

- [54] **AUTOMATIC VENEER MEASURING AND CLIPPING CONTROL SYSTEM**
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- [51] Int. Cl. B26d 5/40
- [58] Field of Search 83/369, 361-363, 83/367, 293-296, 208, 276-278, 255, 404, 416, 71, 522

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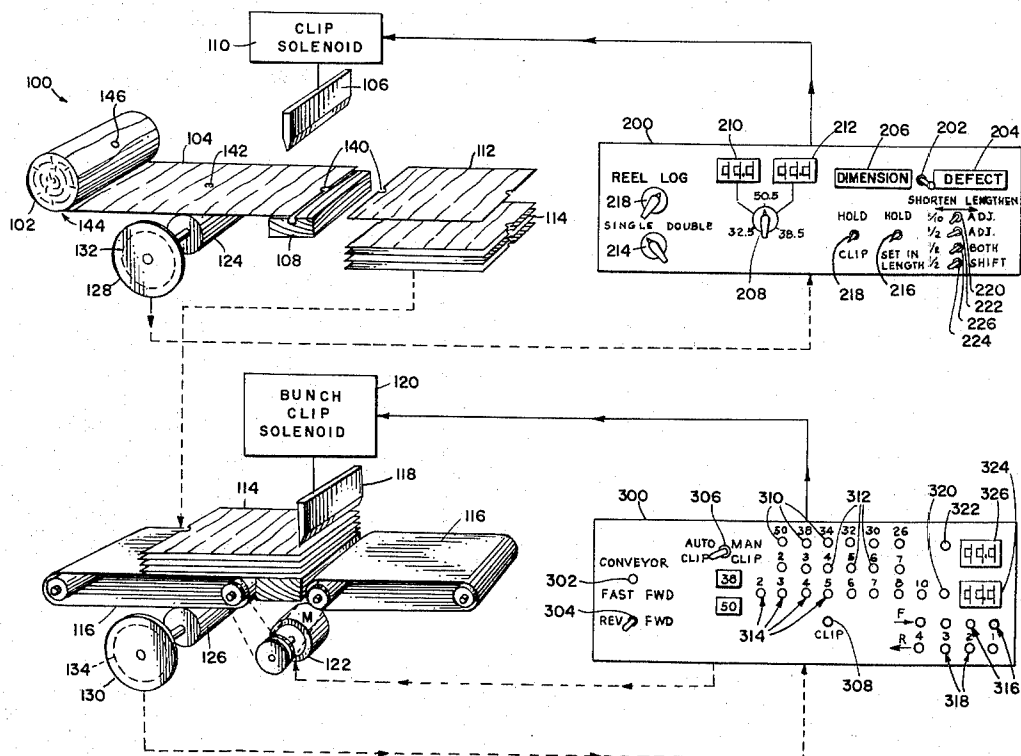
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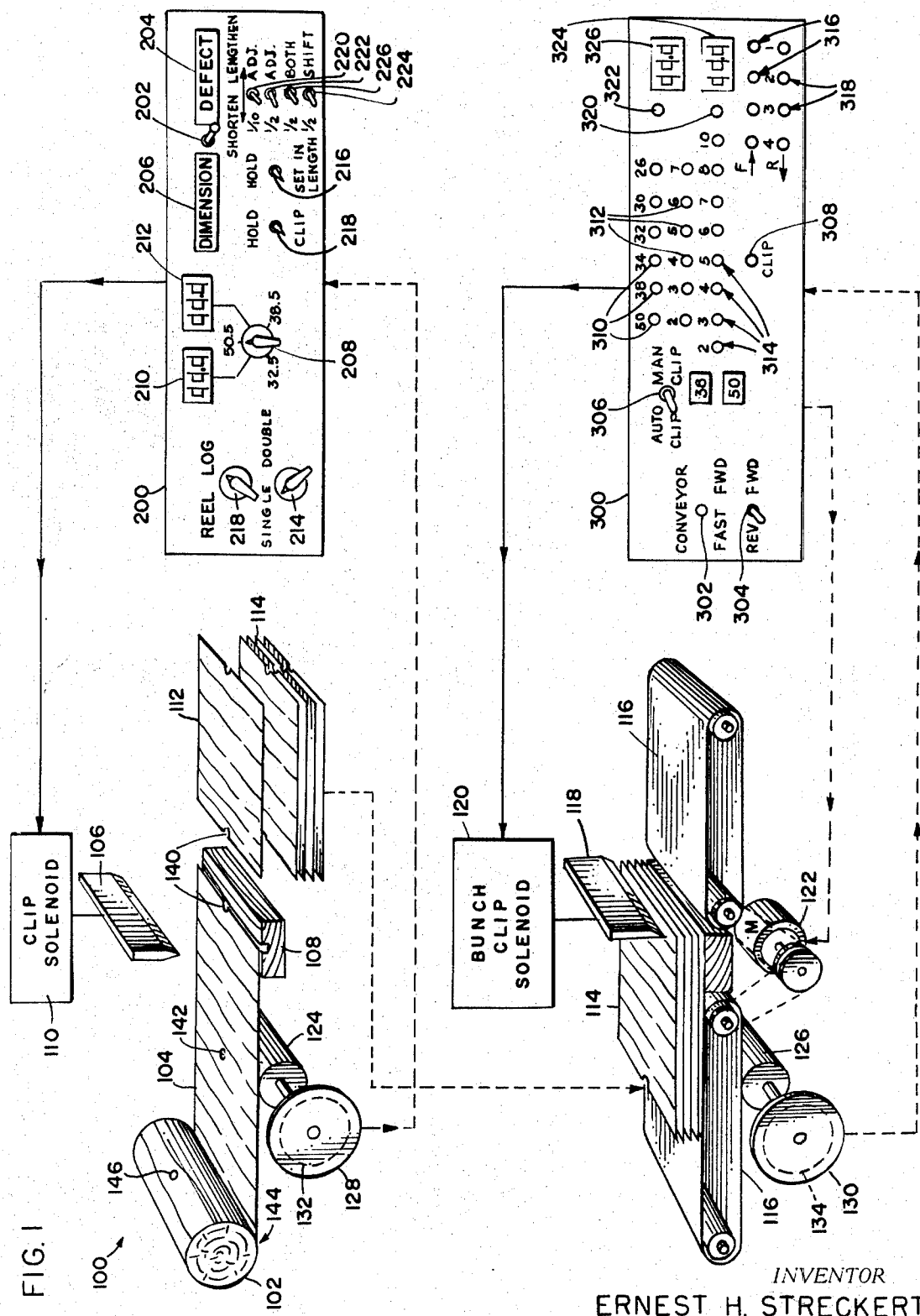
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ABSTRACT

A solid state control system measures out the length of veneer cut from reel or log as it is moved by a conveyor and automatically clips the veneer to the desired length. The veneer can be automatically cut into sheets of any desired length, or it can be automatically clipped whenever a periodic knot or defect appears. After the veneer has been clipped into sheets and stacked, the stacks are semi-automatically shifted and are electronically measured and clipped into sections of the proper length for assembly into standard size panels.

16 Claims, 6 Drawing Figures





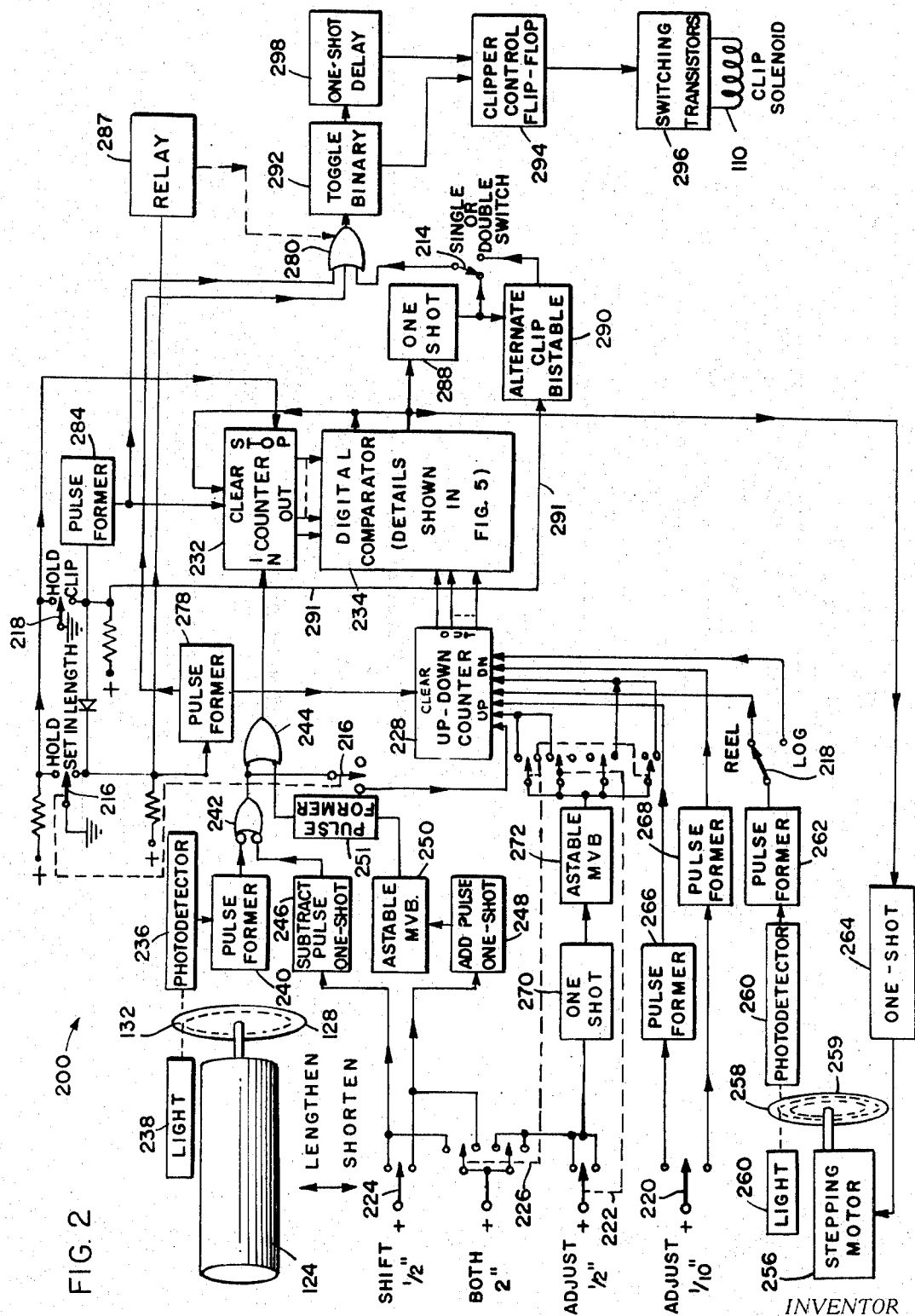
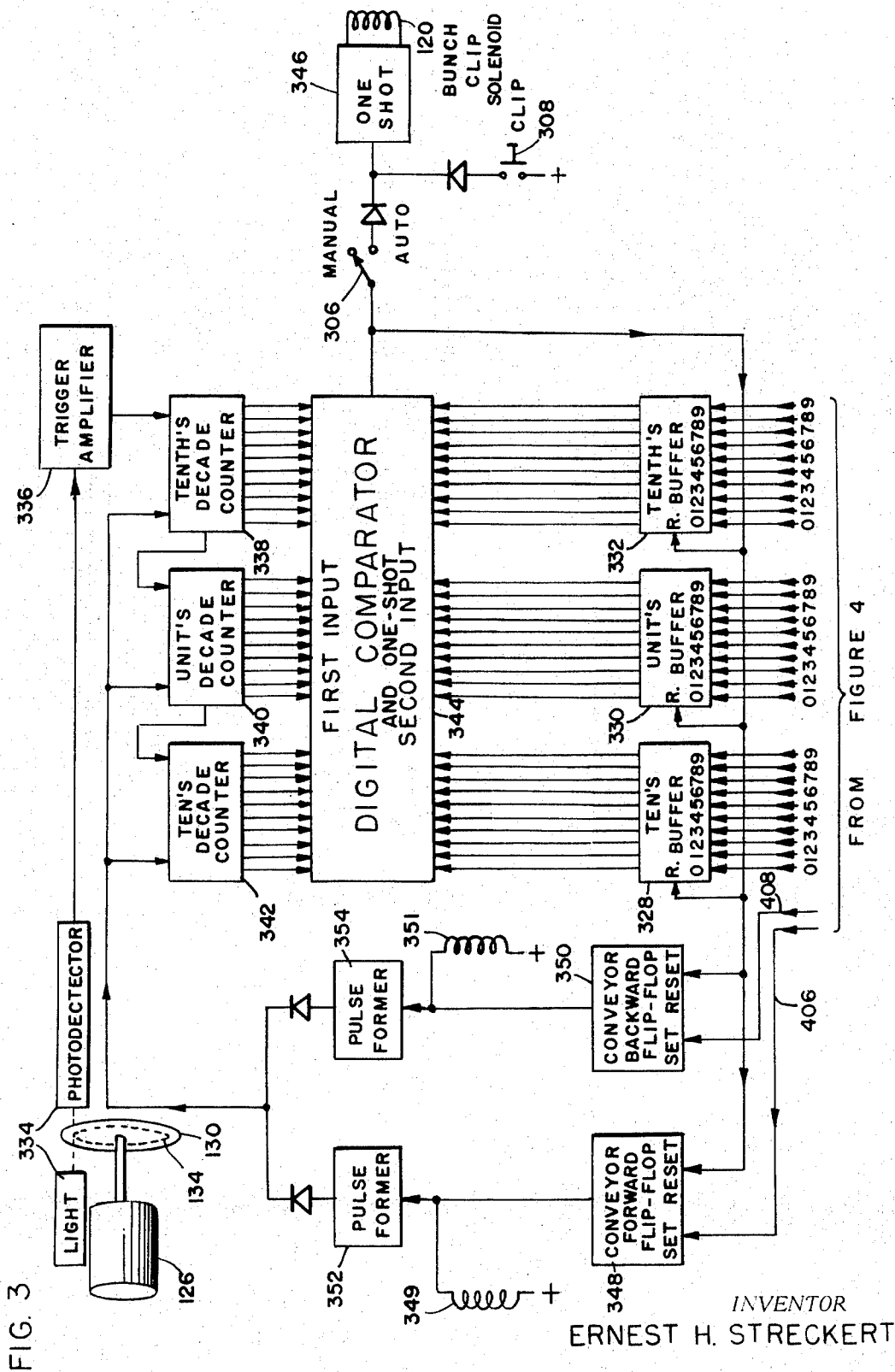


FIG. 2

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FIG. 4

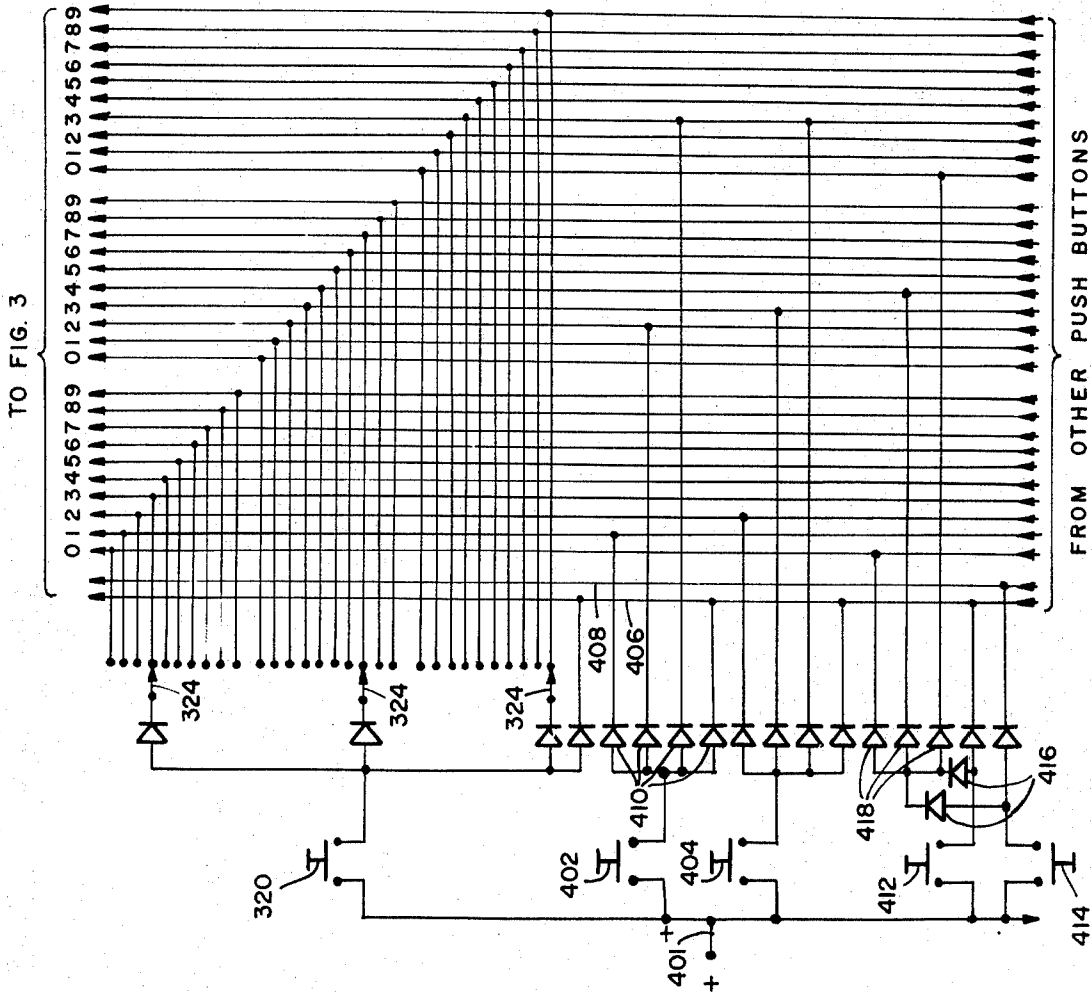
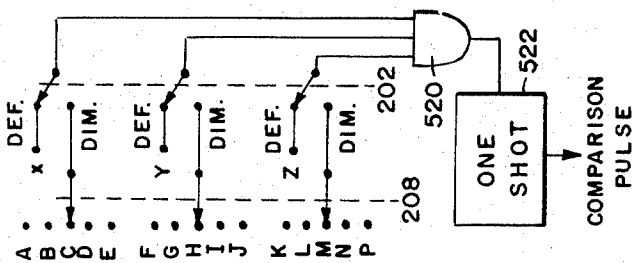


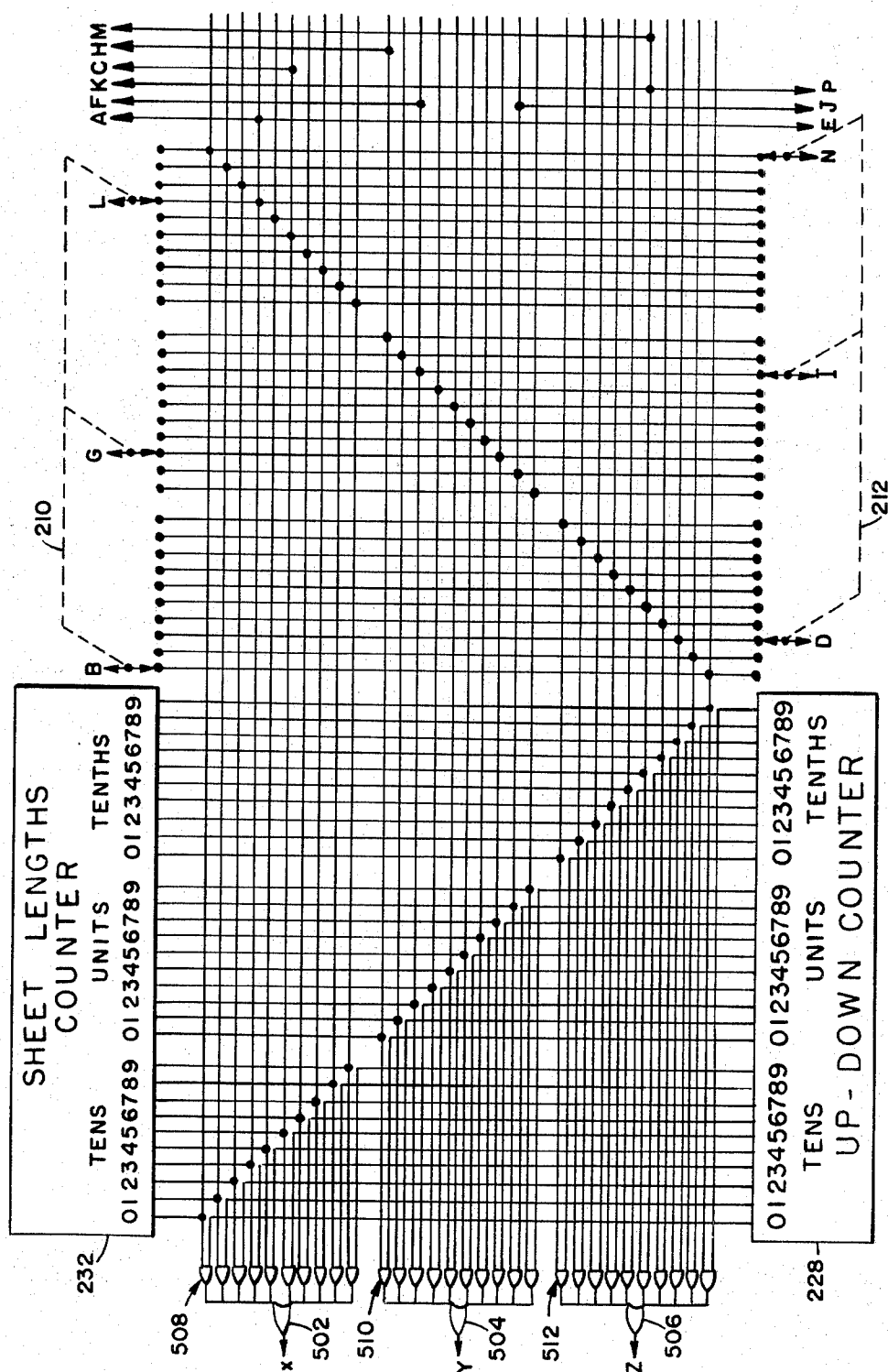
FIG. 5A



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FIG. 5B



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AUTOMATIC VENEER MEASURING AND CLIPPING CONTROL SYSTEM

The present invention relates to a veneer clipping system, and more particularly to a veneer clipping system that includes automatic measuring and clipping means.

Veneer is formed by slicing a thin layer of wood from the surface of a cylindrical wood section mounted in a rotary lathe type of structure. As the wood rotates, the surface of the wood is sliced off and unrolled in a manner analogous to the way in which paper is unrolled from a roll. The veneer strip is carried by conveyors to a clipper which cuts off veneer sheets of convenient lengths, and the veneer sheets are stacked. The stacks are then fed to a bunch clipper which clips the stacks into groups of strips of the proper length for assembly into standard size veneer panels.

The control systems used to control the clipping of veneer in the past have comprised simple devices which are only able to cut off lengths of veneer as it comes from the roll. It has been customary to provide a manually actuatable clipper which is actuated by an employee whenever a knot or periodic defect appears in the veneer. This defect clipping task has proved difficult to automate, because the spacing between successive defects increases or decreases as the veneer is unrolled, and additionally because the spacing between defects is never the same from one piece of veneer to the next and varies within a given log. Control systems used in the past have included no way by which the exact distance between successive clips could be easily altered to correct for small discrepancies resulting from non-uniformity in the veneer and from cumulative error.

The control circuits presently used to run veneer bunch or stack clippers are not automated. An employee advances the veneer stack a distance equal to the length of a standard size panel divided by the number of veneer segments which are to make up the panel, and then manually initiates a clip. This is a slow, unsafe, and time-consuming procedure, since the employee must manually reposition the stack before each clip. Additionally, a fairly skilled employee is required who can remember how far to move the stack in order to produce strips of the proper length for assembly into a standard size panel (stops on the outfeed table are used as a guide).

An object of the present invention is, therefore, to provide a reliable and accurate control system for measuring veneer, for clipping veneer into sheets, and also for clipping veneer stacks into properly sized strips.

An additional object of the present invention is to provide such an apparatus that can easily be adjusted so as to clip a continuous veneer sheet every time a defect appears in the veneer surface, and which automatically compensates for the varying spacing in the defects due to the changing diameter of the roll or log from which the veneer is unrolled.

Another object of the present invention is to provide such a clipper control that can be easily readjusted during the clipping operation, and that can be easily made to clip on a different defect if the original defect disappears and is replaced by another.

A further object of the present invention is to provide a bunch clipper that includes pushbuttons corresponding to the number of segments it is desired to have in a given size panel, and which therefore can be operated by an employee without the employee having to remember the length to which the segments must be cut.

In accordance with these and many other objects, an embodiment of the present invention comprises briefly a system to control the operation of a veneer sheet clipper and a veneer bunch clipper. The system includes two subsystems, one for controlling the operation of the sheet clipper, and another for controlling both the operation of a bunch clipper and also the operation of a bunch clipper conveyor assembly. The first subsystem actuates the sheet clipper after a predetermined length of veneer sheet has passed the clipper. If the first subsystem is set up for defect clipping, each cut is directly over a defect in the veneer sheet. If the first subsystem is set up

for dimension clipping, each sheet is cut to the same length as the previous sheet. The exact location of each clip is determined by a binary comparator which compares the number within a sheet length counter to either a number presented by an array of preset dimension switches, in the case of dimension clipping, or to a number within a second counter, in the case of defect clipping. The sheet length counter is reset to zero after each clip, and then counts pulses each of which corresponds to an incremental movement of the veneer sheet past the clipper. Hence, at any given moment, the number within the sheet length counter represents the length of the sheet lying past the clipper. When the length of sheet lying past the clipper is right, the comparator actuates the clipper to cut off a sheet.

During defect clipping, the second counter is preset to a count corresponding to the distance between defects. This is done by the system operator who depresses a switch when the defect first appears, and releases the switch when the same defect appears a second time. This switch causes the second counter to count the pulses that are fed to the sheet length counter. Between clips, a predetermined number of counts is added or subtracted from this second counter to compensate for changes in defect spacing due to change in diameter of the veneer log or roll. Controls are provided which allow counts to be added to or subtracted from both of the counters to compensate for any cumulative errors which may appear. A manual clip control resets the sheet length counter prematurely, and can be used to shift the location of each clip away from the original defect to another defect which may not have been originally present. This control is actuated when the new defect is below the clipper.

After clipping, the sheets are stacked into bunches and are placed on the bunch clipper conveyor, which is controlled by the second subsystem. Each bunch is positioned by eye for the first bunch clip, and a clip pushbutton is depressed to actuate the bunch clipper. A pushbutton corresponding to a specified width of veneer strip is then depressed, and the subsystem automatically advances the bunch the specified distance and cuts off a stack of strips having the specified width. Several arrays of pushbuttons are provided. A first array includes pushbuttons corresponding to each of the standard veneer panel widths. Second and third arrays include pushbuttons each of which corresponds to the number of strips which it is desired to include in a single panel of standard size. A fourth array includes pushbuttons which, when depressed, move the bunch only a short distance forward or back and then clip. Finally, two pushbuttons are provided for cutting strips of nonstandard size. Each of these pushbuttons is located adjacent a set of digital thumb wheels which can be set to specify the nonstandard length which is to be cut.

Further objects and advantages of the present invention will become apparent as the specification proceeds, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification. For a further understanding of the present invention, reference will be had to the drawings wherein:

FIG. 1 is a diagrammatic representation of a veneer production line including the control system of the present invention;

FIG. 2 is a block diagram of a sheet clipper control subsystem designed in accordance with the teachings of the present invention;

FIGS. 3 and 4 together comprise a block diagram of a bunch clipper control subsystem designed in accordance with the teachings of the present invention; and

FIGS. 5A and 5B together form a logic diagram of a digital comparator suitable for use in the sheet clipper control subsystem shown in FIG. 2.

Referring now to the drawings, FIG. 1 shows a veneer clipping control system designed in accordance with the present invention, and indicated generally by the reference numeral 100. Either a pre-cut reel of veneer, or else a sheet cut from a log 102 is placed at the input to a first conveyor

system (not shown) so that a veneer sheet 104 is passed between a veneer clipper 106 and an anvil 108. The veneer clipper 106 is actuated by a clip solenoid 110. This solenoid 110 is controlled by a sheet clipper control subsystem 200 which is described in more detail in FIG. 2. The subsystem 200 cuts the veneer sheet 104 into individual veneer panels 112. The panels 112 are then stacked or bunched by means not shown so as to form stacks 114 of veneer panels. Each stack 114 is then conveyed to a conveyor 116 which presents the stack 114 to a bunch clipper 118. The bunch clipper 118 is controlled by a bunch clip solenoid 120 which is in turn controlled by a bunch clip control subsystem 300 shown in FIG. 3. A motor 122 controls operation of the conveyor 116 and is in turn controlled by the subsystem 300. To provide an indication of the exact positioning of the veneer sheet 104 and of the veneer stack 114, measuring drums 124 and 126 are respectively arranged to rotate in response to movement of the sheet 104 and of the stack 114. The first measuring drum 124 is in direct contact with the veneer sheet 104 and rotates as the sheet 104 moves. The second drum 126 is rotated by the conveyor 116. Both of the measurement drums 124 and 126 are connected to perforated discs 128 and 130. The discs 128 and 130 each carry circumferentially arranged groups of perforations 132 and 134 which are so displaced from one another about the circumference of the discs 128 and 130 that their spacing represents one-tenth inch increments in movement of the veneer sheet 104 and of the veneer stack 114. The perforated discs 128 and 130 are placed between sources of light and photodetectors (not shown in FIG. 1) so as to cause the photodetectors to generate pulses which when counted represent the distances through which the sheet 104 and the stack 114 have moved.

In accordance with the principles of the present invention, the subsystem 200 can either cause the veneer sheet clipper 106 to cut the sheet 104 so as to produce veneer panels 112 of uniform length dimension, or else it can cause the clipper 106 to always cut adjacent a given defect in the sheet 104. The particular mode of cutting is determined by the position of a DIMENSION-DEFECT switch 202. In FIG. 1, this switch 202 is shown in the DEFECT position, and a DEFECT light 204 is illuminated. If uniform length panels are desired, the switch 202 is thrown to the other position, and a DIMENSION light 206 is illuminated. Assuming the switch 206 to be in the DIMENSION position, the length to which panels are cut is determined by a length switch 208. This switch 208 can either be set to a position which corresponds to a standard length of veneer panel, such as 32.5 inches, 38.5 inches, or 50.5 inches, or it may be set to one of two variable lengths which are individually fed into the subsystem 200 with the assistance of two arrays of thumb wheel switches 210 and 212. If double length panels are desired, a SINGLE-DOUBLE switch 214 is shifted into the DOUBLE position so as to suppress every other clip.

If the switch 202 is in the DEFECT position, the following procedure determines the length of the veneer panels which are cut. When a defect, such as the defect 140, is directly beneath the clipper 106, a three position, center-spring-return switch 216 is depressed so that the switch 216 is in the SET IN LENGTH position. This actuates the clip solenoid 110 and causes the veneer sheet 104 to be clipped at the defect 140 as shown. The switch 216 is held in the SET IN LENGTH position until the next defect 142 is directly below the clipper 106, at which point the switch 216 is released and is allowed to spring back to the center position. Again the clipper 106 clips the veneer sheet 104, this time at the defect 142. From this point, operation of the clipper 106 is entirely automatic. The next clip is at the defect 144, the next at the defect 146, and so on. The subsystem 200 automatically compensates for the change in spacing between defects due to change in log diameter by cutting each panel 112 to be slightly shorter than the panel cut previously. If, in place of the log 102, a reel of precut veneer is being clipped into sheets, a switch 218 is shifted from the LOG position to the REEL position. The switch 218 takes

account of the fact that veneer is unwound from a precut veneer reel in the opposite direction from which it is unwound from a log, such as the log 102. Hence, while the defects coming from the log 102 are progressively spaced closer and closer together, the defects coming from a precut reel are progressively spaced farther and farther apart. The mechanism whereby the system 200 compensates for the variable spacing between defects will be explained in detail below.

If the operator notices that the defect which is presently being used for a clipping guide becomes less pronounced and that a new defect comes into prominence, he can shift from clipping at the old defect to clipping at the new defect by merely depressing a three position, center-spring-return switch 218 when the new defect is directly below the clipper 106. The clipper 106 cuts the sheet 104 at the new defect each time it appears.

If the operator notices a progressive error in the accuracy of the cut in relation to a defect, he can change the length of the panels being cut with the assistance of two ADJUST switches 220 and 222. Both of these switches are three position, spring-center-return switches. The switch 220 is used either to shorten or to lengthen the panels by one-tenth of an inch, and the switch 222 is used to shorten or to lengthen the panels by one-half of an inch. These two adjustment switches may be used in combination with each other, and may be used repetitively. Thus, if a lengthening adjustment of seven-tenths of an inch is required, the switch 22 can be depressed to the right once, and the switch 220 can be depressed to the right twice. The system 200 will automatically reprogram itself so as to cut panels which are seven-tenths of an inch longer from that time on. If it is desired to maintain the length of the panels constant but to shift the location where the panels are being clipped, a SHIFT switch 224 is used. The switch 224 functions in the same manner as the switches 220 and 222, but only changes the length of a single panel without changing the length to which other panels are cut at a later time. The switch 224 can also be used during fixed dimension clipping so as to produce a single panel which is slightly longer or shorter than other panels. If it is desired to simultaneously adjust the length of a single panel and to also shift the clip location, a BOTH switch 226 is used. Depression of this switch is equivalent to simultaneous depression of the switches 222 and 224.

The bunch clipper control subsystem 300 controls actuation of the bunch clipper 118 and also controls the operation of the conveyor motor 122. A stack 114 is initially positioned by eye for the first clip with the assistance of a pushbutton 302 and a switch 304. When a stack 114 is to be brought rapidly into the clipping area, FAST FORWARD pushbutton 302 is depressed. Precision positioning of a stack beneath the clipper 118 for the first clip is then accomplished with the assistance of FORWARD-REVERSE switch 304, which is a three position, center-spring-return switch.

The location of subsequent clips is then determined automatically by the subsystem 300 in response to pushbutton commands from the operator. The subsystem 300 includes an array of pushbuttons each of which corresponds to a different type of clip. The operator depresses a pushbutton corresponding to the type of clip which is desired, and the system 300 automatically causes the motor 122 to advance the stack 114 the proper distance to position it for the desired cut. Depending upon the position of an AUTO-MANUAL switch 306, the stack 114 is either automatically clipped as soon as it is in position, or else it is merely positioned for clipping, and the operator initiates the clip by depressing the CLIP pushbutton 308.

Four different arrays of pushbuttons are available to the operator. The first array 310 includes six pushbuttons each of which corresponds to a standard length of veneer paneling, 50 inches, 38 inches, 32 inches, and so forth. When one of these six pushbuttons is depressed the stack 114 moves forward the distance specified, and is clipped. A second array of pushbuttons includes two rows—a first row 312 of six pushbuttons, and a second row 314 of eight pushbuttons. These pushbut-

tons are used if it is desired to cut veneer strips which have matching grain patterns and which can be assembled into standard width panels in such a manner that adjacent strips are mirror images of each other. The upper row of pushbuttons 312 is used when it is desired to cut strips which are to be placed together to form a 38 inch standard width veneer panel. For example, if the pushbutton labelled FIVE is depressed, the strips cut from the stack 114 will be of such a length that, after finishing, five of them can be placed side by side to form a panel 38 inches across and having a mirror image grain pattern. The pushbuttons in the row 314 function in a similar manner, but cause strips to be cut which may be placed together to form a 50 inch standard length panel. The system 300 greatly facilitates the preparation of mirror image veneer strip sets by freeing the operator from the task of remembering how wide the strips must be to form a given size panel containing a given number of strips. The operator merely depresses a button which corresponds to the number of strips desired, and the subsystem 300 keeps track of how wide the strips are to be. If the FIVE pushbutton in the row 314 is depressed, veneer strips ten inches wide are cut (plus a small amount to allow for later finishing). Any five of the strips cut can thus be placed adjacent one another to form a mirror image strip veneer panel exactly 50 inches in width.

The third array of pushbuttons comprises an upper row 316 and a lower row 318 each of which includes four pushbuttons. These pushbuttons are used when it is desired to move the stack 114 a short distance either in the forward or reverse direction, and then to clip the stack 114. The upper row 316 of pushbuttons is used to move the stack 114 in the forward direction 1, 2, 3, or 4 inches. The lower row 318 of pushbuttons is used in the same manner to move the stack in the reverse direction. For example, if the pushbutton in the upper row 316 adjacent number FOUR is depressed, the stack 114 moves forward 4 inches and is then clipped (assuming the switch 306 is in the AUTO CLIP position). The final array of pushbuttons includes only the two pushbuttons 320 and 322. Each of these pushbuttons has associated with it a set of three thumb wheels 324 and 326 which may be set to any specified width between 0.1 inches and 99.9 inches. When one of the two pushbuttons 320 or 322 is depressed, the stack 114 moves forward a distance as specified by the thumb wheel array 324 or 326, and is automatically clipped.

Referring now to FIG. 2, the details of the sheet clipper control subsystem 200 are shown. This circuit is organized around a sheet length counter 232 that counts pulses of light which pass through the perforated disc 128. When a predetermined count is reached, a digital comparator 234 energizes the clip solenoid 110 and resets the counter 232. The predetermined count is either presented to the comparator 234 by a preset dimension switch 208 (shown in FIGS. 1 and 5) or it is presented by a second counter, an up-down counter 228. Whether the preset dimension switch 208 or the up-down counter 228 is used for comparison depends upon the setting of the DEFECT-DIMENSION switch 202 (shown in FIGS. 1 and 5). The up-down counter 228 and the sheet length counter 232 both are connected directly to the comparator 234 by data lines. When the predetermined count is reached, the digital comparator 234 generates an output pulse which resets the sheet length counter 232 and also passes through a series of gates and logic to the clip solenoid 110. Pulses for the counter 232 come from a photodetector 236 that is mounted adjacent and on one side of the perforated disc 128. A source of illumination or light 238 is mounted on the opposite side of the perforated disc 128 from the photodetector 236 so that when one of the perforations 132 passes the photodetector 236, light from the light 238 passes through the perforation and strikes the photodetector 236. As the perforated disc 128 rotates in response to movement of the drum 124, the light path between the light 238 and the photodetector 236 is repeatedly broken, and pulses appear at the output of the photodetector 236. These pulses are shaped by a suitable pulse former 240 and are fed through a NOR gate 242 and a pulse former and OR gate 244 to the counter 232.

When the DEFECT-DIMENSION switch 202 (FIGS. 1 and 5) is in the DIMENSION position, veneer sheets are cut to a uniform length. It will be remembered that the counter 232 is reset each time a clip is initiated by the digital comparator 234. After each clip, as the conveyor moves the veneer sheet 104 forward, the measuring drum 124 rotates and causes pulses from the photodetector 236 to be counted by the counter 232. After the sheet has moved forward a predetermined distance, as determined by the preset dimension switch 208 (shown in FIGS. 1 and 5), the number displayed by the counter 232 matches the number specified by the preset dimension switch 208, and the digital comparator 234 initiates another clip. In this manner, veneer sheets 112 of uniform width are successively clipped from the elongated veneer sheet 104 by the sheet clipper 106 (FIG. 1).

When the DIMENSION-DEFECT switch 202 is in the DEFECT position, the system 200 performs in exactly the manner described above, except that the clip solenoid 110 is actuated when the number within the counter 232 matches the number presented by an up-down counter 228, rather than that specified by the preset dimension switch 208. In accordance with one feature of the present invention, each time a clip is initiated, the digital comparator 234 actuates a rotary ratchet or stepping motor 256. The motor 256 causes a perforated disc 258 to advance a predetermined distance, thus causing a light and photodetector assembly 260 to generate a fixed number of pulses. The number of pulses generated is determined by the number of perforations 259 in the disc 258. These pulses are amplified and shaped by a pulse former 262, and are fed either into the UP or into the DOWN input of the up-down counter 228. The pulses either subtract or add to the count currently stored in the up-down counter 228, depending upon the position of the LOG-REEL switch 218. These pulses cause a change in the spacing between successive clips to compensate for the change in spacing between successive defects in the sheet 104 (FIG. 1) due to circumference change in the log or reel from which the sheet is cut. When the switch 218 is in the REEL position, these counts are added to the count within the counter 228 and thus cause the spacing between successive defects to increase with each clip. When the switch 218 is in the LOG position, these counts are subtracted from the count within the counter 228 and thus cause the spacing between successive defects to decrease with each clip. The perforations on the disc 258 are adjusted so that the number of pulses generated with each clip is proper for the particular thickness of veneer being processed. Since different thickness of veneer can be processed in the subsystem 200, several circles, each including different numbers of perforations, are included upon the disc 258. The subsystem 200 is adjusted to handle veneer of differing sizes by switching to a different lamp and photocell pair, aligned with each circular row of perforations 259.

A one-shot 264 is placed between the output of the digital comparator 234 and the stepping relay 256 to insure that the waveform reaching the stepping relay 256 is maintained for a sufficient length of time to actuate the relay 256.

The ADJUST switches 220 and 222 provide a means for altering the count in the up-down counter 228 so as to change the length of the panels being cut. The switch 220 actuates one or the other of two pulse formers 266 or 268 which respectively add or subtract a single count to or from the up-down counter 228. This changes the length of the panels cut by one-tenth of an inch each time the switch 220 is actuated. The multi-contact switch 222 actuates a one-shot 270 which enables an astable multi-vibrator 272 to generate a predetermined number of pulses, and simultaneously channels these pulses to either the UP or DOWN input of the counter 228, depending upon the direction in which the switch 222 is thrown.

As mentioned above, defect clipping is initiated by depressing the multi-contact SET IN LENGTH switch 216 when a defect is directly below the clipper 106 (FIG. 1). The switch 216, when depressed, actuates a pulse former 278 which sends a pulse through an OR gate 280 to the clip solenoid 110.

noid 110, thus causing the sheet 104 (FIG. 1) to be clipped right at the defect. This same pulse is also used to clear the counter 228. Another contact of the switch 216 simultaneously allows pulses from the NOR gate 242 to reach the UP input of the up-down counter 228. Thus, as long as the switch 216 is held depressed, the up-down counter 228 continuously counts the tenth inch pulses coming from the photodetector 236. When a second defect is adjacent the clipper 106, the switch 216 is released. This stores a number corresponding to the exact distance between two adjacent defects within the up-down counter 228. A pulse former 284 is actuated by the release of the switch 216, and this pulse former applies a second pulse to the OR gate 280. This pulse actuates the clip solenoid 110 and causes a second clip adjacent the second appearance of the defect. The pulse former 284 also resets the counter 232. From this point in time onward the subsystem 200 automatically continues to clip the veneer sheet 104 each time the defect comes below the sheet clipper 106 (FIG. 1).

When it is desired to have one sheet slightly longer or shorter than the other sheets, the three position, center-spring-return switch 224 is depressed in one direction or the other. When it is desired to lengthen a particular sheet, the switch 224 is thrown in an upwards direction in FIG. 2 (to the right in FIG. 1) so as to energize a subtract pulse one-shot 246 for a short time interval which is determined by the time constant of the one-shot 246. This subtract pulse one-shot disables the NOR gate 242 and prevents a certain number of photodetector pulses from reaching the counter 232. The counter 232 must then be supplied with additional photodetector pulses before a comparison results in a clip, and this causes an extended length sheet to be produced. When it is desired to shorten a given sheet, the switch 224 is actuated in the other direction so as to enable an add pulse one-shot 248. This add pulse one-shot 248 enables an astable multivibrator 250 for a time interval determined by the time constant of the add pulse one-shot 248. The astable multivibrator 250 feeds extra pulses through a spike pulse former 251 and into the counter 232 through the OR gate 244. These pulses are narrow, and therefore are interspersed between pulses coming into the OR gate from the photodetector 236. These pulses advance the counter 232 prematurely so that a comparison results at an earlier time than otherwise would be the case.

When it is desired to have one sheet slightly longer or shorter than the other sheets and to simultaneously change the length of the panels being cut, the multi-contact BOTH switch 226 is actuated. Actuation of the BOTH switch is equivalent to simultaneous actuation of the SHIFT switch 224 and the ADJUST switch 222, as can be seen in FIG. 2, since the BOTH switch includes contacts which parallel all of the contacts in the switches 222 and 224. The BOTH switch is used when the location of a clip drifts away from the location of a defect, or vice versa.

If the defect originally chosen as a clipping guide begins to fade as the veneer is unrolled, and if another larger defect appears, the system 200 can be made to clip adjacent the new defect by depression and release of the switch 218. When the new defect is directly below the sheet clipper 106 (FIG. 1), the switch 218 is depressed and released. This activates the pulse former 284 which, as explained above, causes the clip solenoid to be actuated and also resets the counter 232. The veneer sheet 104 is thus clipped at the new defect, and all future sheet length measurements are made with reference to the new defect.

The signal generated by the digital comparator 234 is passed through a pulse forming one-shot 288. The signal is then either routed directly through the OR gate 280, or is routed through a bistable 290 on its way to the OR gate 280, depending upon the position of the SINGLE OR DOUBLE switch 214. The alternate clip bistable 290 generates one output pulse for every two input pulses, and thus causes double length sheets of veneer to be cut when the switch 214 is in the DOUBLE position. The bistable 290 is directly set by the switches 216 and 218 whenever they are actuated. This in-

sures that whenever double length sheets are cut, a double length sheet is cut after a clip initiated by one of the two switches 216 or 218. A line 291 connects a set terminal of the bistable 290 to the CLIP terminal of the switch 218 for this purpose.

When the switch 216 is depressed to the SET IN LENGTH position, it actuates a relay 287 which opens the clipping circuit and which thereby prevents any clips from occurring during the period when pulses are fed to the up-down counter 228.

When either of the switches 216 or 218 is depressed to the HOLD position, a ground level signal is supplied to a STOP terminal of the counter 232. This signal disables an input gate to the counter 232 and thus prevents the counter from advancing. When the switch 216 or 218 is released, the counter 232 once again functions in its usual manner. Whenever it is desired to prevent a clip from occurring, either switch 216 or 218 is held in the up position before the time when the clip is due to occur.

A clip is initiated every time a pulse is generated by the OR gate 280. In the preferred embodiment of the system 100, the sheet clipper 106 and clip solenoid 110 are designed in such a way that energization of the clip solenoid 110 produces one clip, and deenergization of the clip solenoid 110 produces a second clip. The time delay between actuation of the solenoid 110 and the actual clipping action is not the same for both energization and deenergization of the solenoid 110. Therefore, compensation is required to insure that each clip occurs a fixed time interval after the OR gate 280 generates a pulse regardless of whether the clip solenoid 110 is energized or deenergized. This compensation is provided by elements 292 through 298. Element 292 is a toggle binary which changes its state each time it receives a pulse from the OR gate 280. In response to a change in state of the toggle binary, a clipper control flip-flop 294 also changes its state. The flip-flop 294 causes switching transistors 296 to energize or deenergize the clip solenoid 110 in accordance with the state of the flip-flop 294. Two signal leads couple the toggle binary 292 to the clipper control flip-flop 294. A one-shot delay 298 is placed in one of these two leads so that one or the other of the pulses coming from the toggle binary 292 is delayed. The delay provided by the one-shot delay 298 is made adjustable so that precise compensation can be provided for the unequal time delays mentioned above. The particular lead into which the delay 292 is inserted is determined by whether a delayed energization or a delayed deenergization is required.

The details of the digital comparator 234 are shown in FIGS. 5A and 5B. The comparator 234 includes the DIMENSION DEFECT switch 202, the present dimension switch 208, and two arrays of thumb wheel switches 210 and 212. It also includes a number of comparison logic gates and an output one-shot 522.

Assume first that the DIMENSION-DEFECT switch is in the DIMENSION position. In this case a selected output from each of the three sets of 10 outputs presented by the sheet length counter 232 is fed through the switch 202 and into an AND gate 520. When the count is such that all three selected outputs are energized, the AND gate 520 energizes the output one-shot 522 and thus causes a clip. The switch 208 determines which outputs are selected. If the switch 208 is in the middle position, as shown, the fifth output in the first set, the 0th output in the second set, and the fifth output in the third set are selected. This causes panels 50.5 inches long to be clipped. Similarly, if the switch is in the first or fifth position, the panels are cut to a length of 32.5 inches and 38.5 inches respectively. If the switch is in the second or fourth position, the length to which panels will be cut is respectively determined by the settings of the arrays of thumb wheel switches 210 and 212.

Assume next that the DIMENSION-DEFECT switch 202 is in the defect position, as shown. The three inputs to the AND gate 520 are now respectively connected to the outputs of three 10-input OR gates 502, 504, and 506. The ten inputs to

each of the OR gates 502, 504, and 506 are connected to the outputs of 30 two-input AND gates. The 10 AND gates 508 have their inputs connected to correspondingly numbered digits in the TENS outputs of the counters 228 and 232, and their outputs connected to the 10 inputs of the OR gate 502. The ten AND gates 510 are similarly connected between the UNITS outputs of the counters 228 and 232, and the ten inputs of the OR gate 504; and the 10 AND gates 512 are similarly connected between the TENTHS outputs of the counters 228 and 232, and the 10 inputs of the OR gate 506. This arrangement functions as a decimal coded, three digit number comparator which energizes the output one-shot if and only if the counters 228 and 232 simultaneously present the same count. When the sheet length counter 232 has counted up to the count presented by the up-down counter 228, the one-shot 522 generates a pulse which initiates a clip.

Referring now to FIGS. 3 and 4, the details of the bunch clipper control subsystem 300 are shown. This subsystem includes an array of pushbuttons (some of which are shown in FIG. 4) which, when depressed, cause the stack conveyor 116 (FIG. 1) to move forward or backward a predetermined distance, and then energize the bunch clip solenoid 120. Numerical signals generated by these pushbuttons are stored in a plurality of buffers 328, 330, and 332. Each buffer comprises an array of bistable circuits. As the stack conveyor 116 advances, the perforated disc 130 rotates and causes a light and photodetector assembly 334 to generate pulses corresponding to the distance which the stack 114 is moved. These pulses are shaped and amplified by a trigger amplifier 336, and are counted in a three section counter comprising decade counters 338, 340, and 342. When the decade counters contain the same number that is presented by the buffers 328, 330, and 332, a digital comparator and one-shot 344 generates a pulse that both stops the conveyor 116 (FIG. 1) and that also actuates the bunch clip solenoid 120 (assuming the AUTO-MANUAL switch 306 is in the AUTO position - if the switch 306 is in the manual position, the conveyor stops, but the veneer bunch is not clipped until the CLIP pushbutton 308 is depressed). Pulses generated by the digital comparator and one-shot 344 and by the CLIP pushbutton 308 actuate a one-shot 346 which energizes the bunch clip solenoid 120 for the proper length of time. The numerical contents of the three buffers 328, 330, and 332 are fed into the second input of the digital comparator and one-shot 344, and the numerical contents of the three counters 338, 340, and 342 are fed into the first input of the comparator and one-shot 344. When the count agrees with the number presented by the buffers, the comparator and one-shot 344 generates a short output pulse that actuates the bunch clip solenoid 120 and clears the elements 328, 330, 332, 348, and 350. The comparator and one-shot 344 is identical to the digital comparator shown in FIG. 5, except that the switch 208, the thumb wheel switches 210 and 212, and the DIMENSION-DEFECT switch 202 are not required. The switches 208, 210, and 212 are simply deleted, and the switch 202 is replaced by direct connections between the three terminals X, Y, and Z and the three inputs to the AND gate 520.

Operation of the conveyor 116 is controlled by forward and reverse motor control relays 349 and 351, which control A.C. solenoids (not shown) that actuate motor clutches (also not shown). A conveyor forward flip-flop 348 generates an output signal which actuates the conveyor forward relay 349 when it is set. Similarly, a conveyor backward flip-flop 350 generates an output signal which actuates the conveyor backward relay 351 when it is set. When either of the flip-flops 348 or 350 is set, a pulse former 352 or 354 associated with that flip-flop generates an output pulse which clears the three decade counters 338, 340, and 342. This prepares the counters to receive pulses from the light and photodetector assembly 334. One of the flip-flops 348 or 350 is set whenever one of the pushbuttons on the front panel of the subsystem 300 is depressed to initiate movement of the conveyor 116 (FIG. 1). After the conveyor movement is completed, the pulse generated by the

digital comparator and one-shot 344 clears the flip-flop 348 or 350 that was set, and simultaneously clears the buffers 328, 330, and 332 to prepare the buffers for reception of the next code number.

The decade counter 338 is used to record 10ths of an inch movement of the stack 114, and it advances one count for each tenth of an inch pulse received from the light and photodetector assembly 334. When this counter 338 counts up to 10, it resets itself and generates a pulse for the units decade counter 340. When the units decade counter 340 counts up to 10, it generates a pulse which advances the tens decade counter 342. Thus, at any given movement in time, the decade counters 338 through 342 contain a three digit number that represents the distance in tenths of an inch which the conveyor 116 has conveyed the stack 114. When the stack 114 has been conveyed the proper distance, the three digit number presented by the counters 338-342 matches the three digit number presented by the buffers 328-332, and the comparator and one-shot 344 generates an output pulse which stops the conveyor 116 and energizes the bunch clip solenoid 120.

Representative pushbuttons from among the many pushbuttons found on the front panel of the subsystem 300 as shown in FIG. 1 are shown in FIG. 4. When any one of these pushbuttons is depressed, it connects one of the lines entering each of the buffers 328, 330, and 332 to a source of positive potential 401. This causes a three digit number to be read into the buffers 328, 330, and 332. The three digit number represents the distance which the stack 114 is to be moved before the next clip. The first digit represents tenths of an inch, the second digit represents inches, and the third digit represents tens of inches. The first digit is placed into the buffer 332, the second into the buffer 330, and the third into the buffer 328.

The pushbuttons 402 and 404 are typical of pushbuttons found in rows 310, 312, and 314 on the front panel of the subsystem 300 (as shown in FIG. 1). When depressed, each of these pushbuttons supplies a positive potential to one line in each group of ten lines extending from the buffers 328-332 and simultaneously energizes a set line 406 or 408 which feeds the set inputs of the two flip-flops 348 or 350. The diodes 410 and other similarly placed diodes in FIG. 4 prevent current from flowing in the wrong direction through the leads extending from the pushbuttons and thus prevent false signals from arising. The pushbutton 402, when depressed, supplies a positive potential to the line 406 which sets the conveyor forward flip-flop 348, and causes the conveyor 116 to commence operating in a forward direction. Simultaneously this pushbutton 402 energizes the 1 line entering the tens' buffer 328, the 2 line entering the units' buffer 330, and the 3 line entering the tenths' buffer 332 and thus places the number 12.3 within the buffers 328 through 332. Depression of this pushbutton 402 thus causes the conveyor 116 to advance a stack 114 forward exactly 12.3 inches. If the switch 306 is in the AUTO position, the stack 114 is automatically clipped when it reaches its new position. Similarly, the pushbutton 404 causes the conveyor 116 to advance the stack 114 forward exactly 23.3 inches, and then causes the stack 114 to be clipped. The circuitry for the remaining pushbuttons 310, 312, and 314 is not shown in detail. They are all connected to the buffer inputs in a manner similar to the manner in which the typical pushbuttons 402 and 404 are connected to the buffer inputs.

Pushbuttons 412 and 414 correspond to the two buttons in the arrays 316 and 318 (FIG. 1) adjacent the "4" inch marking. Depression of the pushbutton 412 causes the conveyor 116 to advance the stack 114 in the forward direction four inches, while depression of the pushbutton 414 causes the conveyor 116 to advance the stack 114 in the reverse direction 4 inches. The two pushbuttons 412 and 414 function in a manner that is almost identical to the manner in which the two pushbuttons 402 and 404 function. The pushbutton 414, however, connects to the line 408, rather than to the line 406, and thus sets the conveyor backward flip-flop 350 when it is depressed rather than the conveyor forward flip-flop 348. A

single diode array 418 is used for both of the pushbuttons 412 and 414. The two diodes 416 are connected between the diode array 418 and the two pushbuttons 412 and 414 to prevent reverse currents from flowing between the two pushbuttons. Since the pushbuttons 412 and 414 are typical of pushbuttons in the arrays 316 and 318, the circuitry for the remaining pushbuttons in the arrays 316 and 318 is not shown.

Depression of the pushbutton 320 causes the conveyor 116 to advance a stack 114 in the forward direction by a distance which is determined by the setting of the three thumb wheels which comprise the thumb wheel switch 324. Each of the three thumb wheels is set to represent one digit of the distance through which the stack 114 is to be moved. Each section of the thumb wheel switch 324 connects to one of the input lines associated with one of the three buffers 328, 330, or 332. The setting of the thumb wheels determines which line into each buffer is energized when the pushbutton 320 is depressed. Any distance from one-tenth of an inch to 99 9/10 inches can be fed into the buffers 328-332 by properly setting the thumb wheels 324 and by then depressing the pushbutton 320. The pushbutton 322 and the thumb wheel switch 326 are not shown in FIG. 4, but are connected identically to the way in which the pushbutton 320 and the thumb wheel switch 324 are connected.

As noted above, the pushbutton connections shown in FIG. 4 are merely representative of the many possible combinations of pushbutton connections that can be used in the control system 300. The preferred embodiment, as shown in FIG. 1, includes 30 such pushbuttons each of which performs a slightly different task. The flexibility of the subsystem 300 is greatly increased if, rather than having pushbuttons permanently wired as shown in FIG. 4, a plug board arrangement is provided so that the interconnection between any given pushbutton and the lines feeding the buffers 328 through 332 can be easily changed. For example, the cathode ends of the four diodes 410 can be connected to miniature plugs, and a plurality of miniature sockets can be connected to each of the vertical lines shown in FIG. 4. Reprogramming of the pushbuttons would then be a simple matter of pulling the plugs out of their present sockets and inserting them into other sockets.

The three position, center spring return FORWARD-REVERSE switch 304, shown in FIG. 1, is not shown elsewhere. This switch actuates the conveyor backward A.C. solenoid (not shown) when in one position, and the conveyor forward A.C. solenoid (not shown) when in the other position.

The preferred embodiment of the control system 100 is constructed using conventional discreet element transistor logic circuits. Pulse formers in the preferred embodiment are resistor-capacitor pulse forming circuits, and single input bistable flip-flops and toggle binaries all include appropriately biased capacitive input gates. All of these circuits are conventional in design, and are well-known to circuit and computer design engineers. Alternatively, the control system may be constructed using integrated circuit logic elements, in which case master-slave or JK type flip-flops replace the capacitively triggered flip-flops shown in the preferred embodiment, as will be understood by those skilled in the art. Throughout this specification logic diagrams have been used rather than circuit diagrams to emphasize that any circuits capable of performing the required logical tasks are suitable for use in constructing the present invention.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A veneer measuring and clipping control system for controlling the actuation of a veneer clipper, said system comprising:

pulse generating means for generating a pulse each time the veneer is moved a specified distance;

a counter connected to said pulse generating means for counting said pulses, said counter generating a first set of signals representative of the count;

signal generating means for generating a second set of signals representative of a count at which it is desired to

clip the veneer comprising a second counter generating a second set of signals;

manually actuatable set in length switching means for feeding pulses from said pulse generating means into said second counter;

a comparator for comparing said first and second sets of signals and arranged to generate a comparison signal when said sets of signals represent the same count; and clipper control means connected to and actuated by said comparison signal for actuating the veneer clipper.

2. A control system in accordance with claim 1 and further including:

a manual shift switch; and

second pulse generating means including said manual shift switch and connected to the input of said counter for feeding a predetermined number of pulses to said counter each time said manual shift switch is actuated.

3. A control system in accordance with claim 1 and further including:

a manual shift switch; and

gating means for preventing a predetermined number of pulses from passing between said pulse generator and said counter each time said manual shift switch is actuated.

4. A control system in accordance with claim 1 and further including:

a manually actuatable adjust switch; and

a pulse generator actuated by said adjust switch to generate a fixed number of pulses, said pulses being fed into said second counter.

5. A control system in accordance with claim 1 wherein said second counter is an up-down counter, and which further includes:

a triggerable pulse generator capable of generating a fixed number of pulses, said pulses being fed into said second counter; and

manually actuatable adjust switching means for triggering said pulse generator and for simultaneously causing said second counter to count either up or down in response to said pulses.

6. A control system in accordance with claim 1 which also includes a second pulse generating means connected to said second counter for changing the count within said second counter by predetermined amounts between successive clips.

7. A control system in accordance with claim 6 wherein said second pulse generating means generates a predetermined number of pulses in response to each occurrence of said comparison signal.

8. A control system in accordance with claim 6 wherein said second counter is an up-down counter, and which further includes count direction reversing means including a log or reel switch for determining whether the pulses from said second pulse generating means add to or subtract from the count within said second counter.

9. A control system for a veneer sheet defect clipper comprising:

a set in length switch;

first measurement means actuated by said set in length switch for measuring and storing the length of the veneer which passes a fixed location during the time interval the set in length switch is actuated;

second measurement means for measuring and storing the length of veneer which passes a fixed location after each clip, and

a comparator which receives as inputs the lengths stored in said first and second measurement means, and which actuates the veneer sheet clipper whenever the two measurements are the same.

10. A control system in accordance with claim 9 and further including length incrementing means for changing the length stored within said first measurement means by an incremental amount after each actuation of the veneer sheet clipper.

11. A control system in accordance with claim 10 wherein said first and second measurement means include counters ar-

ranged to count pulses, said pulses being supplied by a pulse generator that generates pulses spaced in time so as to represent the distance moved by the veneer sheet.

12. A control system in accordance with claim 11 and further including a second pulse generator arranged to supply a predetermined quantity of pulses to the first measurement means after each actuation of the veneer sheet clipper.

13. A control system in accordance with claim 9 and further including a bistable device connected between said comparator and said veneer sheet clipper which causes the veneer sheet clipper to be actuated only every other time the two measurements are the same.

14. A control system for a veneer sheet clipper of the type that clips once when it is actuated and again when it is deactivated, said system comprising:

means for generating a control signal whenever the clipper is to clip;

a toggle binary device connected to said control signal and arranged to change its state each time said control signal appears, said toggle binary device having two outputs;

a clipper control flip-flop having two inputs and arranged to control the actuation and deactuation of the veneer sheet clipper in accordance with its state;

a connection between one of said two outputs and one of said two inputs; and

an adjustable time delay device connected between the other of said two outputs and the other of said two inputs.

15. A veneer measuring and clipping control system for controlling the actuation of a veneer clipper, said system comprising:

pulse generating means for generating a pulse each time the veneer is moved a specified distance;

a counter connected to said pulse generating means for counting said pulses, said counter generating a first set of signals representative of the count;

signal generating means for generating a second set of signals representative of a count at which it is desired to clip the veneer;

a comparator for comparing said first and second sets of signals and arranged to generate a comparison signal when said sets of signals represent the same count;

clipper control means connected to and actuated by said comparison signal for actuating the veneer clipper;

buffers within said signal generating means for storing said second signals having outputs connected to the comparator, and also having data inputs;

a plurality of switches each corresponding to a desired second set of signals;

interconnections between each of said switches and selected data inputs to said buffers, said interconnections being arranged so that the desired second set of signals is placed within the buffers whenever one of said switches is actuated; and

plug and socket connections within said interconnections which can be easily reconnected in different patterns so that the second set of signals corresponding to each switch can be easily changed.

16. A veneer measuring and clipping control system for controlling the actuation of a veneer clipper, said system comprising:

pulse generating means for generating a pulse each time the veneer is moved a specified distance;

a counter connected to said pulse generating means for counting said pulses, said counter generating a first set of signals representative of the count;

signal generating means for generating a second set of signals representative of a count at which it is desired to clip the veneer;

a comparator for comparing said first and second sets of signals and arranged to generate a comparison signal when said sets of signals represent the same count;

clipper control means connected to and actuated by said comparison signal for actuating the veneer clipper;

buffers within said signal generating means for storing said second signals having outputs connected to the comparator, and also having data inputs;

a plurality of switches each corresponding to a desired second set of signals;

interconnections between each of said switches and selected data inputs to said buffers, said interconnections being arranged so that the desired second set of signals is placed within the buffers whenever one of said switches is actuated;

a controllable conveyor for presenting the veneer to the veneer clipper;

conveyor control means for controlling the operation of said conveyor;

an interconnection between each of said plurality of switches and the conveyor control means for actuating the conveyor control means to start the controllable conveyor whenever one of said switches is actuated; and

an interconnection between said comparison signal and said conveyor control means for actuating the conveyor control means to stop the controllable conveyor whenever said comparison signal occurs.

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