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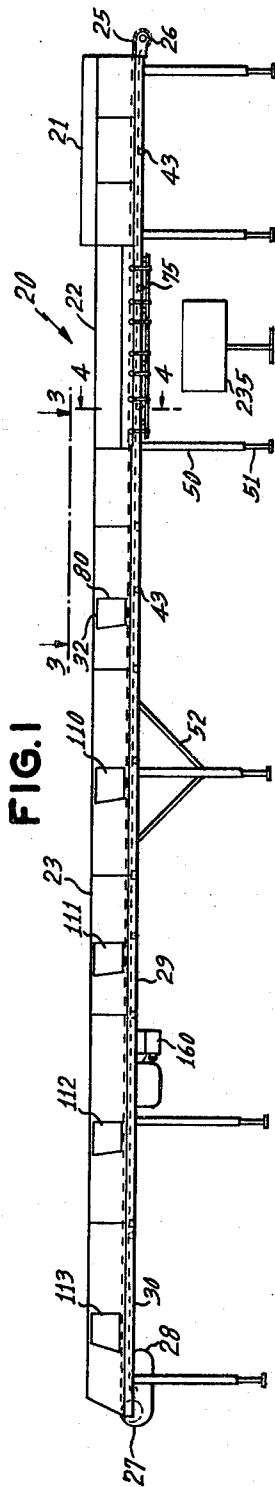
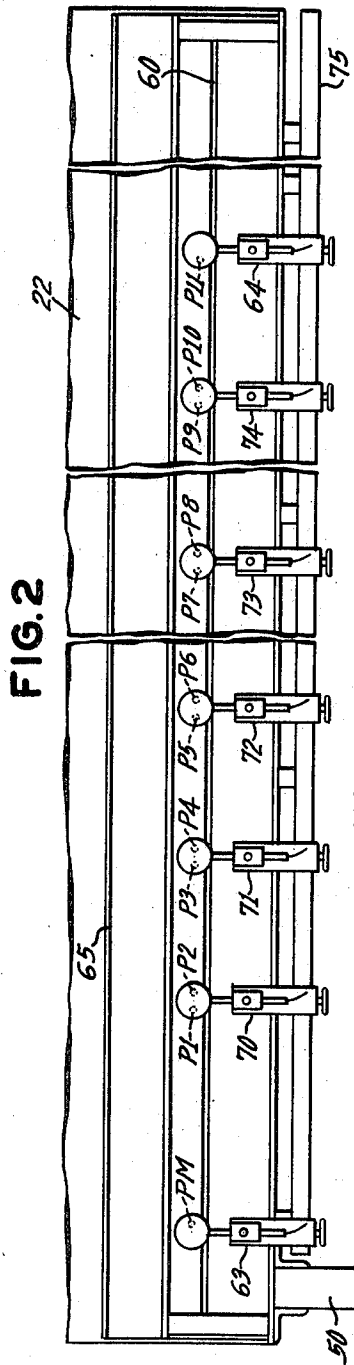
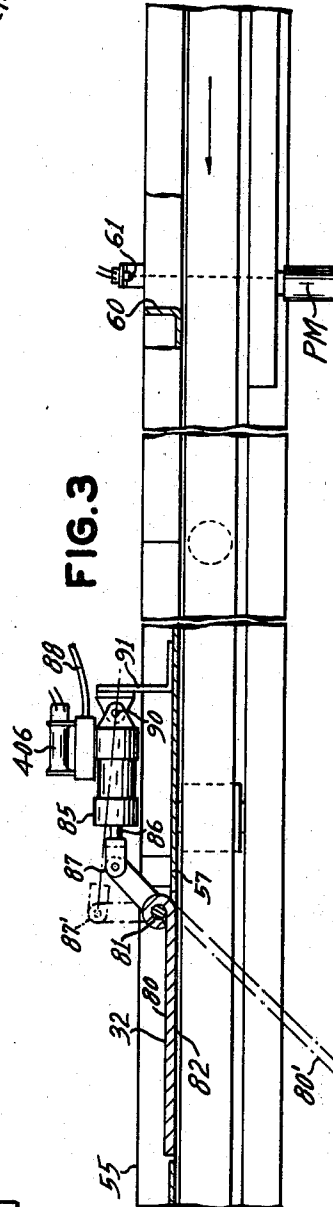
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3,495,707

LUMBER DIMENSION SORTING METHOD AND MACHINE

Filed June 1, 1967

7 Sheets-Sheet 1



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LUMBER DIMENSION SORTING METHOD AND MACHINE

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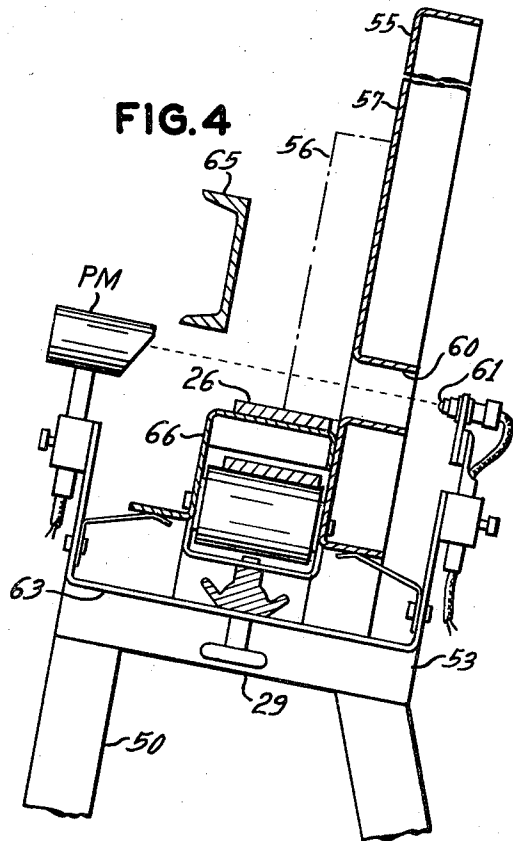
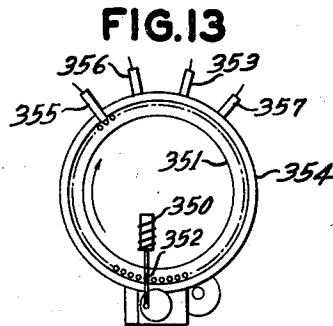


FIG. 14

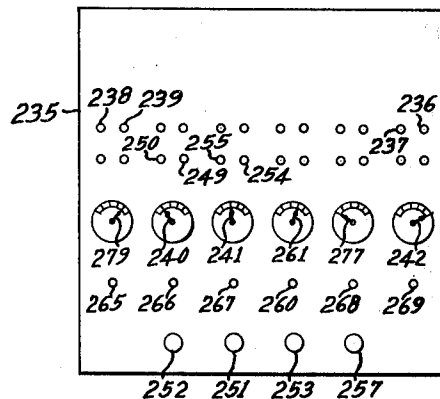
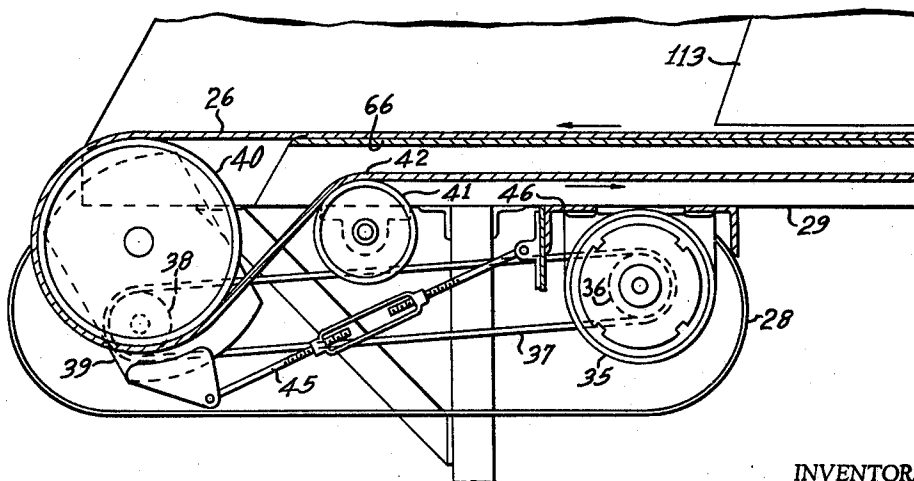


FIG. 5



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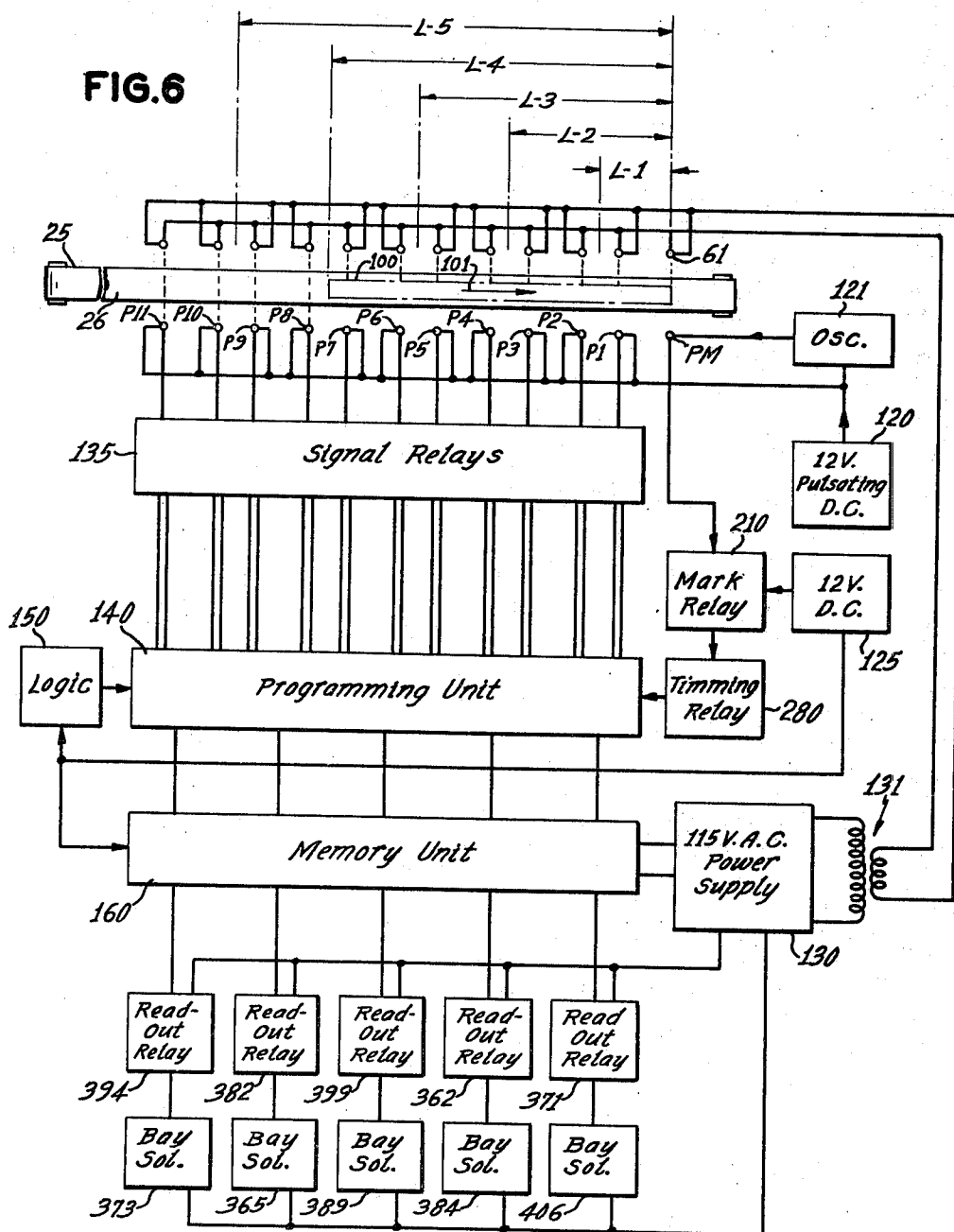
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FIG.6



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LUMBER DIMENSION SORTING METHOD AND MACHINE

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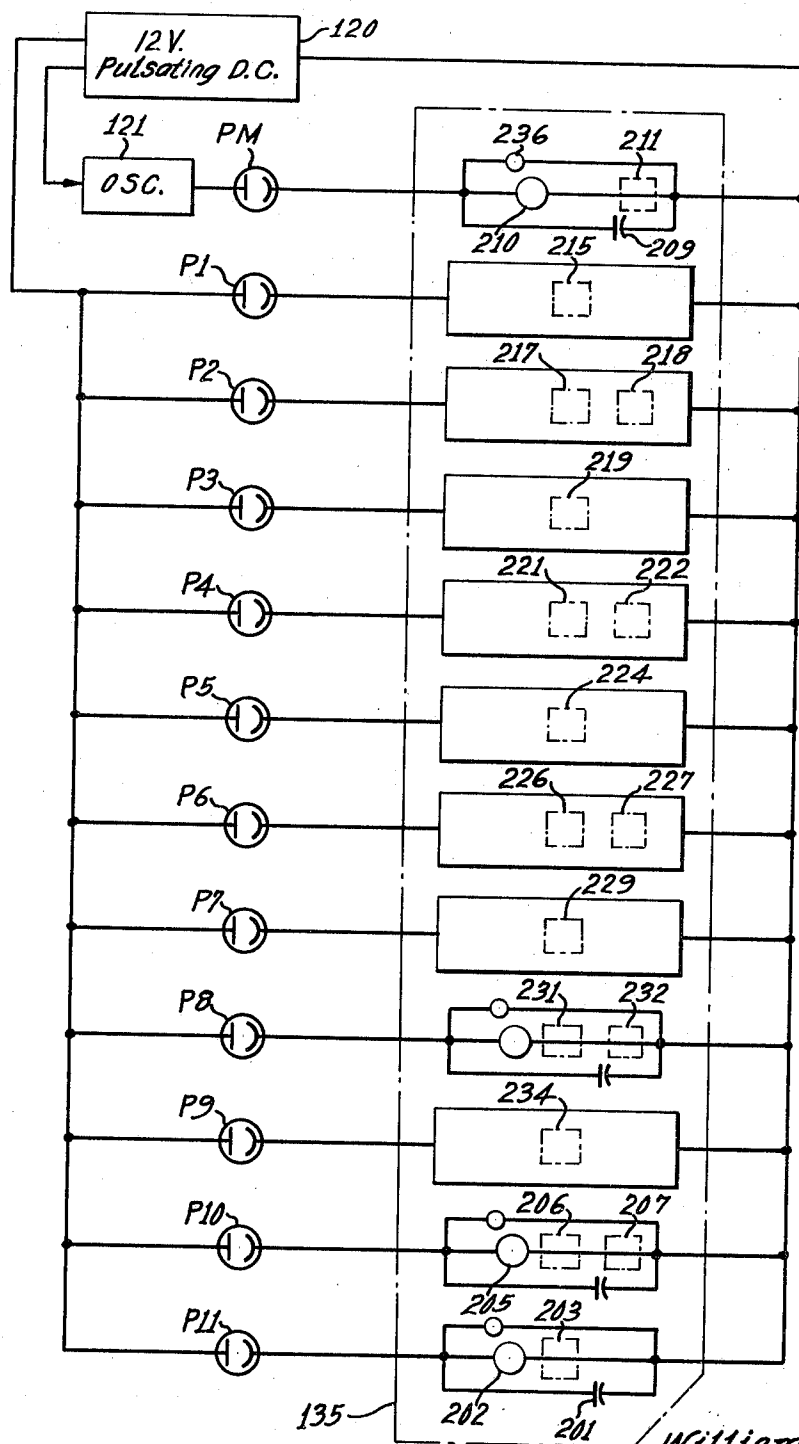


FIG. 7

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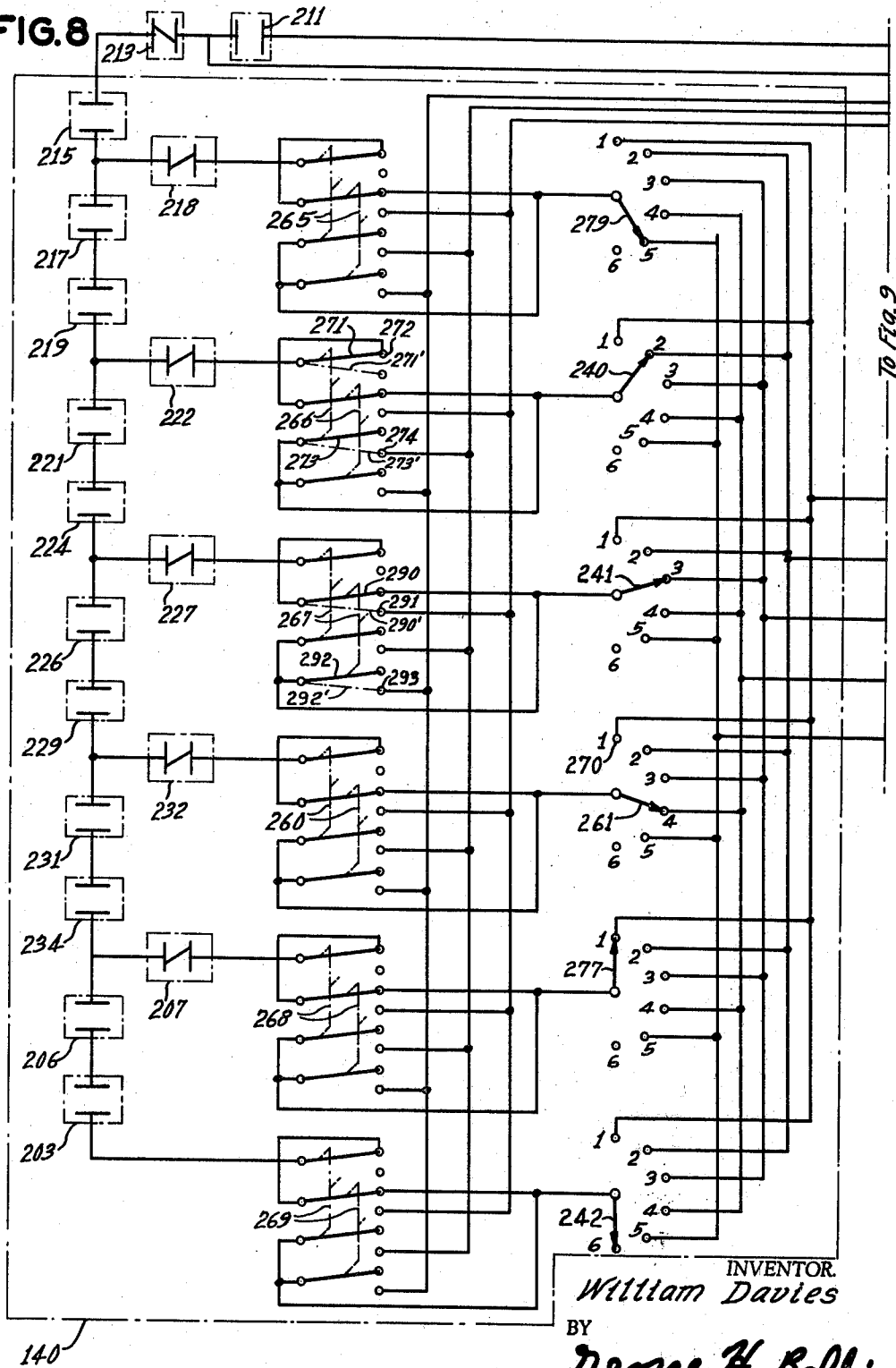
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LUMBER DIMENSION SORTING METHOD AND MACHINE

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FIG. 8



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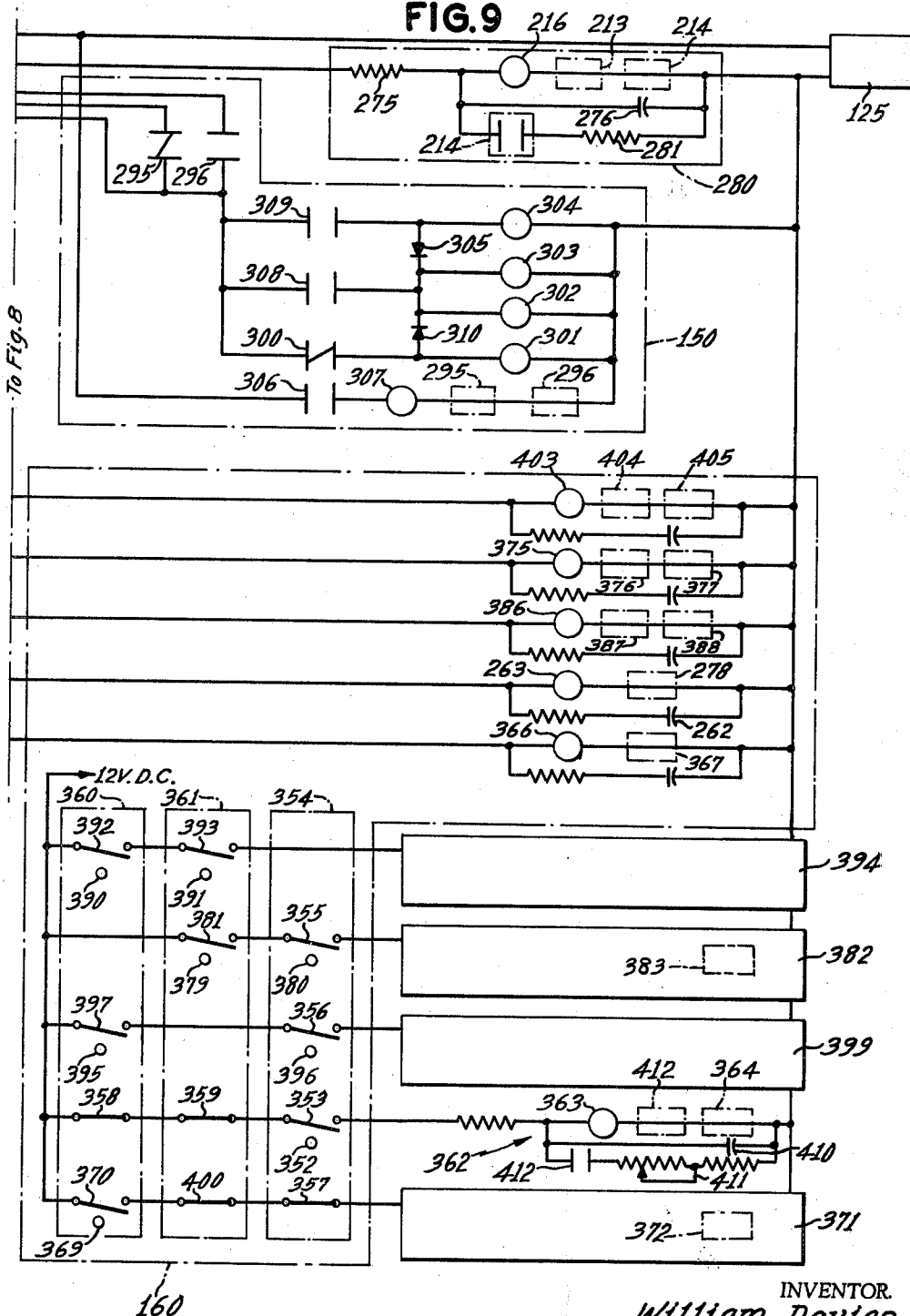
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LUMBER DIMENSION SORTING METHOD AND MACHINE

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FIG. 9



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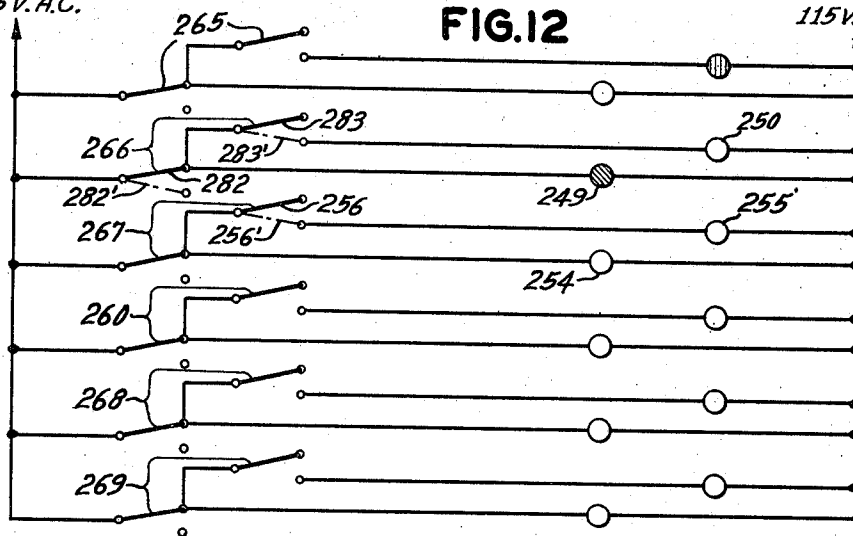
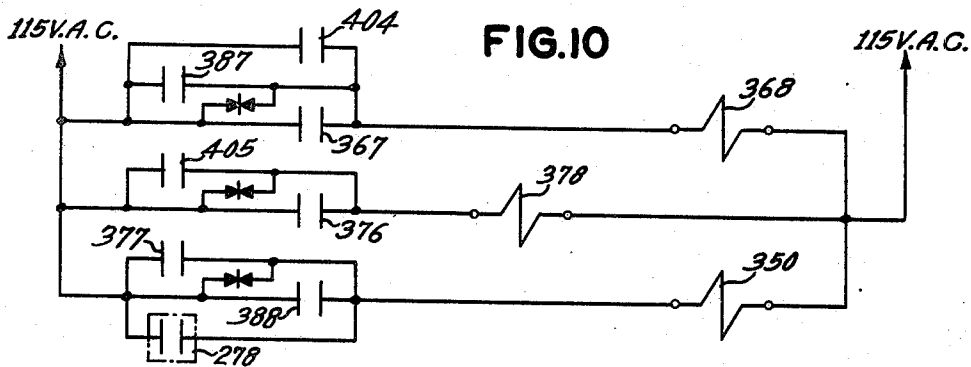
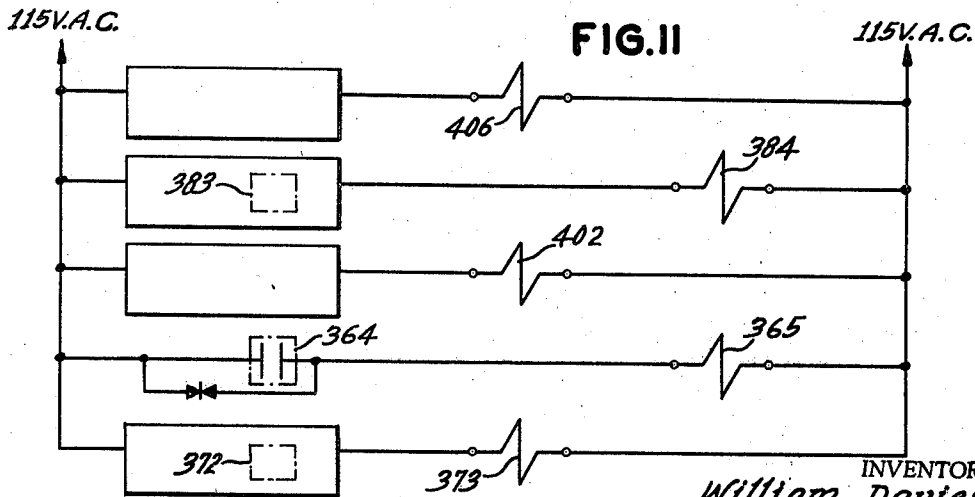
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LUMBER DIMENSION SORTING METHOD AND MACHINE

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7 Sheets-Sheet 7
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**LUMBER DIMENSION SORTING METHOD
AND MACHINE**

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U.S. Cl. 209—73

20 Claims

ABSTRACT OF THE DISCLOSURE

A method and machine for sorting boards of differing lengths including a measuring section comprised of a plurality of spaced photocells which detect the lengths of respective boards of differing lengths being fed by a conveyor from the measuring section to a discharge section of the machine which is comprised of a plurality of spaced discharge means which are actuated by appropriate signals from the photocells. The photocells detect the length of the boards and produce signals which are sent into a programming of switching unit for selectively directing the signals ultimately to selected discharge means after appropriate storage or delay thereof to permit the boards to be moved into proper positions adjacent the selected discharge means. Several different length boards may be programmed to be discharged by a single selected discharge means, or the same length boards may be alternatively discharged by two selected discharge means.

BACKGROUND OF THE INVENTION**Field of invention**

This invention pertains to methods and machines for sorting lumber or boards in at least one dimension thereof, and particularly as to length.

In lumber saw mills and furniture manufacturing facilities there has existed a continuing need for lumber sorters having good sorting speeds, a high degree of accuracy, and with a versatility and adaptability to the various requirements of the users. The method and machine in accordance with this invention is designed to satisfy the above mentioned needs.

DESCRIPTION OF PRIOR ART

The sorting of lumber as to length and/or width has been accomplished manually and with various lumber sorting machines, as exemplified by Patent Nos. 3,279,600 and 3,265,207, respectively granted on Oct. 18, 1966 and Aug. 9, 1966, both patents being assigned to the assignee of this application. While various prior art sorters have been satisfactory for specified purposes, many such sorters have had certain deficiencies as by being slow, inaccurate, expensive in construction and operation, and/or not readily adapted to various use requirements.

SUMMARY

The method and machine in accordance with the invention includes feeding boards of differing lengths along a path, detecting all the lengths thereof in a measuring section, and producing different electrical signals indicative of the lengths thereof. These electrical signals are stored and are supplied after predetermined delays to a plurality of selected electrical discharging means spaced each from the other and spaced from the measuring section, the selected discharging means removing the boards from the path at predetermined selected bay stations along the path upon arrival of the correspondingly measured boards into respective operative alignment with the selected discharging means.

General objects of the invention are to improve the

sorting of lumber, boards or similar items by the method and machine herein disclosed, and to provide a simple method and machine for sorting differing lengths of boards into readily selectable bay stations.

A particular object includes providing an improved sorting machine in which differing lengths of boards may be directed to the same bay station or the same length of board may be directed to any two selected bay stations automatically and alternatively.

Another particular object is the provision of an improved lumber sorting machine which may be readily and durably constructed and easily and efficiently operable to accurately sort boards of differing lengths thereby affording economies in the construction, maintenance and operation of the machine.

A specific object of the invention is to provide an improved board sorting machine which may be manually controlled and adjusted, and readily adaptable to existing installations and to changing uses thereof during the day or from day to day, thereby according versatility and adaptability for various user requirements.

Another specific object is the provision of an improved lumber sorting machine in which human errors of the operator are minimized and the operation and maintenance thereof require a minimum of skill and/or attention of the operator after the machine has been programmed for selected lumber measurements.

BRIEF DESCRIPTION OF DRAWINGS

The novel features which are believed to be characteristic of this invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a front elevational view of the lumber dimension sorting machine in accord with the present invention;

FIG. 2 is an enlarged front elevational view of the measuring section of the machine of FIG. 1;

FIG. 3 is an enlarged partial plan view of the machine taken along line 3—3 of FIG. 1;

FIG. 4 is an enlarged partial cross-sectional view of the machine taken along line 4—4 of FIG. 1, and showing a board being carried by the conveyor of the machine;

FIG. 5 is an enlarged elevational view, partly in section, of the drive components of the conveyor of the machine;

FIG. 6 is a schematic block diagram of the measuring and control circuit of the machine;

FIGS. 7—12 are detail diagrams of the measuring and control circuit of the machine;

FIG. 13 is a general representation of one of the memory ring banks employed in the measuring and control circuit; and

FIG. 14 is an enlarged front elevational view of the control panel and console of the machine of FIG. 1.

**DESCRIPTION OF THE PREFERRED
EMBODIMENT**

Referring now more particularly to the drawings of FIGS. 1—5, the dimension sorting machine is indicated generally by reference numeral 20 which comprises an infeed section 21, a measuring section 22 and discharge sections 23 in general alignment. A conveyor 25, having an endless conveyor belt 26, spans between sections 21, 22 and 23 and conveyor motor means 28 for driving conveyor belt 26 is mounted to the frame 29 adjacent the end 30 thereof. Boards are sequentially fed along a path on the conveyor belt 26 from infeed section 21

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through measuring section 22 in which the length of the board is determined or detected and as the board is moved through the discharge sections 23, appropriate discharge means, for example, discharge means 32 is actuated for removal of that board from the conveyor belt 26, as hereinafter more fully described.

The conveyor motor means 28 for driving conveyor belt 26 is illustrated in FIG. 5, and includes an electric motor 35 driving a dual groove sheave 36, dual belts 37 being driven by sheave 36 for driving dual sheave 38 which is mounted for rotation on torque arm reducer 39. The dual groove sheave 38 drives large conveyor pulley 40 by appropriate driving connections (not shown) therebetween as by gears, sprockets and chains, pulley and belt, or other suitable driving connections. A small conveyor idler pulley 41 is in engagement with the return portion 42 of the conveyor belt 26 closely adjacent pulley 40 for causing greater contact between belt 26 and pulley 40 thereby increasing the frictional engagement therebetween. As seen in FIG. 1 additional idler pulleys 43 are shown spacedly mounted throughout the length of the conveyor belt 26, such idlers being adjustable to maintain belt 26 in an unslackened condition as is common in the art. A turnbuckle 45 is connected between the angle 46 attached to frame 29 and the torque arm reducer 39 to maintain the dual belts 37 in a taut condition between dual sheaves 36 and 38.

As seen in FIGS. 1 and 4 frame 29 comprises a plurality of upright legs 50 which have adjustable telescoping bottom portions 51 for adjusting the height of the machine 20, and a plurality of supporting braces, such as shown at 52, and other cross braces between the upright legs 50 are also provided. The back wall structure 55 is positioned at an angle of approximately 10° with the vertical so that the board 56 will be adjacent wall face 57 while the board 56 is being carried by the conveyor belt 26. Backwall structure 55 is suitably attached to the base 53 of the frame 29. In the measuring section 22 an elongated slot 60 is provided in the backwall structure 55 so that the lights, including light 61 which is associated with the photocell PM, may shine through slot 60 for activation of their respective photocells. Light 61 is mounted on an adjustable U-shaped member 62 rearwardly of backwall structure 55, and U-shaped member 63 supports the PM photocell forwardly of the backwall structure 55 with the light 61 and the PM photocell being on opposite side of the conveyor belt 26.

Conveyor belt 26 is supported substantially throughout its length by an elongated platform 66 thereby maintaining the lumber thereon in substantially the same plane throughout the various sections of the machine and particularly the measuring section 22.

An elongated protective member 65 is positioned between the photocells, and the conveyor belt 26 to protect the photocells from any inadvertent falling of the lumber or boards 56 being carried by the conveyor belt 26 in the measuring section 22.

As shown in FIG. 2 each of the individual photocells PM and P-11 are carried by respective U-shaped members 63 and 64 which may be positioned in particular locations along the length of the measuring section 22, while photocells P1 and P2 are carried by the same U-shaped member 70, with each other pair of photocells, i.e. P3 and P4, P5 and P6, P7 and P8, P9 and P10 being carried by respective adjustable members 71, 72, 73 and 74. It is to be understood that each of the photocells P1 through P10 have individual lights carried by the other side wall of each of the respective channel members 70-74 for individual activation of each photocell by an appropriate light source.

The discharge means 32 is specifically depicted in FIG. 3 and includes a gate 80 which is pivotally mounted at 81 to the backwall structure 55 with the face 82 of gate 80 being coplanar with the front wall face 57 of back wall structure 55 when the gate is in its retracted or in-

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operative position. The gate 80 is shown in its normal inoperative position in full lines, and when the gate is in its operative position shown by broken lines 80', the double-acting pneumatic cylinder 85 extends its piston 86 for movement of the linkage 87 from its full line inoperative position to the broken line operative position 87'. Compressed air cylinder 85 is connected to the compressed air source means 88 momentarily by actuation of bay solenoid valve 406 which is controlled by the control circuit, hereinafter more fully described. When the solenoid valve 406 is actuated the air is supplied to cylinder 85 to extend the piston, and when the solenoid valve 406 is in the inoperative position, the air below the piston is released and the compressed air source 88 is connected above the piston to retract same. As seen the double-acting piston and cylinder assembly 85 is pivotally mounted at 90 to a supporting angle 91 attached to the backwall structure 55.

When the gate is in its operative position 80' the board as it is advancing by conveyor belt 26 is diverted off the conveyor belt 26 by continued movement of the conveyor belt. If the board is of a width similar to the width of board 56 depicted in FIG. 4, the gate 80 could move the board laterally from the conveyor rather than the front edge of the board merely being diverted by the gate 80.

The measuring section 22 can be set up to measure a number of different lengths of boards. For example, the following lengths of boards are to be measured and discharged into different bays: first length—20 inches, 2nd length—26 inches, 3rd length—28½ inches, 4th length—35¼ inches, 5th length—43¾ inches with any boards being conveyed other than those lengths being discharged at the end 27 of the conveyor. A board is cut to the exact first length of 20 inches and the adjustable U-shaped member 70 is positioned at the twenty inch mark on the length gauge 75 with the mark photocell support member 63 being set at zero on the length gauge 75. The conveyor 25 is started and the bay selector switch 279 is set for the first bay so that gate 80 will be actuated to discharge the board into the first bay. The 20 inch board is then dropped into the infeed section 21 and as the board passes through the measuring section, the board should be measured by the photocell measuring circuit between photocells PM and P1 which is then entered into the memory unit 160 as the first length to the first bay. The gate 80 should operate to discharge the board.

A board of the second length of 26 inches is then cut with the support member 71 being positioned at the twenty-six inch mark on the gauge 75, and the board is dropped in the infeed section 21. Bay selector switch 240 may then be turned to the first bay position and gate 80 should then actuate to discharge the 26 inch board into the first bay. The same procedure is followed for the third, fourth and fifth length boards as previously described in connection with the second length board. It is preferable to have the difference in length between any two lengths to be a minimum of about 2 inches to insure proper discharge by the various gates in the discharge section 23, particularly because the distance between photocells P1 and P2 is about 1 inch and the conveyor moves the boards at approximately 375 to 400 feet per minute. Also, it is preferable to have the boards at a gap of about 4 inches between the end of one board and the beginning of the next board to make certain that any machine errors are minimized.

It is to be understood that any of the five lengths of boards may be routed to any of the five bays to be discharged by any of the five gates 80, 110, 111, 112 or 113. Furthermore, several different lengths of boards may be directed to the same bay by merely, for example, positioning selector switch 279 at the first bay and positioning switch 240 for the second length also to first bay. This would then direct both signals indicative of the first length boards and the second length boards to the first bay gate,

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80 for discharge into the first bay. Also, any one length of board may be directed alternatively between any two bays, for example, the initial second length board may be directed to the second bay and the next second length board may be directed to the third bay upon proper settings of bay selector switches 240 and 241 to respective second and third bays and moving switch 266 to the alternate position and the switch 267 to the off position, as hereinafter more fully described.

The block diagram of the control circuit is depicted in FIG. 6 wherein the conveyor 25 is operating to move a length four board 100 on the conveyor belt 26 in the direction of arrow 101 in the measuring section 22. As previously described, the photocells PM and P1-P11 are in general alignment on one side of the belt 26 and the lights, including light 61, are in general alignment on the other side of the conveyor belt 26 rearwardly of the back wall structure 55 and spacedly along slot 60. The lights, including light 61, are coupled in parallel, to the 115 volt A.C. power supply 130 through step-down transformer 131. Photocells P1 through P11, while the board 100 is not blocking any of the photocells, are activated by their respective lights, and will continue to conduct until the anode voltage drops to zero on the 12 volt pulsating D.C. supply 20, in approximately 8.3 milli-seconds or less. The PM photocell activated by light 61 is coupled to supply 120 by oscillator 121 which oscillator 121 oscillates at about 1100 cps. and de-energizes photocell PM in less than one milli-second after the board 100 blocks the light 61 from photocell PM, thereby beginning the measuring sequence and increasing the speed of measurement of the machine.

While the board 100 is moving from a position rearwardly of photocell P11, the board 100 merely blocks and unblocks several light sources which are associated with respective photocells P11, P10, P9 and P8. When the board 100 blocks photocell PM the length of the board is determined in this case by photocell P7. If the board had also blocked photocell P8, the other photocell comprising a pair of photocells with P7 which are carried by support member 73, the length of the board would not have been determined and it would have been discharged from the conveyor at the far end 27. If the board 100 were long enough to block photocell P9, then it would have been a length five board, or if only long enough to block photocell P5, it would be a length three board.

The signal from the 12 volt D.C. supply 125 is normally interrupted by the mark relay 210, but when a board blocks photocell PM, the mark relay 210 is activated to complete the circuit between supply 125 and the normally closed timing relay 280 for passing a signal into the programming unit 140. The signal is controlled by the activation of the signal relays 135, and in this instance is controlled by the signal relays respectively connected to photocells P7 and P8, as hereinafter more fully understood by reference to FIG. 7. In the programming unit 140 selected length boards are programmed to selected bays and depending on the selections, various signals are directed to the memory unit 160 for appropriate storage of such signals for later actuation of the appropriate bay solenoids 373, 365, 389, 384 and 406 from the 115 volt A.C. supply 130 when the boards are in proper positions along the discharge sections 23 of the machine 20 for discharge into the appropriate bays. The information in the memory unit 160 is read out at the appropriate times for actuation of appropriate relays 394, 382, 399, 362, and 371 to couple respectively bay solenoids 373, 365, 389, 384 and 406 to the 115 volt A.C. power supply 130.

When it is desired to alternate the same length of board between two of the bays, switches associated with the two bays selected in the programming unit 140 must be appropriately maneuvered to couple the logic module 150 into the control circuit which functions to direct the same signal from the signal relays which is indicative of a

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single length of board into the memory unit 16 for alternative actuation of the two bay solenoids selected.

The circuit is more specifically shown in FIGS. 7 to 12 with the power on to the various components of the dimension sorter control circuit prior to the arrival of a board to be measured. As a length four board 100, shown in FIG. 6 is moved by the conveyor belt 26 in front of the P11 light-activated silicon controlled rectifier or photocell, P11 stops conducting, and when the anode voltage drops to zero, in approximately 8.3 milli-seconds, on the 12 volt pulsating D.C. supply 120, the capacitor 201 discharges through the coil of single pole reed relay 202 and closes contacts 203, shown in a broken line representation in FIG. 7 and full lines in FIG. 8. Similarly, when the board is moved to block the P10 photocell, the two pole reed relay 205 is de-energized which closes contacts 206 and opens contacts 207. When the board 100 is in a position blocking the PM photocell, the oscillator 121 drops the anode voltage down to zero in less than 1 milli-second, rather than the 8.3 milli-seconds for the anode voltage to drop to zero on P1 through P11 photocells. With the PM anode voltage at zero, the capacitor 209 discharges through the coil of single pole relay 210 and relay 210 is de-energized closing mark contacts 211. At that time the length four board 100 also is seen to block P1 through 7 thereby closing contacts 215, 217, 219, 221, 224, 226 and 229 and opening contacts 218, 222, 227. P8 through 11 are unblocked by board 100 thereby closing contacts 207 and 232 and opening contacts 203, 206, 234 and 231. Since contacts 231 are open and 232 are closed the circuit is completed from the 12 volt D.C. supply 125 through the closed mark contacts 211, the normally closed timing contacts 213, and other contacts 217, 219, 221, 224, 226, 229 and 232 through the six-pole double throw switch 260 and through the bay selector switch 261 for charging the capacitor 262 to maintain relay 263 energized for a sufficient time in which to connect solenoid 350 to the 115 volt A.C. supply, as seen in FIG. 10. The signal from D.C. supply 125 does not pass through the other six-pole double throw switches 265, 266, 267, 268, 269 because respective contacts 218, 222, 227 and 231 are open.

While the signal from the 12 volt D.C. supply 125 is transmitted through switch 260, the signal also passes through a resistor 275 for charging up capacitor 276 in timing relay circuit 280 across the double pole reed timing relay 216 in which contacts 213 are normally closed and contacts 214 normally open. After capacitor 276 is charged the relay 216 is energized by the signal from supply 125, contacts 214 close which discharges the capacitor 276 through resistor 281 after the board 100 completely passes by photocell PM. When contacts 213 open upon energization of relay 216 the signal from supply 115 through contacts 232 and switch 260 is limited to approximately 10 milli-seconds which is sufficient for capacitor 262 to be charged and to energize relay 263 which in turn closes contacts 278 thereby connecting the memory solenoid 350 of the third memory ring 351 to the 115 volt A.C. supply. As shown in FIG. 13, memory solenoid 350 pushes out a pin identified at 352 for later actuation of a switch 353 of memory ring bank 354 of the type commercially available as Model 96-1122 Memory Ring (115 volt), manufactured by Binks Manufacturing Company, 3114-44 Carroll Ave., Chicago, Ill. 60612, and described by Part Sheet 1789R dated May 1966. When the memory ring solenoid 350 is actuated, pin 352 is extended substantially at the instant the board 100 is being measured and into a position to operate any of the switches 353, 355, 356, and 357 upon rotation of the rotating ring 351 carrying pin 352.

It is to be understood that as long as board 100 is blocking off the light from mark photocell PM, contacts 211 remain closed and relay 216 energized with contacts 213 open limiting the number of signals which can be passed through any of the switches 260 and 265-269

to one signal per board being measured. When the board 100 is conveyed further to permit the light to activate photocell PM, the mark contacts 211 open and the capacitor 276 discharges through closed contacts 214 until relay 216 is de-energized, whereupon contacts 213 close and contacts 214 open and the circuit is ready to measure the next board on the conveyor 25.

The memory ring 351 is appropriately chain and sprocket or gear coupled to the conveyor and revolves in proportion to the speed and travel of the conveyor belt 26 of conveyor 25.

When pin 352 rotates to a position to close switch 353 in memory bank 354, board 100 reaches the fourth gate 184. Switches 358 and 359 of respective memory banks 360 and 361 are normally closed, as shown, and the circuit is completed upon closing of normally open switch 353 by pin 352 thereby energizing relay 363 of readout relay circuit 362 which closes contacts 364 connecting the fourth bay solenoid 365 to the 115 volt A.C. power supply which causes the air supply to be connected to the fourth air cylinder for swinging the gate 112 open and board 100 is discharged from the conveyor 25 into the fourth bay.

The specific circuit shown is capable of detecting or measuring boards up to six different lengths at any one time, assuming that all length six boards are of the same dimension. It is to be noted that the length four boards may be discharged at the first bay by movement of selector 261 to the first bay position 270 and movement of the fifth bay selector switch 277 to another bay position. As depicted, the longer length five board is directed to the first bay by selector switch 279 while the length one board is directed to the fifth bay by selector switch 277.

When a length one board is destined for the fifth bay, relay 366 is energized through switch 279 closing contacts 367, activating memory solenoid 368 pushing out a pin 369 on the ring of memory bank 360, which in turn closes switch 370 completing the circuit to readout relay circuit 371 for closing of contacts 372 and actuation of the fifth bay solenoid 373. Similarly, when a length two board is destined for the second bay, relay 375 is activated closing contacts 376 and 377 energizing respective memory solenoids 378 and 350 for pushing out respective pins 379 and 380 of the rings of respective memory banks 361 and 354, which in turn close switches 381 and 355 simultaneously for completing the circuit to relay circuit 382 for closing contacts 383 and actuation of the second bay solenoid 384. As the pins 370 and 380 continue to rotate prior to being returned to their operative positions by respective pin returns within banks 361 and 354, pin 380 may have closed switch 353, but pin 370 would have simultaneously opened switch 359 thereby avoiding any false signal which may have energized relay 363. It is thus seen that two pins 390 and 391 would be required to close normally open switches 392 and 393 and these two pins could only complete the circuit to readout relay circuit 392. Similarly pins 395 and 396 could only close switches 397 and 356 for completing the circuit to readout relay circuit 399.

The alignment of the switches on the three memory rings of the three banks 360, 361 and 354 is critical in that switch 400 or 357 must open prior to switch 370 closing and switch 370 must open before switch 400 or 357 closes to prevent a false signal to actuate relay 371. Also, switches 358 and 359 must open prior to switch 353 closing and switch 353 must open prior to the closing of switch 358 or 359 to prevent a false signal from actuating relay 363. The alignment is accomplished, for example, by disconnecting the chain coupling between the sprockets of the memory banks 360, 361 and 354, manually, lifting on the solenoid mechanisms to extend one pin in each memory ring, and rotating the sprockets until all three pins arrive at the switches 358, 359 and 353 at the same time. The memory rings are all rotated together until normally closed switch 358 barely opens and the normally

closed switch 359 is then physically moved and positioned so that the pin in bank 361 barely opens the switch 359. Normally open switch 353 is then physically moved to a position in which the pin barely closes switch 353 and then it is moved slightly back to a position so that switch 353 is barely open. In this position all switches 358, 359 and 352 are open and as the pins are rotated pass the switches, switch 353 will open before either switch 358 or 359 close. The alignment procedure for aligning switches 370, 400 and 357 is substantially identical to that hereinabove described.

When relay 403 receives a signal, indicative of a length five board, from the fifth selector switch 277, contacts 404 and 405 close and memory solenoids 368 and 378 are actuated for pushing out pins 390 and 391 for operation of respective switches 392 and 393 for energization of the first bay solenoid 406. At the sixth bay the boards merely drop off the end of the conveyor 25 or they may be sheared off the side of the conveyor by a gate positioned at any angle similar to the movable gates in their operative extended positions, as shown in broken lines in FIG. 3.

It is to be noted that relays, including relay 363 are off delay relays in which the relays are energized by the current through their respective coils, but when the switches on the memory rings open, the capacitors, including capacitor 410, being to discharge through the coil of relay 363 and through the potentiometer 411, contacts 412 being also closed when relay 363 is energized, until the current through the coil from the capacitor 410 is below the value to maintain relay 363 energized. The length of time relay 363 remains energized is dependent on the value of the capacitor 410 and the setting of the potentiometer 411. Under ordinary circumstances the bay solenoids should be maintained energized for 150 milli-seconds to assure proper discharge of the boards from the conveyor 25. It is evident that the solenoid and gate which discharged a board must be in their inoperative positions when another board being measured is being conveyed pass the previously operated solenoid and gate.

It is to be noted that photocells P1 and P2 are spaced apart by about one inch and that a length one board must block photocells PM and P1 but must not block photocell P2 for the circuit to measure, store and kick-off the length one board in the appropriate bay. If photocell P2 were blocked by a supposed length one board, contacts 218 would open thereby prohibiting the signal to pass through switch 265. Thus, the supposed length one board was too long and it will be discharged at the end of the conveyor belt 26. Similarly, a length two board must block photocells PM, P1, P2 and P3 without blocking P4 so that contacts 222 remain closed and contacts 221 opened by activation of P4 and its associated relay.

The control console 235 for the sorter is shown in FIG. 14 wherein the mark photocell signal light is identified at 236 and the P11 signal light 237, the P1 signal light being 238 while 239 designates the P2 signal light. The first through the sixth bay selector switches are respectively depicted at 279, 240, 241, 261, 277 and 242. In the positions shown in FIGS. 8 and 14, the six pole double throw switches 260 and 265-269 are in their normal or on positions with the alternating position shown as being up and the off position as being down, as hereinafter more fully described. For example, switch 266 is off when the armature 271 is moved into the broken line position 271' out of engagement with contact 272, which armature is ganged with armature 273 moving it into engagement with contact 273, as shown by broken lines 273' in FIG. 8. When switch 266 is in the on position shown, the green signal light 249 is operating and when switch 266 is in the off position, i.e., armature 282 moves to broken line position 282', the red signal light 250 and green signal light 249 are not operating, as shown in FIG. 2. When the switch 266 is moved to its up or alternating position,

i.e., armature 283 is moved to its broken line position 283', both the green and red signal lights 249 and 250 are operating.

The power on selector switch is shown on the console 235 at 251 and light 252 is operating when switch 251 is on position which turns the power on to the control circuit shown in block diagram FIG. 6 and FIGS. 7 through 12. The start pushbutton switch 253 is depressed to energize the starter coil of the conveyor driving means 28, and the conveyor belt 26 may be stopped by depressing stop pushbutton switch 257 or switching the power switch 251 to its off position.

When it is desired to alternate the same length board between two bays, for example, a length three board between the second and third bays, switch 266 is turned to its off position, shown by broken lines 271', and 273' and 282', thereby opening the circuit between contacts 222 and selector switch 240 and de-energizing signal light 249. Switch 267 is moved to its alternate position wherein armature 290 is moved into engagement with contact 291, as shown by broken lines 290', and armature 292 is moved into engagement with contact 293, as shown by broken lines 292' with both green and red signal lights 254 and 255 being energized by closing armature 256 to its broken line position 256' in FIG. 12.

When the initial third length board blocking photocell PM, photocell P6 is the last blocked photocell thus opening contact 226 and closing contacts 227 and the signal is passed through the broken line position 290' of armature 290 of switch 267 to the common side of contacts 295 and 296, and passes through normally closed contacts 295 to contact 274 and the broken line position 273' of armature 273 into bay selector switch 240 which actuates relay 375, closing contacts 376 and 377, actuating memory solenoids 378 and 350 which respectively push pins 379 and 380 out for ultimate energization of the second bay solenoid 384 through readout relay circuit 382.

Contacts 295 and 296 are always in opposite conditions, i.e., when contacts 295 are closed, contacts 296 are open and vice versa. Thus, when contacts 296 are closed and contacts 295 are open, the signal through contacts 227 pass through the broken line position 290' of armature 290 and contact 291 to the common side of contacts 295 and 296, through contacts 296 back through switch 267 by passing through contact 293 and the broken line position 292' of armature 292 into bay selector switch 241 which actuates relay 386, closing contacts 387 and 388, actuating memory solenoids 368 and 350 which push pins 395 and 396 out for ultimate energization of the third bay solenoid 402 through relay circuit 399.

The contacts 295 and 296 are a portion of the logic module generally depicted at 150 in FIGS. 6 and 9, which may be commercially obtained from Struthers-Dunn Incorporated, Pitman, N.J., reed relay logic module, 12 volt, Type RREF 4A 2BM, described in Catalog C, form No. RRC-C (op. 1062) 5M965.

When the signal has passed through normally closed contacts 295, the signal is also passed to the other components of the logic module 150. The signal is passed through normally closed contacts 300 energizing coils 301 and 302 of a double-acting relay and coil 303 of another double acting relay, but not activating coil 304 which is blocked by diode 305. At the end of the signal, contacts 306 close by energization of coil 302 and relay 307 opens the normally closed contacts 295 and closes the normally opened contacts 296. This condition remains until after the next signal is received through switch 267, because contacts 308 are closed by energization of coil 303 which couples coils 302 and 303 to the 12 volt D.C. supply 125. When coil 302 was energized contacts 300 were opened and when coil 302 was energized contacts 309 were also closed and remained closed whereby the logic module was ready to receive the next signal. When the next signal is received, which not only passes through closed contacts 296, it passes through closed contacts

309 energizing coils 304, but not coil 301 because of blocking diode 310, and coils 303 and 302 remain energized through closed contacts 308. Contacts 308 are opened by energization of coil 304 causing contacts 306 to open by disconnecting coil 302 from the 12 volt D.C. supply 125, whereupon relay 307 is de-activated closing contacts 295 and opening contacts 296. When coil 302 is de-activated, contacts 309 also open while contacts 300 again close to their normally closed position. Thus, it is seen that the logic module 150 functions to alternate the closing and opening of contacts 296 and the corresponding opening and closing of contacts 295 such that the signal indicative of the length three board is alternated between the second and third bay whereby the initial length three board is discharged at the second bay and the next at the third bay, and the next at the second bay, etc.

While only a certain preferred embodiment of this invention has been shown and described by way of illustration, many modifications will occur to those skilled in the art.

What is claimed as new and what it is desired to secure by Letters Patent of the United States is:

1. A method of sorting boards into a plurality of standard minimum length categories comprising the steps of feeding boards of differing lengths differing between a plurality of standard minimum lengths sequentially into and along a predetermined path, detecting the respective lengths one after the other of the boards entering the path at a measuring section location adjacent the path and producing a signal indicative of the length of one passing board, storing the signal while moving the one board along the path, selectively supplying the signal after predetermined delay to any of a plurality of discharging means located spacedly from the measuring section location along the path, and discharging the one board in response to the signal from the path at a bay station adjacent the selected discharging means upon arrival of the one board thereat.

2. The method as defined in claim 1 further comprising the steps of detecting the length of another passing longer or shorter board following the one board in the measuring section location and producing another signal indicative of the length of the other board, storing the other signal while moving the other board along the path, supplying the other signal after another predetermined delay to another selected discharging means, and discharging the other board in response to the other signal from the path at another bay station adjacent the other selected discharging means upon arrival of the other board thereat.

3. The method as defined in claim 1 further comprising the steps of detecting the length of a following longer or shorter board in the measuring section location and storing a signal indicative of the length thereof, supplying the other signal after an appropriate delay to another selected discharging means, and discharging the following board from the path at another bay station in accord with the board length indicated by the other signal.

4. A method of sorting boards as to length comprising the steps of feeding boards of differing lengths sequentially into and along a predetermined path, detecting the respective lengths one after the other of the boards entering the path at a measuring section location adjacent the path and producing a signal indicative of the length of one passing board, storing the signal while moving the one board along the path, supplying the signal after a predetermined delay to a selected discharging means located spacedly from the measuring section location along the path, discharging the one board in response to the signal from the path at a bay station adjacent the selected discharging means upon arrival of the one board thereat, producing another signal indicative of the length of another passing board which is of a length equal to the length of the one board, storing the other signal, supply-

ing the other signal after another predetermined delay to another selected discharging means, and discharging the other board from the path in response to the other signal at another selected bay station adjacent the other selected discharging means upon arrival of the other board thereat whereby the same length boards are alternatively discharged from the path into the one and other bay stations.

5. A method of sorting boards into a plurality of standard minimum length categories comprising the steps of feeding boards of differing lengths differing between a plurality of standard minimum lengths sequentially into and along a predetermined path, detecting the responsive lengths one after the other of the boards entering the path at a measuring section location adjacent the path and producing signals indicative of the lengths of the boards, storing the signals while sequentially moving the boards along the path, selectively supplying the signals after predetermined delays to any of the discharging means located spacedly each from the next and spaced from the measuring section location along the path, and discharging respectively the boards in response to the signals from the path at bay stations respectively adjacent the selected discharging means upon arrival of the corresponding boards thereat.

6. A method of sorting boards as to length comprising the steps of feeding boards of differing lengths sequentially into and along a predetermined path, detecting the respective lengths one after the other of the boards entering the path at a measuring section location adjacent the path and producing signals indicative of the lengths of the boards, storing the signals while sequentially moving the boards along the path, supplying the signals after predetermined delays to selected discharging means located spacedly each from the next and spaced from the measuring section location along the path discharging respectively the boards in response to the signals from the path at bay stations respectively adjacent the selected discharging means upon arrival of the corresponding boards thereat, said step of selectively supplying the signals including alternatively connecting consecutive signals indicative of the same length of board between two of the selected discharge means whereby the same length boards are alternatively discharged from the path into two of the selected bay stations.

7. A lumber sorting machine or the like comprising an elongated frame, a feeding means for sequentially moving boards of differing lengths differing between a plurality of standard minimum lengths along said frame, photocell detecting means for determining the respective lengths one after another of the pieces of board, said photocell detecting means being positioned between the forward infeed portion of said feeding means and the rearward discharge portion of said feeding means, said machine including a plurality of electrical discharge means spaced along and adjacent said discharge portion of said feeding means, said photocell detecting means being operative to produce a first signal indicative of a first length of board, storage means for delaying said first signal a predetermined time dependent on the speed of said feeding means and the location of the electrical discharge means selected, said first signal being supplied to a selected electrical discharge means to actuate same when the corresponding first length of board is moved into operative alignment with said selected discharge means thereby moving said first length board from said feeding means into a selected bay adjacent said selected discharge means.

8. The lumber sorting machine as defined in claim 7 wherein said photocell detecting means is operative to produce a second signal indicative of a second length of board, said storage means delaying said second signal another predetermined time, said second signal being supplied to another selected electrical discharge means to actuate same when the corresponding second length of board is moved into operative alignment with said other

discharge means thereby removing said second length board from said feeding means into another bay adjacent said other discharge means.

9. A lumber sorting machine or the like comprising an elongated frame, a feeding means for sequentially moving boards of differing lengths along said frame, detecting means for determining the respective lengths one after another of the pieces of board, said detecting means being positioned between the forward infeed portion of said feeding means and the rearward discharge portion of said feeding means, said machine including a plurality of discharge means spaced along and adjacent said discharge portion of said feeding means, said detecting means being operative to produce a first signal indicative of a first length of board, storage means for delaying said first signal a predetermined time dependent on the speed of said feeding means and the discharge means selected, said first signal being supplied to a selected discharge means to actuate same when the corresponding first length of board is moved into operative alignment with said selected discharge means thereby moving said first length board from said feeding means into a selected bay adjacent said selected discharge means, said detecting means being operative to produce another first signal indicative of the length of another board which is equal to the length of said first board, logic means for alternatively feeding said first signals to said selected discharge means and another selected discharge means after appropriate delays in said storage means thereby removing said equal length boards from said feeding means into said selected bay and another bay adjacent respective said selected and other selected discharge means alternatively.

10. A lumber sorting machine or the like wherein said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths differing between a plurality of standard minimum lengths from an infeed portion to a discharge portion thereof, and a plurality of discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said detecting means being operative to produce signals indicative of the lengths of the boards, selective means for selectively directing said signals to any said discharge means, storage means for delaying said signals after predetermined delays dependent on the speed of said feeding means and selected said discharge means, said signals being supplied respectively to said selected discharge means to actuate same when the corresponding boards indicated by said signals are moved into operative alignment with said selected discharge means, each said discharge means when actuated by respective said signals removing the boards from said feeding means into respective said bays adjacent respective said discharge means.

11. The lumber sorting machine as defined in claim 10 wherein said selective means for selectively directing said signals to said discharge means includes selectively operable switching means for directing any signal or signals produced by said detecting means to any said discharge means.

12. A lumber sorting machine or the like wherein said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths from an infeed portion to a discharge portion thereof, and a plurality of discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said detecting means being operative to produce signals indicative of

the lengths of the boards, means for selectively directing said signals to said discharge means, storage means for delaying said signals after predetermined delays dependent on the speed of said feeding means and selected said discharge means, said signals being supplied respectively to said selected discharge means to actuate same when the corresponding boards indicated by said signals are moved into operative alignment with said selected discharge means, each said discharge means when actuated removing the boards from said feeding means into respective said bays adjacent respective said discharge means, said means for selectively directing said signals to said discharge means including selectively operable switching means for directing any signal or signals produced by said detection means to any said discharge means, said means for selectively directing said signals to said discharge means including logic means for directing two or more signals indicative of the same length boards and produced by said detecting means alternatively to any two of said discharge means whereby equal length boards are sorted into two of said bays adjacent said two discharge means.

13. A lumber sorting machine or the like wherein said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths from an infeed portion to a discharge portion thereof, and a plurality of discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said detecting means being operative to produce signals indicative of the lengths of the boards, means for selectively directing said signals to said discharge means, storage means for delaying said signals after predetermined delays dependent on the speed of said feeding means and selected discharge means, said signals being supplied selectively to said selected discharge means to actuate same when the corresponding boards indicated by said signals are moved into operative alignment with said selected discharge means, each said discharge means when actuated removing the boards from said feeding means into respective said bays adjacent respective said discharge means, said detecting means producing two or more signals indicative of the same length boards, said means for selectively directing said signals including logic means for alternatively feeding said two or more signals to one said discharge means and to another said discharge means after appropriate delays in said storage means, said equal length boards being alternatively removed from said feeding means into one and another bays adjacent respective said one and other discharge means.

14. A lumber sorting machine or the like wherein said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths from an infeed portion to a discharge portion thereof, and a plurality of discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said detecting means being operative to produce signals indicative of the lengths of the boards, means for selectively directing said signals to said discharge means, storage means for delaying said signals after predetermined delays dependent on the speed of said feeding means and selected said discharge means, said signals being supplied respectively to said selected discharge means to actuate same when the corresponding boards indicated by said signals are moved into operative alignment with said selected discharge means, each said discharge means when actuated

removing the boards from said feeding means into respective said bays adjacent respective said discharge means, said detecting means includes a plurality of adjustably spaced photocells on one side of said feeding means and a plurality of adjustably spaced light means on the other side of said feeding means with respective lights and photocells being in alignment laterally of said frame, said detecting means determining the length of one board when said one board initially blocks the light between one said photocell immediately adjacent said discharge portion and its said light means and blocks the light between one or more other said photocells and light means, said photocell most remote from said one photocell which is blocked by said one board and said one blocked photocell producing a signal indicative of the length of said one board which is supplied to said means for selectively directing said signals for later actuation of a selected discharge means.

15. A lumber sorting machine or the like comprising, an elongated frame, an infeed portion, a measuring portion and a discharge portion, said measuring portion including a control circuit having a mark photocell immediately adjacent said discharge portion and a plurality of pairs of photocells adjustably spaced from said mark photocell, light means associated with each said photocell in operative alignment with respective said photocells, said machine having feeding means for sequentially moving boards of differing lengths from said infeed portion through said measuring portion between said photocells and said light means and through said discharge portion, said machine further having a plurality of spaced discharge means along said discharge portion to remove boards thereat upon receipt of an appropriate signal from said control circuit, said control circuit detecting the first length of board when said mark photocell is blocked by the first length of board and when the next adjacent photocell of the first pair of photocells is blocked by the first length of board and producing one signal indicative of said first length of board, said control circuit including programming means for selectively directing said one signal to a selected said discharge means, storage means for storing said one signal a predetermined delay dependent on the speed of said feeding means and said discharge means so selected, said one signal being supplied to said selected discharge means upon arrival of said first length board thereat whereby said selected discharge means is actuated and said first length board is removed from said feeding means into a bay adjacent said discharge means.

16. The lumber sorting machine as defined in claim 15 wherein said next adjacent photocell of said first pair of photocells and the other photocell thereof are spaced closely apart, said control circuit being inoperative to produce an appropriate signal when a following board also blocks said other photocells but does not block the next adjacent photocell of said second pair of photocells whereby first length boards equal to or greater than the distance between said mark photocell and said next adjacent photocell of said first pair and less than the distance between said mark photocell and said other photocell of said first pair are discharged into said bay by said discharge means.

17. A method of sorting boards into a plurality of standard minimum length categories comprising the steps of feeding boards of differing lengths differing between a plurality of standard minimum lengths sequentially into and along a predetermined path, detecting the respective lengths one after the other of the boards entering the path at a measuring section location adjacent the path and producing signals indicative of the lengths of the boards, selectively programming said signals for later actuation of selected discharging means, storing the signals while sequentially moving the boards along the path, supplying the programmed signals after predetermined delays to selected discharging means located

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spacedly each from the next and spaced from the measuring section location along the path, and discharging respectively the boards in response to the programmed signals from the path at bay stations respectively adjacent the selected discharging means upon arrival of the corresponding boards thereat.

18. A lumber sorting machine or the like wherein said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths from an infeed portion to a discharge portion thereof, and a plurality of electrical discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising photocell detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said photocell detecting means being operative to produce signals indicative of the lengths of the boards, means for selectively directing said signals to said discharge means, storage means for delaying said signals after predetermined delays dependent on the speed of said feeding means and the location of said discharge means selected, said signals being supplied to said selected electrical discharge means to actuate same when the corresponding boards indicated by said signals are moved into operative alignment with said selected discharge means, each said electrical discharge means when actuated removing the boards from said feeding means into respective said bays adjacent respective said discharge means.

19. The lumber sorting machine as defined in claim 18 wherein said means for selectively directing said signals to said discharge means includes selectively operable switching means for directing any signal or signals produced by said detecting means to any said electrical discharge means.

20. A lumber sorting machine or the like wherein

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said machine includes an elongated frame, a feeding means along the frame for sequentially moving boards of differing lengths from an infeed portion to a discharge portion thereof, and a plurality of discharge means spaced each from the next along and adjacent said discharge portion for moving the boards from the feeding means into a plurality of spaced bays, the improvement comprising detecting means positioned between said infeed and discharge portions for determining the respective lengths one after another of the boards, said detecting means being operative to produce signals indicative of the lengths of the boards, storage means including a plurality of storage banks less than the number of said discharge means for storing said signals predetermined times dependent on the speed of said feeding means and the location of said discharge means selected, means for supplying signals indicative of lengths of boards from said storage banks to selected discharge means to actuate same when the corresponding boards indicated by said signals from said storage banks are moved into operative alignment with said selected discharge means, each said discharge means when actuated removing the boards from said feeding means into respective said bays adjacent respective said discharge means.

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U.S. Cl. X.R.

209—74, 82

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,495,707 Dated February 17, 1970

Inventor(s) William Davies

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 49, the word "operative" should read
-- inoperative --

Column 9, line 6, after "is" insert -- in --

Column 11, line 35, after "path" insert a comma (,)

Column 13, line 38, after "selected" insert -- said --

Column 13, line 62, omit the word "means"

**SIGNED AND
SEALED
JUL 14 1970**

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents