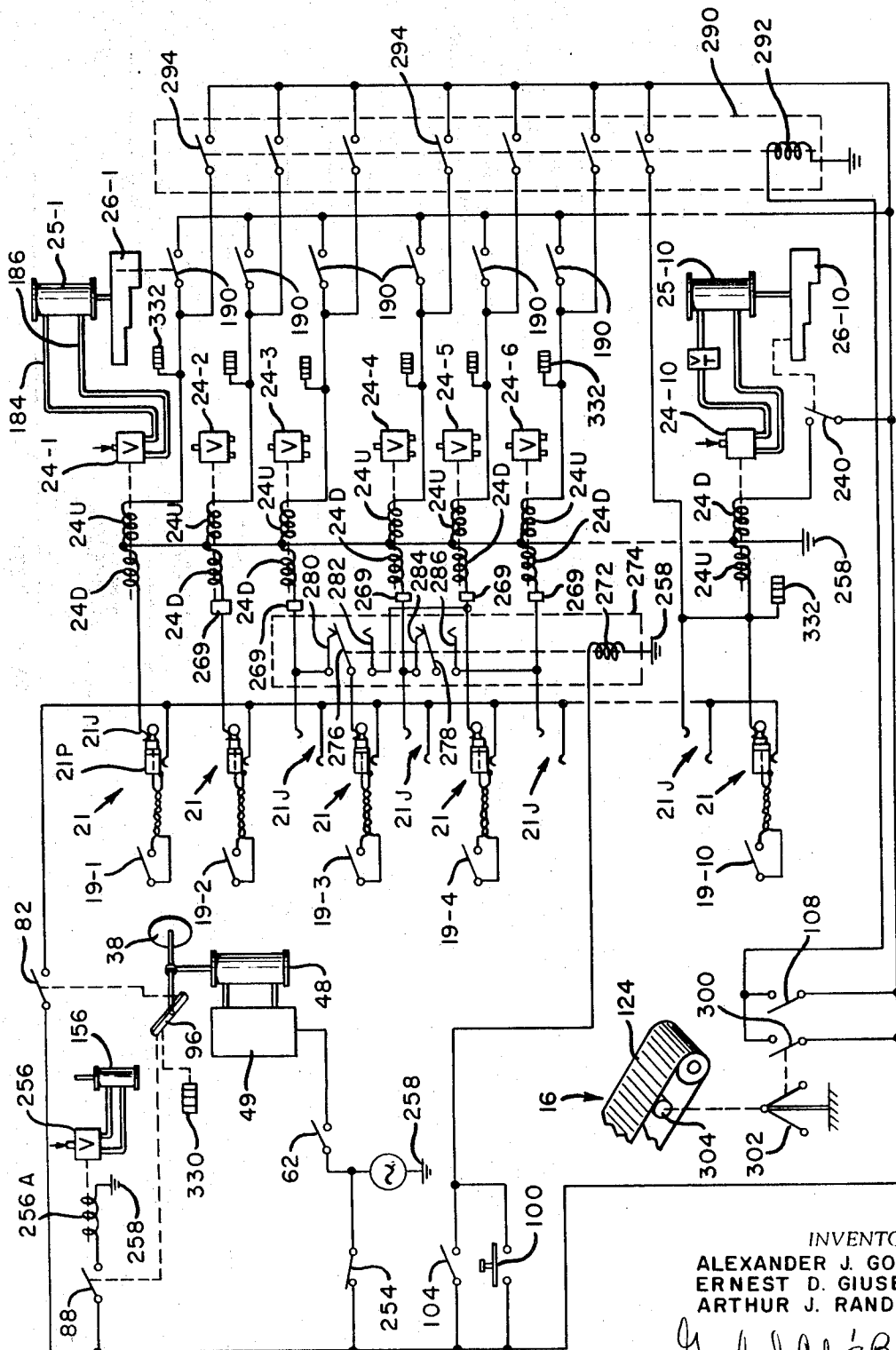


FIG-8

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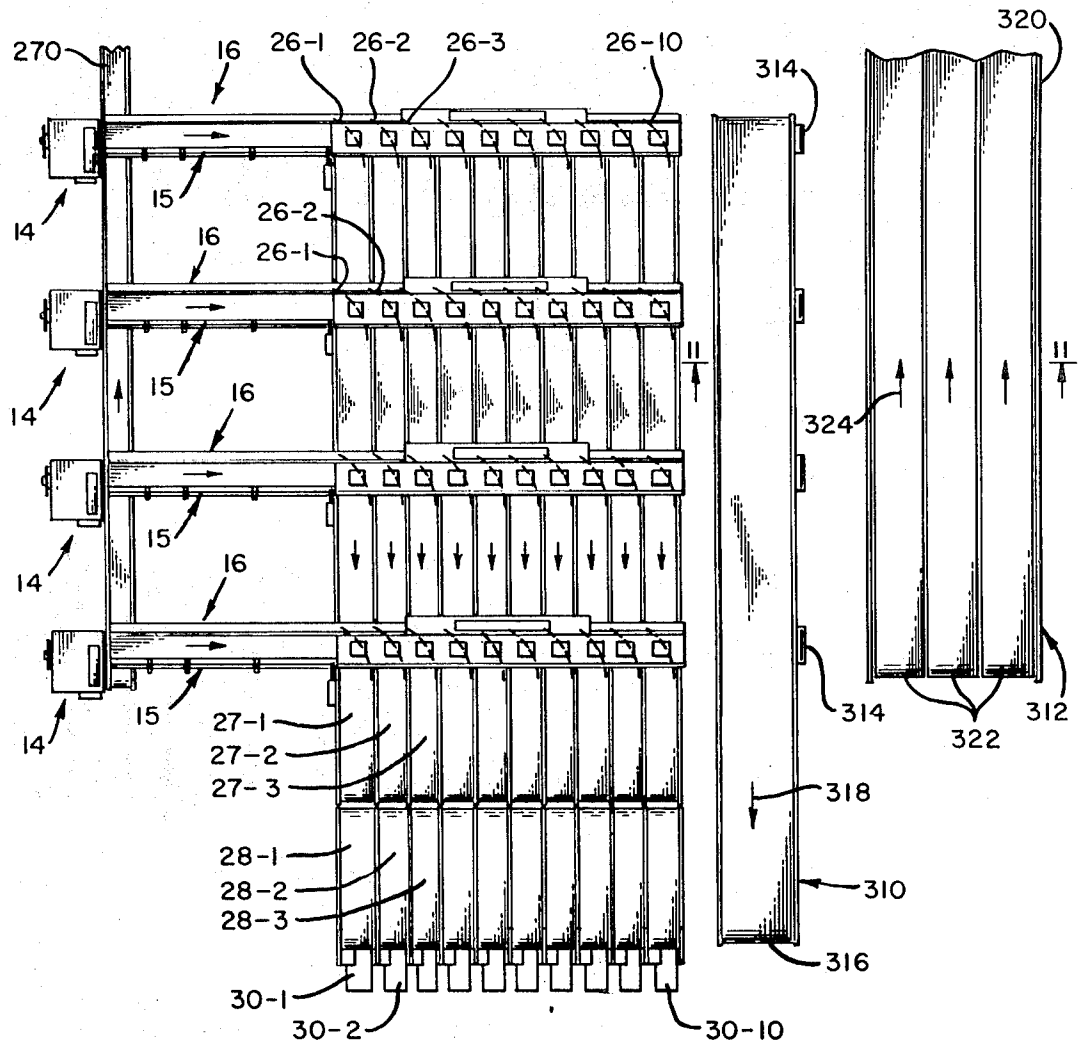


FIG-10

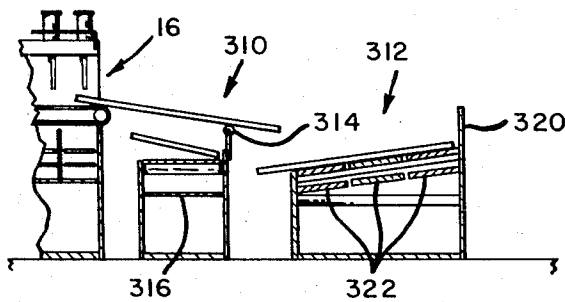


FIG-11

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LUMBER SORTING METHOD

CROSS-REFERENCE TO RELATED APPLICATION

This is a division of our copending application 515,697, entitled Lumber Sorting Machine and filed Dec. 22, 1965, the said application having been granted as U.S. Pat. No. 3,502,123 on Mar. 24, 1970.

This invention relates to a lumber cutting and sorting method and more particularly to a method for sorting lumber according to the length of the cutting.

Under conventional systems of cutting and separating components of various lengths, the normal procedure has been to cut the components of various lengths and grades. The pieces are carried away on a common conveyor with all lengths intermingled together. A workman would then separate the various lengths and grades and stack the various lengths and grades in separate bins, carts, etc.

With the system of this invention we are able to separate the various lengths into separate bins and separate pieces of the same length of different grade into additional bins, at the same time the piece is being cut at the saw, thus saving manpower.

An object of this invention is the provision of an automatic lumber cutting-sorting method which eliminates the need for manually sorting the lumber after cutting, and which requires considerably less space and equipment than conventional lumber cutting and sorting apparatus.

These and other objects and advantages are obtained by means of apparatus comprising a saw, such as a cutoff saw, and a lumber cutoff gauge stop in tandem therewith. The gauge stop may comprise a plurality of adjustably positioned stop members. In accordance with this invention, the stop members are provided with sensing means, such as switches, for sensing which stop member is employed when making the cut. Other sensing means such as photocells, ultrasonic means, etc., located in any suitable position also may be employed. After the cut is made by the saw the cut piece is moved transversely off the gauge stop and onto a primary conveyor extending parallel with the gauge stop. The transfer of the cut piece from the gauge stop onto the conveyor may be effected by any suitable means such as by gravity or by mechanically operated kicker members.

In accordance with this invention a plurality of movable deflector plates are located at spaced locations along and above the primary conveyor downstream of the saw, which deflector plates are normally disposed out of the path of movement of the cut pieces of lumber. The deflector plates may be lowered into deflecting position over the conveyor to deflect the cut board from said conveyor into the desired channel. The means for actuating said deflector plates include said sensing means at the stop members whereby the location at which the lumber is deflected from the main conveyor is determined by the length of board cut. The boards are thereby sorted according to length.

If desired, two or more deflector actuating means may be selectively connected to a single stop member switch through a selector switch means under control of the operator whereby, in addition to automatically sorting the lumber by length, the operator may also divert the board to an alternate destination by simply actuating the selector switch.

The lumber deflected from the primary conveyor may be directed by said deflector plates onto parallel or diverging cross conveyors extending transversely of and beneath the primary conveyor. From the cross conveyors the sorted lumber may be stacked in corresponding accumulators by means of a stacking unit.

In the drawings wherein like reference characters refer to the same parts in the several views:

FIG. 1 is a perspective view of a lumber cutting-sorting apparatus embodying this invention;

FIG. 2 is a sectional view taken substantially on line 2-2 of FIG. 1;

FIG. 3 is a fragmentary sectional plan view showing a portion of the primary conveyor and cross conveyors;

FIG. 4 is a fragmentary view taken on line 4-4 of FIG. 2;

FIG. 5 is an enlarged fragmentary plan view showing a portion of the primary conveyor and measuring guide;

FIG. 6 is a sectional view taken on line 6-6 of FIG. 5;

FIG. 7 is an enlarged fragmentary sectional view taken on line 7-7 of FIG. 1;

FIG. 8 is an enlarged perspective view of the cutoff saw, showing a control box and limit switches added thereto;

FIG. 9 is a simplified schematic diagram of the control system for the apparatus.

FIG. 10 is a diagrammatic plan view showing a plurality of saws, primary belts, cross conveyors, and random length and long length conveyors at the end of the primary belts, and

FIG. 11 is a diagrammatic fragmentary sectional view taken on line 11-11 of FIG. 10.

For a brief description of the apparatus of this invention reference is first made to FIG. 1 wherein the apparatus is shown comprising a saw 14 to which long lengths of lumber may be supplied from any suitable source (not shown) for cutting to desired length. Any suitable type saw such as a mechanically operated cutoff saw may be employed in the apparatus. In the illustrated apparatus a conventional cutoff saw which has been modified by the addition of various control switches as described in detail below is employed. A lumber support table 13 at one side of the table saw 14 may be used to support lumber being supplied to the saw and the outer end of the lumber extending across the saw.

A lumber cutoff gauge stop 15 is arranged in tandem with the saw 14, a primary conveyor 16 is arranged in parallel with the gauge stop. A substantially conventional lumber cutoff gauge stop 15 is shown which includes a plurality of adjustably positioned stop members 17 pivotally mounted on a slotted bracket 18. In accordance with this invention the gauge stop 15 is modified by the addition of sensing means such as switches 19 to the stop members 17. Lead wires 20 from the switches 19 are provided with plug connectors 21P for plugging into desired jacks 21J carried on a panel 22 below the lumber measuring guide, (a plug and jack together being designated 21). The jacks, in turn, are connected through cables 23 to control windings of solenoid-actuated air valves 24-1, 24-2, etc., which valves control the pressurization of air cylinders 25-1 through 25-10. The cylinders 25-1 through 25-10 actuate curved deflector plates 26-1 through 26-10, respectively, for vertical plane movement of the deflector plates between raised and lowered positions over the primary conveyor 16. With the deflector plates in the raised position, the lumber on the primary conveyor passes therebeneath. In the lowered position, the deflector plate is lowered into the path of the lumber traveling along the primary conveyor whereby the lumber is deflected from the primary conveyor 16 and onto one of a plurality of parallel extending cross-conveyors 27-1 through 27-10. The cross-conveyor onto which the lumber is transferred depends upon which deflector plate is lowered, which, in turn, depends upon which stop switch 19 at the measuring guide is actuated. The cut pieces are thereby automatically separate according to length and deposited onto the cross-conveyors.

The lumber from the cross-conveyors 27-1 through 27-10 is fed to inclined elevating conveyors 28-1 through 28-10, respectively, from whence it is stacked in accumulators 30-1 through 30-10, respectively.

As best seen in FIG. 8, a plurality of switches are included at the saw 14. A foot-controlled switch 62 controls the raising of the saw blade 38 to cutting position through the slot 37 in the saw by means of any suitable mechanism. Saws of conventional design may be employed and need not be described in detail. Mounted on the side of the saw cabinet are a pair of switches 82 and 88 which are actuated by a switch actuating lever 96 fixedly secured to a pivot shaft 46, which shaft is pivoted as the saw blade 38 is raised and lowered. The switch 82 is a normally closed switch which is held open by the lever 96 when the saw blade is retracted and which closes only when the blade is extended. This switch is included in the energization circuit for the control windings of the solenoid actuated

valves 24-1, 24-2, etc., for the operation of the deflector plates 26-1, 26-2, etc. The switch 88 is normally open and is actuated to a closed position by the lever 96 when the saw blade is raised. This switch is included in the energization circuit for control of a kicker mechanism for the transfer of cut lumber off the lumber cutoff gauge stop 15 and onto the primary conveyor 16.

A control box 98 is mounted on the front panel of the saw cabinet within convenient reach of the sawyer. A normally open grade selector switch 100 with an actuating arm 102 extending therefrom is mounted on the box 98. The switch 100 is effective for grade selection during only a single cycle of operation of the machine. The control box 98 houses another grade selector switch 104 which may be set by the operator to the predominate grade lumber being run through the machine. Push button switch 108 is also contained in the control box 98, which switch is included in a circuit for raising all of the deflector plates 26-1 through 26-10.

Reference is now made to FIG. 6 wherein the primary conveyor 16 is shown comprising a pair of spaced longitudinally extending channel beams 114A and 114B mounted on a base plate 116 attached to suitable supporting means not shown. A vertical guide plate 118 and an elongated rectangular-shaped frame member 120 are attached to the upper edges of the channel beams 114A and 114B, respectively. Idler rollers 122 for the support of the forward run of a conveyor belt 124 are rotatably supported between the members 118 and 120. The conveyor belt passes over end rollers at opposite ends and is driven by a motor 126. (See FIG. 1).

The lumber cutoff gauge stop 15, as seen in FIGS. 5 and 6, comprises the inverted L-shaped mounting bracket 18 attached as by bolts or other suitable means not shown to the longitudinal frame element 120. The lumber 132 to be cut is supported on the horizontal bracket 18 against upright flange 136 formed thereon. In FIGS. 5 and 6 the lumber to be cut is shown in broken line view on the lumber cutoff gauge stop 15, and a cutoff piece of lumber is shown in full line on the conveyor 16.

Slots 140 are formed in the bracket 18 at suitable intervals therealong. In the fragmentary view of FIG. 5 the slots are shown spaced one inch apart, and inch markings 15 through 20 inches are shown adjacent the slots. The slots extend along the bracket 18 for any desired length of say 8 to 10 feet. The stop members 17 are pivotally supported on the bracket 18 within any of the slots 140 as desired. Inverted L-shaped slots 144 are formed in the stop members for ready positioning of the stop members at any desired slot 140. In FIG. 5 stop members are shown at the sixteen and twenty inch slots. Each stop member 17 carries a weight 146 at the lower end thereof, and the force of gravity on the weights operates to hold the upper end of the stop members in an extended position through the slotted portion of the lumber supporting surface, as shown in full line in FIG. 6. The stop members may be manually pivoted in a clockwise direction as viewed in FIG. 6 to the broken line position wherein the upper portion of the stop member no longer extends through the lumber supporting surface. Pivotal movement of the stop members is accomplished when the sawyer moves the lumber transversely of the measuring guide into engagement with the flange 136. Those stop members engaged by the side of the lumber are forced into a nonoperative position.

In use, the stop members are positioned in desired slots for cutting the lumber to the desired length, and the lumber to be cut is manually advanced by the sawyer over the saw table and along the lumber cutoff gauge stop. When the forward end of the lumber just short of the desired stop member, but extends beyond the last preceding stop member, the sawyer moves the lumber transversely against the flange 136, at the same time sliding the lumber forward into abutting relation with the desired stop member. It will be apparent that all of the stop members between the saw and the desired stop member are swung out of normal position by the lumber at this time. With the lumber abutting the desired stop member, the lumber may then be cut to the desired length.

After the cut has been made by the saw, the cutoff forward section of lumber is transferred off the lumber cutoff gauge stop 15 and onto the conveyor belt 124 of the conveyor 16. For this purpose pivotally mounted kicker arms 150 of any suitable design are employed. In the illustrated arrangement the arms are shown fixedly secured to a shaft which is rocked by an air cylinder 156.

In accordance with this invention, the stop or abutment members 17 are supplied with sensing means such as the normally open electrical limit switches 19 which have actuating rods 164 extending through sleeves 166 which face upstream and against which the end of the lumber to be cut is abutted. Thus, it will be seen that the lumber is butted against the desired stop member through the actuating mechanism of a switch whereby the switch at the desired stop member is actuated into a "closed" position while the remainder of the switches 19 remain unactuated. The sleeves 166 are removably attached to the stop members by means not shown, and by proper selection of sleeves lumber may be cut to any desired length in increments of less than one inch.

As mentioned above, a plurality of parallel aligned cross-conveyors 27-1 through 27-10 extend beneath the primary conveyor 16, and movable deflector plates 26-1 through 26-10 are positioned over the primary conveyor at the cross-conveyors for selectively deflecting the cut lumber from the primary conveyor onto the cross-conveyors. All deflectors may be of the same construction whereby a description of one applies to them all. As seen in FIGS. 1 and 2 a U-shaped supporting member 176 extends longitudinal of the primary conveyor 16 over the cross-conveyors 27-1 through 27-10 and is supported by suitable framework, not shown. The air cylinders 25-1 through 25-10 are mounted on the member 176 with the piston rods 180 extending downwardly through clearance holes in the member. The deflector plates 26-1, 26-1, etc. are attached to the lower ends of the piston rods by welding or other suitable means, not shown. The deflector plates are of a curved shaped and extend across the main conveyor 16 and along the far edge of the channel divider of the associated cross-conveyor. The lower edges of the deflector plates are formed with downwardly protruding portions directly over the cross-conveyors for directing the lumber as it is projected from the main conveyor. The deflector plates may be of any desired configuration for guiding the travel of the deflected boards. The invention is not limited to deflector plates of any particular shape.

As seen in FIG. 2 each deflector plate is movable between a lowered position, shown in full lines and raised position shown in broken lines. In the lowered position, the deflector is positioned in the path of the lumber traveling along the main conveyor. Engagement of the end of a board 132 with the deflector deflects the board to the right as viewed in FIG. 2, for transfer of the board off the primary conveyor and onto a cross-conveyor. The primary conveyor 16 operates at high speeds (generally between 500-100 feet per minute) whereby the cut boards are positively projected off the primary conveyor and along the cross-conveyor as a result of the high inertia imparted to the boards. The primary belt has a rough top surface for a high coefficient of friction to insure prompt acceleration and removal of the cut board. Mechanical means may be included in the kicker mechanism, if desired, to provide a longitudinal component of velocity to the board as it is kicked from the lumber cutoff gauge.

The fluid connections for the cylinders 25-1, 25-2, etc. will be described in detail hereinbelow. For present purposes, it will be sufficient to note that hoses 184 and 186 lead from opposite ends of the cylinders to the solenoid operated valves 24-1, 24-2, etc. for control of air flow to the cylinders. The valves 24-1, 24-2, 24-2, etc. are mounted on top of an inverted L-shaped bracket 188 attached to the supporting member 176 along one edge thereof as by welding or other suitable means, not shown.

A switch 190 is attached to each of the deflector plates 26-1 through 26-9 at the downstream end adjacent the upper edge of the deflector plate. A movable switch actuating arm 192 ex-

tends downwardly from each of the switches into the path of the board being deflected by the lowered deflector plate. The normally open switch 190 is actuated to a closed condition by the board 132 passing thereby. The switches are included in the control circuit for the associated solenoid operated valves 24-1, 24-2, etc. for returning the lowered deflector plates to the raised position.

The deflected boards drop onto one of the cross-conveyors 27-1, 27-2, etc., depending upon which deflector plate is lowered. The cross-conveyors as shown in FIGS. 1 and 2 are mounted on a base 194 having parallel upright guide rails 196 attached thereto by means not shown. Cross-conveyor belts 198 pass over rollers 200 at opposite ends thereof. Only the rollers 200 at one end of the belt are shown, which rollers are driven by a motor 202 through a suitable belt and pulley arrangement. Idler rollers, not shown, may be positioned beneath the forward run of the conveyor belts 198 if desired. Also, the cross-conveyors may be of sufficient length to extend beneath other primary conveyors, shown in FIGS. 10 and 11, whereby lumber from several primary conveyors and saws is fed onto the cross-conveyors. The cross-conveyors are generally operated at speeds of 150 to 175 feet per minute to reduce stacking of the boards thereon from the primary conveyors.

From the cross-conveyors 27-1, 27-2, etc. the lumber is fed onto the elevating conveyors 28-1, 28-2, etc., for stacking of the cut lumber in the corresponding accumulators 30-1, 30-2, etc. The elevating conveyors as seen in FIGS. 1 and 2 comprise a base 216 having a plurality of upwardly extending walls 220A and 220B attached thereto at the rear end of the base. A pair of wide conveyor belts 222 are employed in the stacking conveyor; one for the conveyors 28-1 through 28-5 and the other for the conveyors 28-6 through 28-10. Each conveyor belt passes over rollers 224 and 226 at opposite ends of the conveyors. The roller 224 at the lower end of the conveyor is driven by a motor 228 through a belt and pulley arrangement for driving the conveyor belts. The elevating conveyors are preferably operated at a speed of 10 to 25 percent greater than the cross-conveyors. The lower roller 224 is rotatably supported at its ends and center by vertical walls 225 extending upwardly from the base 216, only one of which walls is seen in FIG. 2. The upper roller 226 is similarly rotatably supported by the walls 220A. The walls 220B intermediate the walls 220A are notched as at 227 for the roller 226 and upper end of the belts 222. A plurality of guide rails 218 extend over the conveyor belts between the guide rails 196 for the cross-conveyors and the walls 220A and 220B. The guide rails 218 may be welded or otherwise suitably secured by means not shown to said guide rails 196 and walls 220A and 220B. The conveyor belts 222 have a rough top surface for a high coefficient of friction whereby boards resting directly on the belts are conveyed therealong. The conveyors are inclined at a sufficient angle such that boards stacked on those being conveyed normally slide back.

Each of the inclined conveyors 28-1, 28-2, etc. is provided with lumber orienting fingers 231 and 232 attached to opposite guide rails 218 and extending over the conveyor belt. The fingers 231 are shown attached to the left-hand guide rails, looking downstream, and are closely spaced with the conveyor belts 222, to deflect all boards which engage the same to the right side of the conveyors. The fingers 232, on the other hand, are at a height such that boards traveling with the wide face thereof on the conveyor belt pass under the fingers without engaging the same as shown at conveyor 28-3 in FIG. 4. Boards traveling on edge, however, strike the finger 232, as shown at conveyor 28-2, and are tipped over onto the wide face thereof. The fingers 232 also serve to unstack boards that may remain piled upon each other. In FIG. 4, at the conveyor 28-1, a first board 132A is shown flat on the conveyor belt, and the forward end of a second board 132B is shown resting upon the rear end of the first board. The first board 132A passes beneath the finger 232 without contacting the same. However, the second board 132B engages the finger

232 and is detained until the first board 132A passes out from under it, after which it too passes under the finger 232.

The boards 132 are projected off the upper end of the inclined elevating conveyors 28-1, 28-2, etc., and come to rest in the accumulators 30-1, 30-2, etc. As seen in FIGS. 1 and 2, each accumulator comprises an inclined base 236 for the support of the bottom board of the stack. The ends of the stacked boards butt against an inclined end member 234 extending at substantially right angles with the base 236. To form neat stacks deflectors 238 extend from one side of the upright panels 220A and 220B to urge the boards against an opposite panel. The boards which are propelled off the elevated end of the elevating conveyors slide along landings 239 and into the accumulators. Provision is made for convenient removal of stacked lumber from the accumulators.

The movable deflector plates 26-through 26-9 are in a normally raised position and are selectively lowered in accordance with the length of the board cut by the saw, and the grade of the cut board. The last deflector plate 26-10 at the downstream end of the row of deflector plates, on the other hand, is in a normally lowered position and is raised by actuation of one of the stop member switches 19. Generally, one or more of the stop member switches 19 on stop members farthest from the saw are utilized to raise the deflector plate 26-10 whereby long length boards are passed along the primary conveyor without being deflected by any of the deflector plates 26-1 through 26-10. Lumber which is cut without the actuation of one of the stop switches 19 (e.g., where a stop member 17 without a switch 19 is employed or where the switch is removed from the circuit by removal of the associated plug 21P from a jack 21J) passes beneath all the raised deflector plates 26-1 through 26-9 and is deflected by the last deflector plate 26-10. The last bin 30-10 therefore receives the odd-length cuts.

A suitable arrangement for returning the deflector plate 26-10 to the lowered position includes a normally open switch 240 which is attached to the bracket 188 with the switch actuating arm in the path of travel of the deflector plate 26-10 such that the switch is closed when the deflector plate is in a raised position as illustrated in broken line in FIG. 7. The "down" coil of the solenoid operated valve for the cylinder 25-10 is thereby energized and air under pressure is supplied to the upper end of the cylinder 25-10 to return the deflector plate 26-10 to the lowered position. A throttle valve 242 is included in the air pressure line leading to the upper end of the cylinder 25-10 to delay the downward movement of the deflector plate 26-10 for a sufficient time to permit the cut board to pass therebeneath.

The operation and advantages of the apparatus will be better understood with a description of the schematic diagram of FIG. 9 to which figure reference is now also made. For purposes of description, assume that the stop switch 19-1 is actuated to the closed position by the board. (In FIG. 9 the numerals 1, 2, etc. are added as suffixes to the switches designated 19 in other figures for convenience in individually identifying the same.) In FIG. 9, this switch 19-1 is shown connected through a plug connector 21 to the "down" winding 24D of the solenoid operated valve 24-1. The solenoid remains deenergized, however, until the saw actuated series connected switch 82 is closed upon actuation of the saw. With this arrangement of switches if the board to be cut is placed against a stop member not desired, the operator may reposition the board at the desired stop member without lowering a plurality of deflector plates.

Holding the board against the desired stop member, the operator momentarily closes the foot actuated switch 62 for actuation of the saw to the raised position to cut the board. An air cylinder 48 under control of a solenoid actuated valve 49 (shown in block form) may be used to actuate the saw. As mentioned above, the saw automatically returns to the retracted position. When the saw reaches the raised position, the switch 88 is closed for energization of a solenoid winding 256A included in a solenoid actuated valve 256. The valve

256, in turn, is included in the air pressure system for the kicker cylinder 156 for actuation of the kicker members 150. Kicker mechanisms are well known and require no further explanation.

It was assumed above that the stop switch 19-1 was closed by the board to be cut. At the beginning of the saw stroke, the switch 82 is closed thereby completing the energization circuit for the "down" solenoid winding 24D for the valve 24-1 through the main switch 254, saw actuated switch 82, stop switch 19-1 and plug connector 21. The other end of the winding is connected to the ground terminal 258. With the valve 24-1 in the "down" position the deflector plate 26-1 is lowered by the cylinder 25-1. It here will be noted that the switch 82 may be actuated after the saw completes the cut, if desired, and alternately the switch may be located downstream of the saw between the saw and deflector plates with appropriate modifications of the circuitry.

When the cut board is transferred from the lumber cutoff gauge stop the switch 19-1 reopens. However, the deflector plate 26-1 remains in the lowered position until the "up" solenoid winding 24U for the valve 24-1 is energized. As the cut board is deflected by the lowered deflector plate 26-1 onto the cross-conveyor 27-1, the board closes the switch 190 at the deflector 26-1 for completion of the energization circuit of the "up" solenoid winding 24U for the valve 24-1. The deflector plate 26-1 is thereby returned to the raised position in preparation for another cycle of operation. Before the deflector plate is returned to the raised position the cut board will have been deflected onto the cross-conveyor 27-1. From the cross-conveyor 27-1 the board is fed to the inclined conveyor 28-1 and thence into the accumulator 30-1 in the manner described above. The above described cycle of operation of the deflector plate 26-1 applies also to the other deflector plates 26-2 through 26-9 and need not be repeated. With this arrangement the cut boards are sorted into the accumulators 30-1, 30-2, etc., according to length dependent upon which stop switch 19 is actuated and which movable deflector plate operator 25-1, 25-2, etc., is controlled by the stop switch. The deflector plates 26-1 through 26-9 should be lowered for only the length of time required to deflect the board to avoid interference with boards cut immediately prior thereto and immediately thereafter. Lowering of the deflector plates after closure of the stop switch 19 and switch 82 is preferably delayed until the board is conveyed to a position just in front of the deflector plate. Any suitable delay means may be provided for this purpose. Electrical time delay units 269 are included in the circuits to the down windings 24D of the solenoid controlled valves 24-2 through 24-9 to provide the desired time delay. (The first deflector plate 26-1 being close to the saw generally does not require a time delay.) Other suitable time delay means would include throttle valves in the air system for the cylinders 25-2 through 25-9. Also, instead of individual time delay means, banks of say three of the deflector plate actuating means could be supplied with a single time delay means, if desired.

Often, relatively low grade lumber, such as shopgrade is employed in the production of goods such as doors, door frames, and the like, from which lumber the major defects are cut out by the saw operator. Short length sections of defective lumber, such as loose knots and the like, which are cut off simply fall off the edge of the saw and onto a transversely extending conveyor 270 positioned between the saw 14 and main conveyor 16 where they are carried away from the saw (see FIG. 1).

As mentioned above the control box 98 at the saw is provided with grade selector switches 100 and 104 which permit separation of lumber cut to the same length into different accumulators under control of the operator. This additional separating or sorting process may be made on any desired basis such as the grade of the cut boards. As seen in FIG. 9 the switches 100 and 104 are connected in parallel in the energization circuit for the control winding 272 of a relay 274. The relay is shown with a pair of movable arms 276 and 278 under control of the winding 272. The movable arms 276 and 278

are shown connected to the stop member switches 19-3 and 19-4, respectively, through connector plugs 21. Fixed contacts 280 and 282 associated with the movable contact arm 276 are connected to the "down" control windings 24D of solenoid controlled valves 24-3 and 24-5, respectively, whereas fixed contacts 284 and 286 associated with the movable contact arm 278 are connected to the "down" control windings 24D of the solenoid controlled valves 23-4 and 24-6, respectively. It will be apparent therefore that the stop member switch 19-3 may be used to control the lowering of either the deflector plate 26-3 or 26-5, and stop member switch 19-4 may be used to control the lowering of either the deflector plate 26-4 or 26-6, depending upon the condition of the relay 274. With the relay deenergized, as illustrated, the boards which are cut using the stop switches 19-3 and 19-4 are deflected by the deflector plates 26-3 and 26-4, respectively. When the relay is energized by closure of either switch 100 or 104, actuation of the same stop switches 19-3 and 19-4 results in deflection of the boards by the deflector plates 26-5 and 26-6, respectively.

Assume that the cut boards are predominately of an "A" grade quality. With the switches 100 and 104 in the open position, the "A" grade cuttings made using the stop switch 19-3 are deflected onto conveyor 27-3 for transfer to the corresponding accumulator 30-3. Now assume a "B" grade quality piece is to be cut using the stop switch 19-3. The operator then trips the switch 100 momentarily whereby the "B" grade piece is deflected onto conveyor 27-5. The switch 100 returns to the normal open position upon deenergization of a suitable holding circuit, not shown, when switch 82 is closed. If the lumber to be cut is predominately of "B" grade, the switch 104 may be closed, which switch remains closed until reopened by the operator when an "A" grade piece is to be cut. It will be understood that the "A" and "B" grade designations are for purposes of description only, the apparatus not being limited for use with any particular grade lumber. Also, although a relay 274 is shown with two movable arms for sorting by grade cuttings made using stop switches 19-3 and 19-4, additional relay contacts may be included for use with other stop switches, as desired. Also, by use of additional switches (not shown) lumber cut to a single length may be selectively diverted into any one of three or more accumulators.

The lumber also may be sorted according to width and thickness by use of appropriately located sensing means which means are included in the deflector actuating circuit. Such sensing means may include photocells, sensing switches, ultrasonic sensors and the like. In FIG. 8 switches 287 located on the saw table sense the width of the boards and switches 288 sense the thickness. The switches 288 are actuated by switch actuating plates carried on the saw guide and clamping mechanism, which mechanism reciprocates in a vertical plane to stabilize the lumber on the saw table when making the cut in the usual manner. These switches also may be locked manually when cutting boards of any one width. These switches when used in conjunction with the switches 19, provide for sorting the lumber according to width, thickness and length simultaneously. Such switches obviously may be used independently of the switches 19 for sorting the lumber by width and/or thickness without sorting according to length.

A schematic diagram of the control circuit for the deflector plate 26-10 is also shown in FIG. 9. There, the deflector plate is shown under control of the stop member switch 19-10. A plurality of shunt-connected jacks 21J for control by other stop switches are provided. When a long board is cut using the stop switch 19-10, the "up" winding 24U of the solenoid controlled switch 24-10 is energized upon closure of the saw controlled switch 82 to raise the deflector plate 26-10. As described above, when the deflector plate 26-10 reaches the raised position the switch 240 is closed, for energization of the "down" winding 24D of the solenoid controlled valve 24-10. The valve 24-10 remains in the "up" condition until energization of the associated "down" winding 24D upon closure of the switch 240. Flow of air under pressure to the upper end of

the cylinder 25-10 is restricted by the throttle valve 242 whereby the deflector plate 26-10 is slowly lowered, permitting the long piece of lumber to pass therebeneath.

If any or all of the deflectors are to be raised, switch 108 may be closed, which switch is included in the energization circuit for a relay 290. The relay 290 includes a plurality of movable contacts 294 individually connected to the "up" windings 24U. It will be apparent that whenever the relay 290 is energized by closure of the switch 108, all of the "up" windings 24U of the solenoid controlled valves 24-1 through 24-10 are energized to raise the deflector plates 26-1 through 26-10. The deflector plate 26-10, of course, automatically returns to the lowered position after being raised, in the manner described above. (However, by opening the main power switch 254 at the appropriate time when all of the deflector plates are in a raised position lumber cut by the saw is conveyed to the end of the primary conveyor without being deflected. Random length and long length conveyors are positioned at the end of the primary conveyors as shown in FIGS. 10 and 11 and described in detail hereinbelow.)

As seen in FIG. 9, a second switch 300 is connected in parallel with the switch 108. The switch 300 is under control of a governor mechanism 302 driven by the primary conveyor belt 124 through a roller 304. When the conveyor belt is traveling at or above a predetermined speed, including the normal speed thereof, the switch 300 is held open by the governor 302. If a deflector plate 26-1 through 26-10 lowers onto a piece of lumber that is delayed in its travel along the primary conveyor belt 124, the belt is stopped or its speed is reduced whereby the governor controlled switch 300 is closed to raise all of the deflector plates. The piece trapped between one of the deflector plates and the primary conveyor belt is thereupon released and travels therealong past the cross-conveyors and onto the random length or long length conveyor. The machine is thereby automatically restored to operative condition when such a situation occurs without intervening action by the operator.

Reference is now made to FIG. 10 wherein a plurality of primary conveyors 16 are shown extending over the cross-conveyors 27-1 through 27-10. Also, a random short length lumber conveyor 310 and a long length lumber conveyor 312 are shown at the end of the primary conveyors 16 for separation of boards which pass along the main conveyors undeflected by any of the deflector plates. Such boards are separated according to length. The shorter length boards projected off the primary conveyors strike the face of stop plates 314 at the far edge of the conveyor 310 and fall onto the conveyor belt 316 to be carried away in the direction of the arrow 318. Long length boards, (of about 6 feet or greater) span the distance between the end of the main conveyors and the associated stop plate 314. Such long boards therefore are propelled along the upper edge of the stop plates 314 and strike the face of a stop plate 320 at the far edge of the conveyor 312. These long boards then fall onto the conveyor belts 322 to be carried away in the direction of the arrows 324. The conveyors 310 and 312 may feed into accumulators or to any desired location, not shown. As described above, means are provided for passing selected boards off the end of the primary conveyors 16. Also, as described above, the apparatus may be operated with all of the deflector plates in a raised position whereby all the cut lumber passes off the end of the primary conveyors 16.

A count of the total number of cuts made by each saw and the number pieces of any size or grade which are cut are readily obtained with the apparatus of the invention by simply adding counters at appropriate locations in the system. As seen in FIG. 9, a mechanically operated counter 330 is suitably attached to the saw to provide a count of the number of times the saw is actuated. Electrical counters 332 are shown connected to the windings of each solenoid controlled valve to provide a count of the number of pieces deflected by the deflectors 26-1 through 26-9 and the number of pieces passed beneath the deflector 26-10. Any type counter (such as elec-

trical, mechanical, etc.) may be used at the various locations as desired. The information provided by the counters is particularly useful for inventory purposes (including a "running" inventory), production control, and the like. Accurate lumber recovery information for each sawyer is also obtained from this information. In addition to counters, signal or alarm means could be included to signal the operator when a desired count is reached. Also, the information may be fed to remote locations, and may be used for control purposes.

The invention having been described in detail in accordance with the requirements of the Patent Statutes, various changes and modifications may suggest themselves to those skilled in this art. For example, although a total of ten cross conveyors 27-1 through 27-10 and associated bins 30-1 through 30-10 are shown the apparatus may include a greater or lesser number thereof, as desired. Also, while four saws and primary conveyors are shown, a fewer or greater number of saws and main conveyors may be employed in association with the illustrated cross conveyors.

In addition, it is not necessary to mount the switches 19 directly on the stop members. Instead, the switches 19 could be mounted for actuation by the stop members when the lumber is butted against the stop members. Alternatively, the switches 19 may be mounted for sensing stop members 17 which are swung out of the normal position by the board. With suitable electrical circuitry the stop member against which the board is butted may be ascertained with such an arrangement of switches.

Although the illustrated deflector plates are mounted for vertical reciprocating movement, other movements are possible. For example, the deflector plates could be pivotally mounted upon a common shaft for pivotal movement between operative and inoperative positions. Further, while individual air cylinders are shown for each deflector plate, the deflector plates could be individually gravity and/or resiliently biased toward one position, and a suitable return mechanism adapted for actuation by a single air cylinder could be used to return the deflector plates to normal raised position after being lowered. Obviously actuating means other than air (or hydraulic) cylinders under control of solenoid actuated valves may be employed.

Further, although switches 190 are shown for use in raising the deflector plate after a board has passed thereby, other suitable arrangements are possible. For example, a simple time delay mechanism for raising the deflectors a predetermined time after they have been lowered, or after actuation of the saw, may be employed. The requirement for sensing switches 190 would be eliminated by such an arrangement.

In the illustrated arrangement the cross-conveyors are shown extending at right angles with the primary conveyors. Obviously, other angular relationships are possible. Further, as mentioned above, the cross-conveyors could extend in a diverging pattern from the primary conveyors, if desired.

If desired one or more of the cross-conveyors could feed onto a remote conveyor or conveyors rather than onto the elevating conveyors. Such remote conveyor may be under control of an operator at a remote location for selectively supplying boards to such remote location as required. It is intended that these and other such changes and modifications shall fall within the spirit and scope of the invention as recited in the following claims.

We claim:

1. A method of sorting lumber comprising: processing the lumber, sensing a dimension of the lumber while processing the same, and sorting the lumber according to the dimension sensed.
2. A method of sorting lumber comprising: determining a dimension of the lumber when the lumber is located where cut, moving the cut lumber along conveyor means, and transferring the lumber from the conveyor at selected positions therealong in accordance with the determined

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dimension of the lumber, the location at which the lumber is transferred from the conveyor means being established at the time the lumber dimension is determined.

3. The method of sorting lumber as recited in claim 2, wherein a determined dimension of the lumber is the length thereof.

4. The method of sorting lumber as recited in claim 2, wherein a determined dimension of the lumber is the width thereof.

5. The method of sorting lumber as recited in claim 2, wherein a determined dimension of the lumber is the thickness thereof.

6. The method of sorting lumber as recited in claim 2, wherein determined dimensions of the lumber include the thickness, width and length thereof.

7. The method of sorting lumber as recited in claim 2, including dropping the lumber which is transferred from the conveyor means into accumulators in stacks.

8. The method of sorting lumber as recited in claim 2,

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wherein the lumber is moved at high speed by the conveyor means and is transferred from the conveyor by deflection off selectively operated deflectors movable between operative and inoperative positions over the conveyor means.

9. The method of sorting lumber as recited in claim 8, which includes changing both the direction of travel and orientation of the lumber substantially the same amounts when deflecting the lumber from the conveyor means.

10. A method of sorting lumber according to length comprising:

butting one end of a board to be cut against any one of a plurality of stop members, cutting the board to length as determined by the position of a stop member against which the end of the board is butted, sensing against which stop member the board is butted when cut, and sorting the cut lumber according to the sensed position when the board is cut.

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