

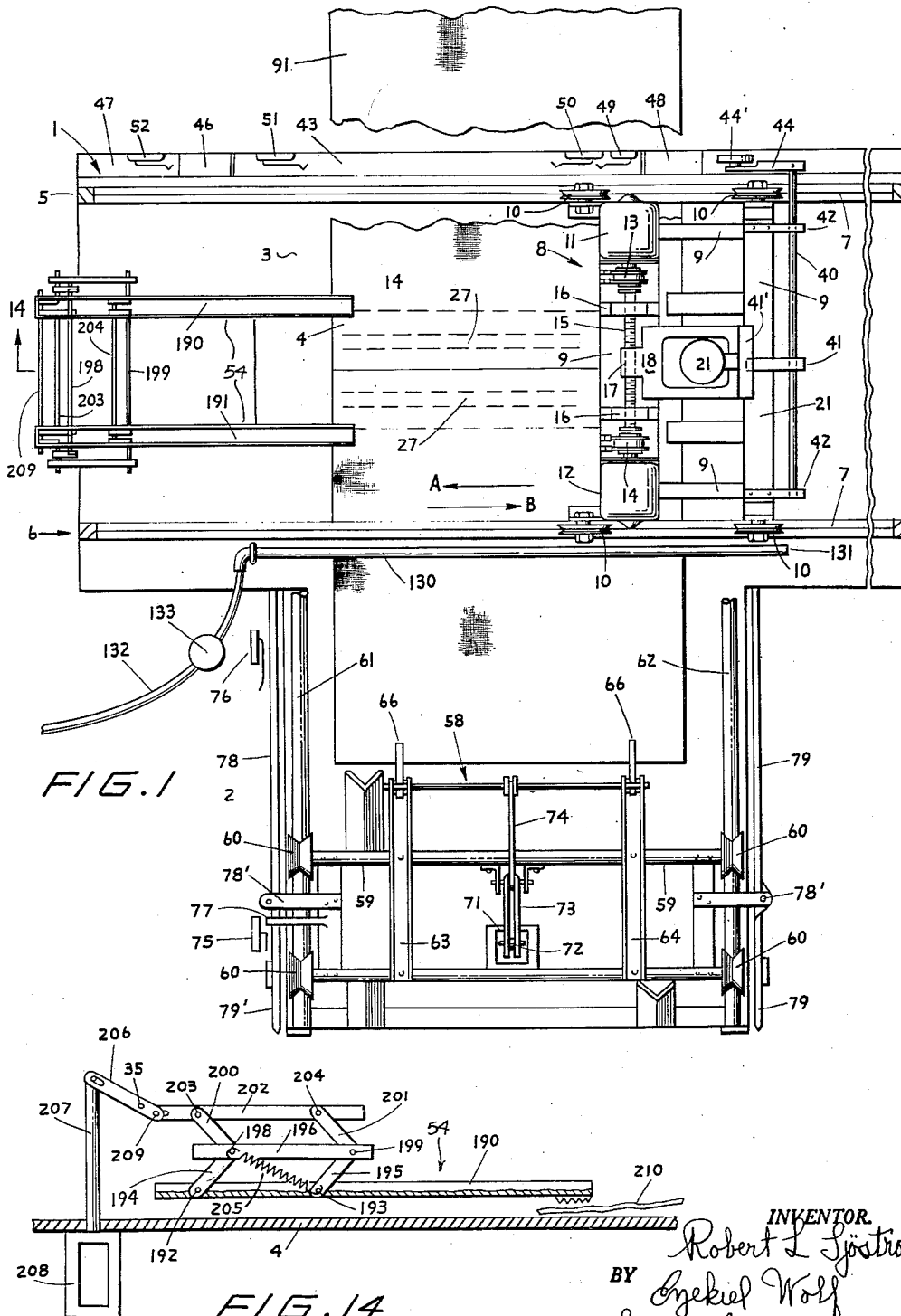
Dec. 27, 1960

R. L. SJÖSTROM
FABRIC CUTTING MACHINE

2,966,086

Filed May 10, 1956

7 Sheets-Sheet 1



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7 Sheets-Sheet 2

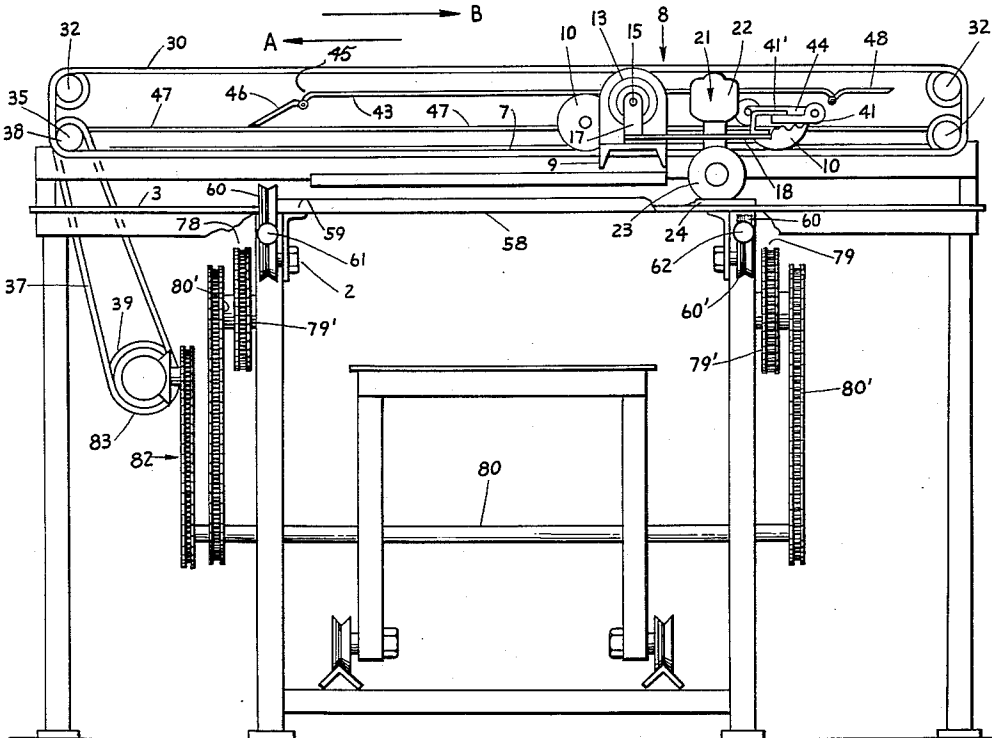


FIG. 2

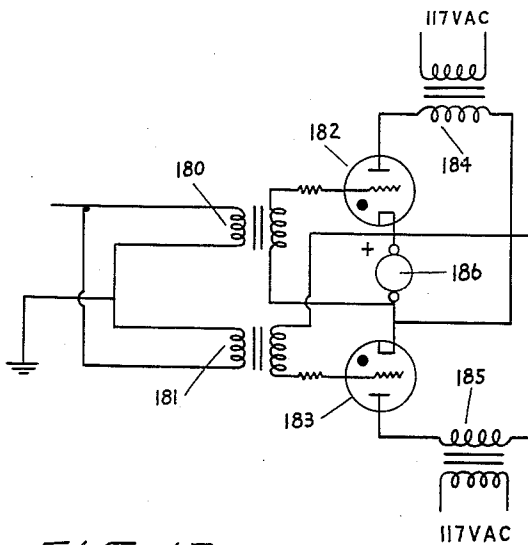


FIG. 13

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7 Sheets-Sheet 3

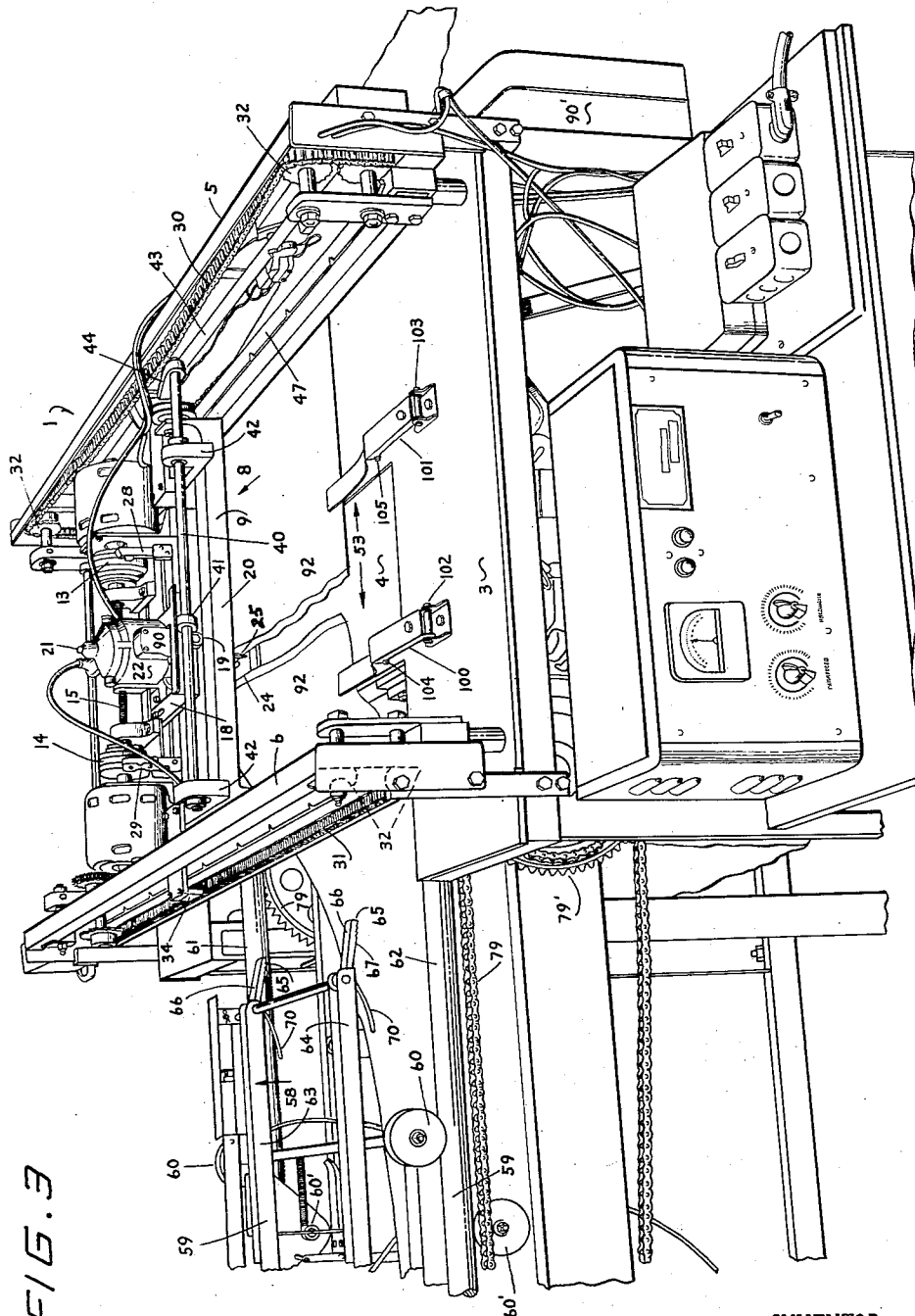


FIG. 3

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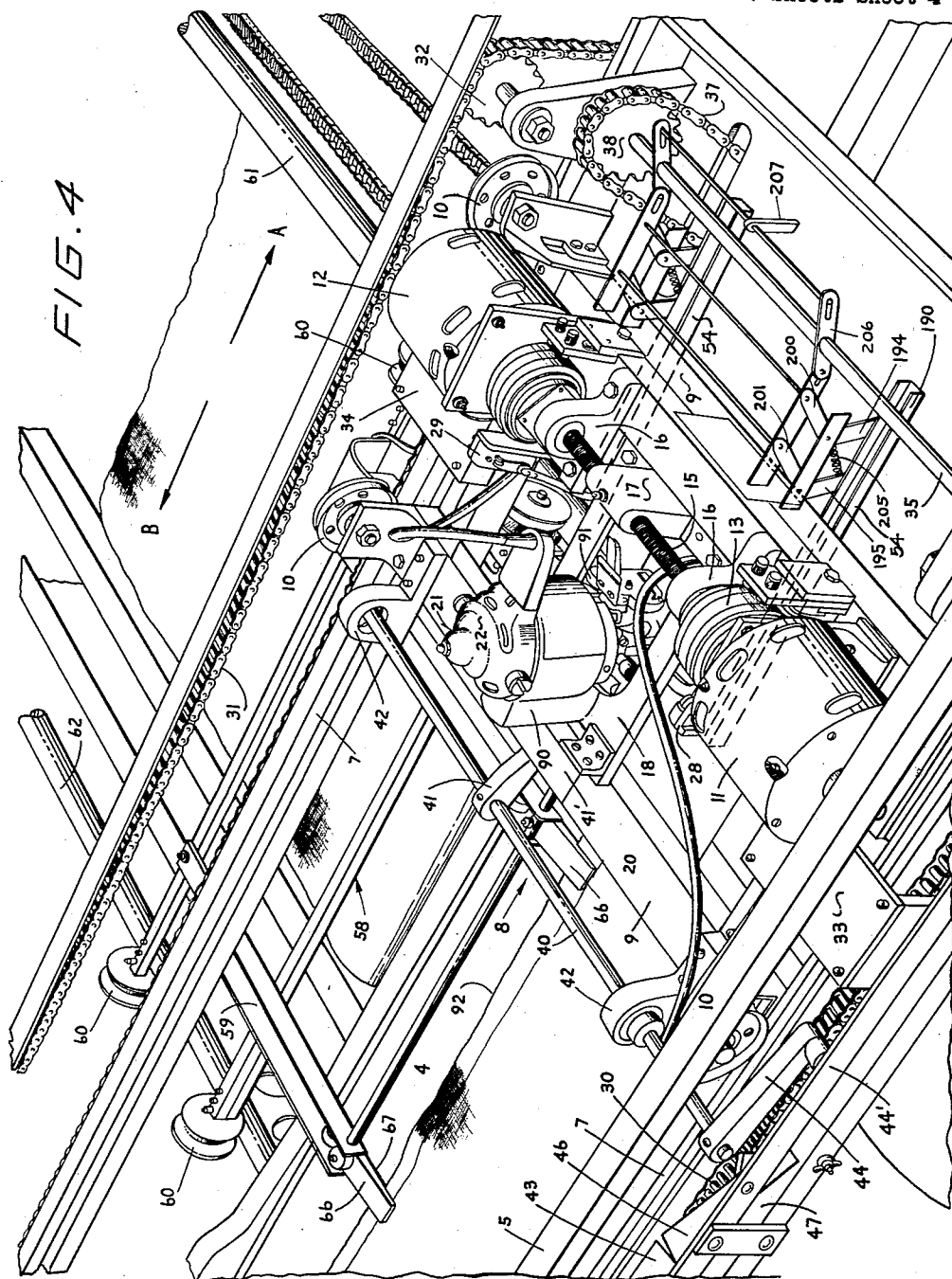
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7 Sheets-Sheet 5

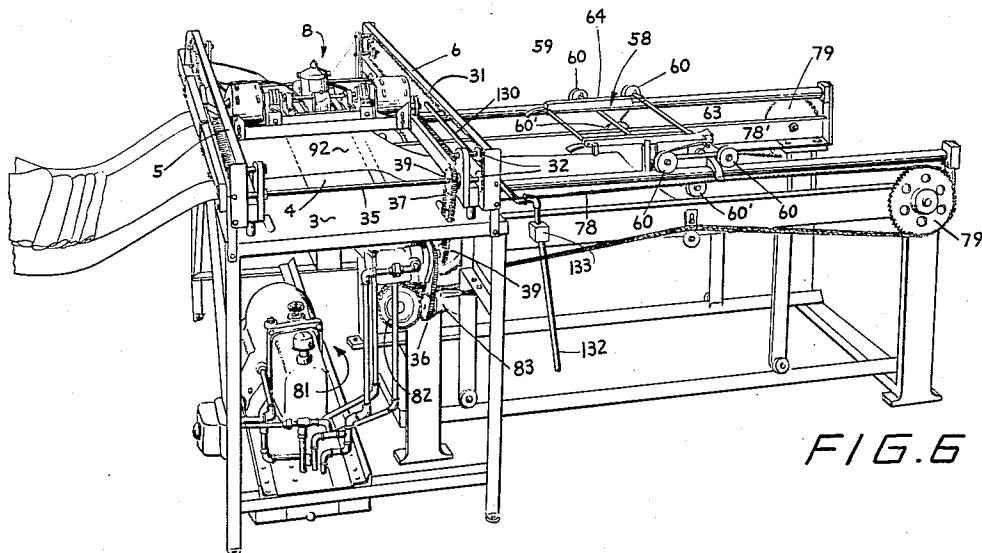


FIG. 6

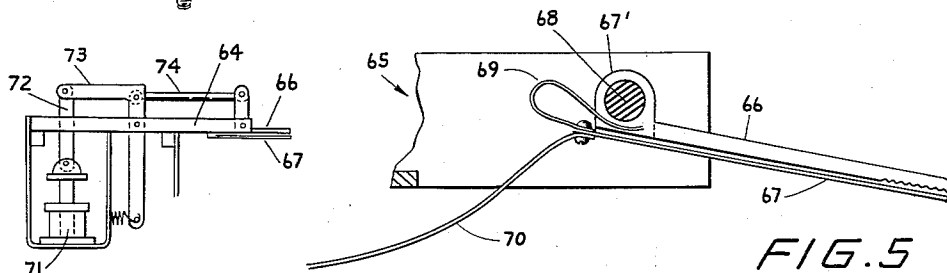


FIG. 7

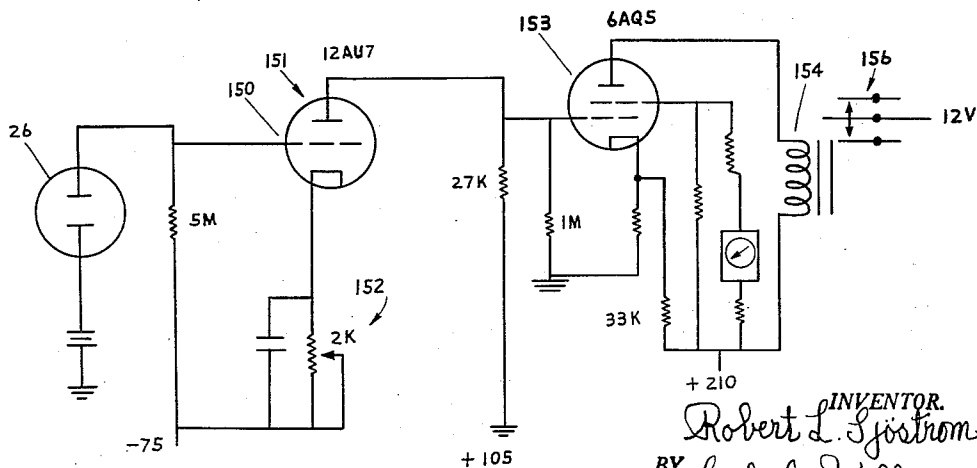


FIG. 8

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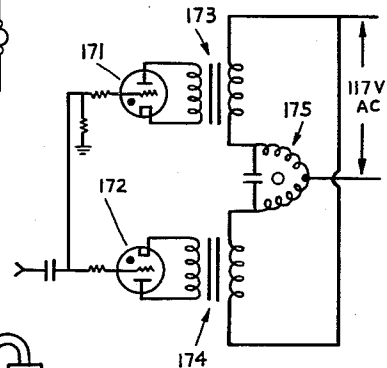
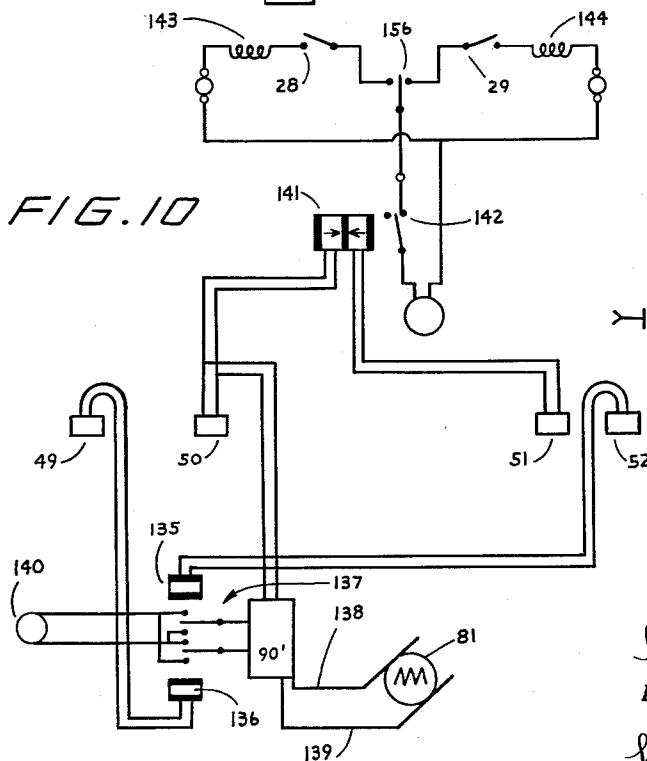
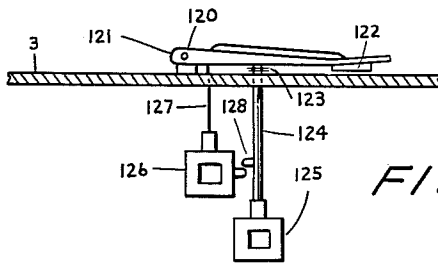
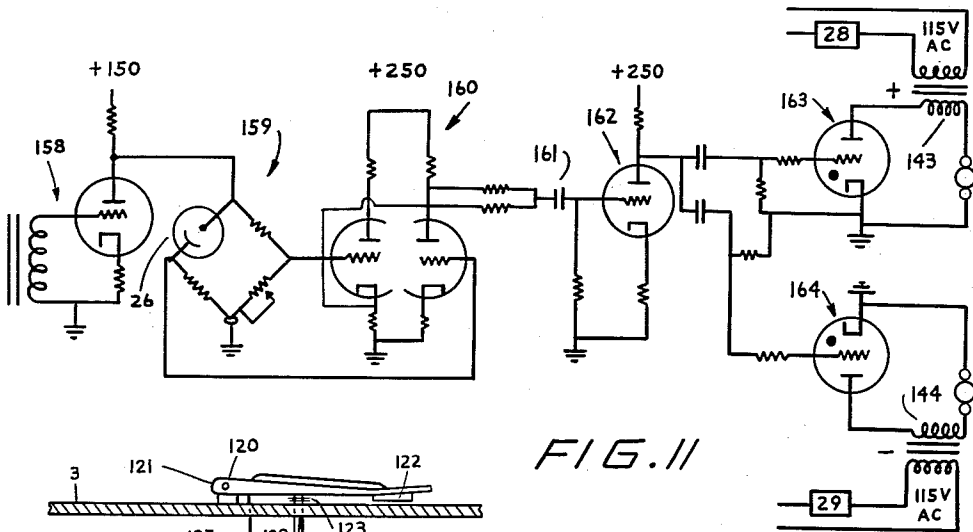
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7 Sheets-Sheet 6



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2,966,086

FABRIC CUTTING MACHINE

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Filed May 10, 1956, Ser. No. 583,993

11 Claims. (Cl. 83—175)

The present invention relates to a device for automatically cutting continuous lengths of material into selected individual pieces along preselected lines. In particular the present invention is related to a machine for cutting individual articles, such as towels, from continuous lengths of material in which the individual articles are defined by transverse bands of different thicknesses than the main portions of towels.

In the past, rolls of towelling were normally unrolled on a table and stretched out in a flattened position. With the material in this position, an operator would then hand-cut an individual towel from the roll by directing a cutting device across the flattened material at the thin transverse band which defines the edge of the towel. In this operation, the operator would pay particular attention to make this cut at exactly the center of the band, so that in the finished towels, uniform margins of thin band sections would appear at each end of each towel. The difficulty with this operation is of course that it requires at least one operator to perform this hand cutting operation, and in several instances may require more than one operator where the towelling material is particularly large.

Until the present, automatic devices for performing this cutting operation have not been feasible for the towel material when unfolded for successive cuttings will not have the successive transverse bands of thin material fall in exactly the same location. Normally these transverse bands of thin material will be slightly bowed or positioned at slightly different spots on the cutting table. Such conditions pose problems which makes prior known transverse cutting devices impractical for automatically cutting the towelling.

The present invention however overcomes these problems and provides a structure in which a cutting element is automatically guided across the towel material along the proper and desired cutting line.

Further, the present invention provides a structure in which individual towels may be severed from the whole length of the towel material along selected lines and then stacked, with means being provided for repeating the cycle automatically to insure a continuous proper cutting of a stack of towels from a continuous length of towel material.

Although reference is made herein to the severing of toweling materials, from a towel roll, the present invention is designed to be used with continuous lengths of any fabric or similar thin materials in which individual pieces are to be successively severed from a substantially continuous length of material along transverse lines, co-incident with contrasting transverse bands on the towel material. Thus any reference herein to the processing of toweling material should be considered to apply equally as well to other types of continuous thin flexible material having successive contrasting transverse bands.

In the present invention, there is in general, provided a structure which will feed a leading edge of a continuous length of towel material over a table surface having

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transparent top section under which is located a light source extending transverse to the length of toweling material. Means are also provided in this structure to stop the movement of the lengths of towel at a point at which the leading thin band of material is positioned over the transversely extending light source. At this point, toweling material is securely gripped at either side edge, and a cutting blade guided by means which follows one edge of this transverse band severs the leading towel piece from the length of material along a line preferably co-incident with the center line of the transverse band. The sensing or guiding means are formed preferably of a photoelectric circuit in which a photoelectric cell is carried transverse to the length of material by a carriage element. This photoelectric cell continually aligns with one band defining edge. Normally these bands are formed of thin dense bands between the towel pieces in the length of material, thus having different light transmitting qualities.

It is to be noted that this invention may be operated with other forms of material, as for example, fabric material in which the bands are formed by contrasting color bands. The photoelectric cell is activated to operate the cutting element to move in either longitudinal direction through the cells' sensitivity to light passing through the thicker and thinner sections of the towel material with different intensities.

These and other objects of the present invention will be more clearly understood when considered in connection with the accompanying drawings, in which:

Figure 1 is a plan schematic view of the invention with certain elements omitted for clarity of understanding.

Figure 2 is a partially schematic view of the invention with portions omitted for clarity of understanding taken from the back end of the invention.

Figure 3 is a perspective fragmentary view of the invention taken from the left side.

Figure 4 is a perspective fragmentary view of a detail showing in particular the cutting carriage.

Figure 5 is an enlarged detail of an element of the invention.

Figure 6 is a perspective view of the invention taken from the right side of the machine with the clamping elements for the side of the towel removed.

Figure 7 is a partially schematic detail of an element shown in Figure 1.

Figure 8 is a circuit diagram of the photo tube circuit.

Figure 9 is a partially schematic detail of a modification of an element of the invention.

Figure 10 is a circuit diagram of the controls for the carriages of the present invention.

Figure 11 is a circuit diagram of a modified circuit for a photo tube control.

Figure 12 is a modified circuit of a portion of the circuit of Figure 11.

Figure 13 is a modified circuit of a portion of Figure 11.

Figure 14 is a somewhat schematic cross sectional detail taken substantially along the line 14—14 of Figure 1.

Figure 15 is a schematic diagram of the modified version of a portion of the circuitry of the present invention, and,

Figure 16 is a schematic diagram of a modified portion of the present invention.

Referring specifically to the figures, there is shown a frame formed preferably in two sections, in which one section generally indicated as 1, is provided to support the cutting carriage and light transmitting source and in which the section generally designated 2, supports the carriage which longitudinally moves the length of fabric.

On frame 1, there is provided a table surface 3, having secured within it and formed as a portion of it, the

transparent glass section 4. Also secured to the frame section 1 and positioned above the level of the table 3, is a pair of opposite and parallel frame and guide elements 5 and 6 respectively. In each of these frame guide elements, there is provided a transversely extending rail 7 adapted to support either side of the cutting carriage 8. This cutting carriage 8 has a supporting frame member 9 in which are secured the wheels 10 which guide this cutting carriage 8 along the rail 7 in a transverse movement. Supported on this frame member 9 by suitable means are a pair of motors 11 and 12. Secured to the armature of these motors 11 and 12, are one-half of the electro-magnetic clutches 13 and 14 respectively. The other half of these clutches are secured to opposite ends of the lead screw 15 which is in turn secured in and rotatably supported by suitable means such as bearings 16 to the frame member 9. Threaded on the lead screw 15 is a collar or yoke 17 which in turn has secured to it a cutter supporting element 18. This cutter supporting element 18 is adapted to move longitudinally with the collar or yoke 18 by the wheel 19, Figure 3. This wheel 19 is pivotally secured to the side of the supporting element 18 and rests upon the beams 20 which forms a portion of the frame member 9. This cutter supporting element 18 supports the cutting tool generally designed 21.

This cutting tool 21 comprises an operating motor 22 which may have if desired a locally positioned "ON," "OFF" switch 90. The cutting motor 22 operates the cutting blade 23 which is preferably protected by the apron 24. This apron 24, rests when the cutting blade is in a cutting position, very close to the glass plate 4. If desired the cutting tool may be provided with sharpening implements 91 secured in to the supporting elements 18. Also positioned on the cutting frame and secured to the cutting support element is the photo tube supporting member 25 which contains the photo tube 26 directed to receive light signals from the fluorescent light tubes 27 positioned directly beneath and parallel to the glass plate 4.

The cutter support element 18 although adapted to move longitudinally of the lead screw 15 and in the direction of movement of the towel lengths, is limited in its motion in either direction by the microswitches 28 and 29 which operate to disengage the magnetic clutches 13 and 14 respectively upon overrunning either direction of the lead screw. When said overrunning occurs, the edges of the support element 18 trips the appropriate microswitch and causes it to operate. The cutting carriage 8 is carried back and forth across the length of the towel material, cutting in one direction and returning in the other without cutting through the movement of parallel chain conveyors 30 and 31. These continuous chain conveyors 30 and 31 respectively, are supported parallel to one another in the frame elements 5 and 6 respectively by the gears 32. The cutting carriage 8 is secured to these conveyors for transverse movement by the securing plates 33 and 34, respectively, with one side of each plate being secured to one of these chain conveyors and the other to the frame member 9. These chain conveyors 30 and 31 are operated simultaneously by the driving shaft 35 coaxially with a pair of gears 32, one on each chain. This shaft 35 in turn receives its power from a drive source 36 through the chain drive 37, which interengages the sprocket gear 38 with the motor gear 39. In the cutting movement of the cutting carriage, in the direction of the arrow A, the cutting blade comes down to the surface of the glass plate 4. In the reverse movement the cutting blade is somewhat moved upward from this glass plate 4 so as to permit a length of towel material to be pulled underneath the blade while it is in its transverse return motion indicated by the arrow B. In the return movement of the cutting carriage 8, the blade is raised from the surface of the glass plate 4 by the upward rotation of the tongue 41 which engages the flange 41' of the support-

ing element 18. This tongue 41 is fixed to the shaft 40, which in turn is rotatably mounted in bearings 42. These bearings 42 are in turn secured to the beam 20. One end of this shaft 40 extends over the guide channel 43 and has a finger 44 fixed at right angles to its end and adapted to engage the surface of the channel 43 in the return motion B of the carriage 8. This guide channel 43 has at end 45, a pivotable runner 46, normally tensioned in a downward position against the lower channel 47 by suitable spring members, not shown, but which may comprise a leaf opening. At the other end of this guide channel 43, there is positioned a second pivotable runner 48 which is pivotably secured in a spring tensioned normally horizontal position by means, not shown, but which may comprise a leaf spring member. In the movement of the cutting carriage in the cutting direction A, the finger 44, which may have a rotatable wheel 44' at its end, engages by this wheel 44' the lower channel 47 thereby permitting the cutting blade 23 to assume its lower and cutting position as the carriage 8 and finger 44 move in this direction beyond the runner 46. Movement in the return no-cutting direction B, will cause the finger 44 to be carried upwards by the runner 46 to the upper guide channel 43, and thus cause the cutting blade 23 to assume its upper no-cutting position in the movement of the cutting carriage 8 across the toweling material. In the return movement on reaching the end of its movement in the return direction B, the guide finger 44 moves downwardly over the upwardly tensioned runner 46, until it is beyond runner 46 and resting on the lower channel 47. In this position the cutting carriage 8 is again ready for another cutting cycle. Two sets of microswitches 49, 50 and 51, 52, are provided on the frame guide element 6. These microswitches are adapted to be engaged successively by the securing plate 33. Starting with the motion of the carriage in the cutting direction A, microswitch 49 has no effect as it controls the cutting carriage 8 causing it to move in a cutting direction (the direction in which the carriage is already moving). On continued motion, this securing plate 33 engages microswitch 50. This microswitch has the dual function of energizing the operative circuit for the electromagnetic clutches 13 and 14 and also for energizing a stop and time delay circuit 90'. By energizing the electromagnetic clutches 13 and 14, at this point, they will respond to excitation signals supplied from the photoelectric tube 26, thus moving the cutting blade in a desired direction as determined by the photo tube 26. The stop and time delay mechanism (90') is provided to permit the photoelectric tube 26, sufficient time to locate the cutting blade in its proper initial position prior to the movement of the cutting carriage across the towel material. Ordinarily one or two seconds should be sufficient. In this operation, towel material, which is located beneath the cutting carriage 8, has been positioned with its thin transverse sections 12 of material positioned over the plate 4. The photoelectric tube 26 during the time delay interval hunts back and forth until it locates the edge defining the thicker main portion of the towel material from the thin sections 12 of the towel material. The hunting motion is caused through the control of the electric magnetic clutch circuit (hereafter described), by the photo tube, with the clutches in turn controlling the operation of the motors 11 and 12. When the cutting tube 26 is on the edge, the cutting blade is in turn positioned at a selected fixed distance from the photo-tube so as to begin the initial cut at the center of this transverse thin section, at a selected distance from an edge. In order to provide proper adjustment so that the blade may be moved to the center of these thin sections which may be varied in sizes, the photo-tube is positioned on an adjustable support.

After the selected time delay has elapsed, the carriage 8 is moved across the towel member by the chain conveyors 31 with the cutting blade 23 severing the lead

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piece of towel from the main portion of the toweling length at the thin transverse band. The cutting blade 23 is guided in this action by the photoelectric tube which continuously follows the edge transverse to the length of the toweling.

As the blade approaches the far side of the toweling, the plate 33 engages the microswitch 51. This microswitch deenergizes the electrical circuit through the electromagnetic clutches 13 and 14, thus disengaging the lead screw 15 and causing the blade 23 to be non-responsive to signals of the photoelectric tube. This action has been found necessary because the tube shortly thereafter moves off the toweling material and directly over the plate 4, where it is subject to a much higher intensity of light. This higher light intensity would otherwise cause the cutting blade to move entirely out of line with the selected cutting direction. Since the clutch is deenergized with the blade only approximately 2" from the edge of the toweling material, very little off center cutting, if any, will occur in this short distance. Shortly after passing over the microswitch 51, the securing plate 33 next engages the microswitch 52 in the operating motor circuit, which causes the motor, and therefore the carriage 8 to reverse direction and return. In its return direction the cutting blade 23 is raised level of the plate 4 by the action of the finger 44 as previously described. As the carriage in this return movement reaches the other end of it, it trips microswitch 49 which reverses its direction and returns the carriage in a cutting direction and thereupon starts a new cycle. The towel material is perpendicularly pulled forward by the carriage 58 after the leading section is cut. This carriage operates to engage the leading edge of the length of towel and pull it forward until the subsequent transverse thin strip of material has reached the position over the plate 4. This gripping and pulling action takes place during the return motion of the cutting carriage to an initial cutting position in the direction B. The carriage 58 is formed of a supporting bed 59 having wheels 60 pivotally secured at each corner. These wheels 60 rest on the runners 61 and 62 to permit the carriage to be moved freely and in a longitudinal direction with relation to the direction of movement of the towel material. A second set of wheels 60' below the runners 61 and 62 also secured to the bed 59 serve to secure the carriage in place. Supported on this carriage are a pair of supporting arms 63 and 64 extending rearwardly and parallel with one another. These arms are each provided with similar clamps 65 at their ends. (See Figure 5.) These clamps consist essentially of upper and lower jaw members 66 and 67 respectively. The jaw members of each clamp are pivotally supported by a common transversely extending shaft 68 with the upper jaw members fixed rigidly to the shaft 68 and the lower jaw members freely mounted on them by pivotable bearing elements 67' extending upwardly on either side of the upper jaw 66. To each of the lower jaw members 67, is secured an upper and lower leaf spring 69 and 70 respectively. The lower leaf spring 70 is adapted to engage the upper surface of the table 3 upon movement of the carriage 58. This engagement forces the edge of the lower jaw member downward in a pressed relationship with the table top, insuring the towel member which is to be engaged to be carried above this lower jaw member. The upper leaf spring 69 tensions this lower jaw member so that the rear edge of this jaw member will normally pivot upwardly above the leveling table 3 when the lower spring 70 is not engaged. The purpose of this upper leaf spring is to insure that the leading edge of these jaws 67 will not jamb against the side of the table 3 but rather will always clear it. After the jaw 67 has cleared the table, the spring 70 will cause the jaw to move downwardly against the top as described.

The upper jaws of each of the clamps are simultaneously controlled by a solenoid 71 fixed to the carriage.

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This solenoid 71 (see Figure 7), operating through the lever arm 72 and arm extensions 73 and 74, when actuated, will raise the upper jaw elements to permit the leading edge of toweling material to pass between the jaw elements. This solenoid 71 is electrically controlled in its operation by the switches 75 and 76. Each of these switches are engaged by the elongated arm 77 fixed to the carriage. Switch 75 is actuated during movement from the table 3 or the forward movement of the carriage 58 by this elongated arm 77, to energize the solenoid 71 and thereby open the jaws from their normally closed position. This will release the towel which has previously been secured between the jaw elements. On its rearward movement, or movement toward the table 3, the elongated arm 77 engages the switch 76. This engagement which occurs over a time interval will energize the normally closed clamps 65 to an open position as they pass over the table, so that the leading edge of the towel material may be sandwiched between the upper and lower jaw members of the clamps. As soon as this leading edge is so positioned, the elongated arm 77 will have passed over the switch 76, thus causing it to deenergize the solenoid 71 and thereby permitting the jaw members to close on the leading edge of the towel. The carriage will then on its forward motion carry with it the towel member drawing it forward to a selected position determined by the location of switch 75. The farther switch 75 is positioned from the plate 4, the greater amount of towel material is drawn out. By properly selecting location of the switch 75, the transverse band of thin material may be approximately located in its proper position on the plate 4.

As the toweling material when drawn out by the carriage 58 has the trailing edge of the cut piece about to be cut, resting over the glass plate 4, and a portion of the table 3, it is necessary to insure a prompt removal of this tail end from this surface prior to the movement of the carriage 58 over the glass plate and the table top during the successive cycle. In order to assure that this tail end of the severed piece is promptly removed, an air doffer system is utilized in conjunction with the synchronous operation of the carriages 58 and 8. This air doffer system comprises essentially a perforated tube 130 positioned parallel to the table top 4 and at a position slightly above this top and above the toweling material which is drawn through. It should also be positioned sufficiently high so as not to interfere with the movement of the carriage 58. This tube 130 is provided with perforations directed downwardly towards the point at which the toweling material passes over the edge of the table. This tube 130 is closed at one end 131 and has connected to it a tube 132 providing air pressure of sufficient force to blow the toweling material downwardly off the table. This air pressure is intermittently admitted to the tube 130 through a solenoid operated valve 133. This solenoid operated valve 133 will open only after a cut has been completed on the toweling material and prior to the return of the carriage 58 for the next cutting cycle. The valve 133 and its operating solenoid may be controlled by a microswitch positioned on the frame supporting the carriage 8 and may be actuated by this carriage on its return movement.

When the length of the toweling has been drawn over the plate 4 and is ready for cutting, it is secured in position on either side by two sets of clamp members 53 and 54. Clamp member 53 comprises a pair of parallel jaws 100 and 101 pivotally secured to the table 3 at one end by pivot elements 102 and 103. Each jaw is operatively connected to a solenoid (not shown) below the table at positions 104 and 105. These jaws are normally tensioned in an "up" or open position and are closed through energizing the solenoid just prior to the cutting operation. The clamping member 54 is designed not only to hold the towel material down against the table 3, but also to draw it outwardly of the table in

order to stretch it and straighten to some extent the transverse bend of material through which the cut is to be made. By this means the amount of hunting required of the photo tube 26 is reduced substantially.

The clamp element 54 comprises a pair of opposite jaw members 190 and 191. These jaw elements are interconnected by a pair of shafts 192 and 193. Pivotally extending from the shafts at each end are pairs of lever arms 194 and 195. These lever arms are pivoted at their other end by cross member 196 which is also pivotally supported on cross members 198 and 199. Pivotally extending from these cross support members 198, 199 are two additional sets of lever arms 200 and 201 which have pivotally secured at their upper end an additional cross member 202. This cross member 202 is also positioned on cross support shafts 203 and 204. A pair of springs 205 interconnect cross supporting shafts 198 and 193. A lever arm 206 pivoted on the shaft 35, interconnects the shaft 207 of the push solenoid 208 with the end of member 202. These may be linked together at 209 in such a manner that when the solenoid 208 is actuated and moves the shaft 207 upwardly, the jaws 190 and 191 operating through this lever system will move downwardly and outwardly towards the solenoid 208 thus drawing any toweling material positioned below them outwardly and simultaneously force the toweling material downward against the table top 4.

A second modification of this clamp member 54 is illustrated in Figure 9, where there is shown schematically a clamp member having identical and parallel arms 120. These arms 120 are pivotally secured by the pivot elements 121 to the table top 3. Each arm is provided with a contact element 122 longitudinally slidable on the arm 120. The arm 120 is normally tensioned in an "up" position by the spring 123, preferably coaxial with a shaft 124 which interconnects the arm 120 with the solenoid 125. This solenoid 125 when actuated will act against the tension of the spring to close the arm 120 downwardly. The contact member 122 is connected to a solenoid 126 by means of a wire or cord 127. The solenoid 126 is actuated to pull this cord 127 downwardly on the downward movement of the shaft 124. Thus in the operation of this modification, when the solenoid 125 is actuated and thereby closes the arm 120, the pin 128 on this shaft 124, will in its downward movement, close the circuit of the solenoid 126, thus causing a subsequent movement of the contact 122 outwardly of the table. By proper positioning of these elements, the contact 122 will move outwardly as it comes in contact with the table surface or comes close to the table surface 3. Thus a toweling material positioned between the contact 122 and the table surface 3, will be simultaneously secured between these elements and drawn outwardly towards the edge, thus providing the necessary stretch of the transverse band of material.

The carriage 58 for moving the toweling material longitudinally of the carriage 8 are operated in synchronism from a common power source. Thus the carriage 58 is secured by arm members 78' to the chain conveyors 78 and 79. These conveyors 78 and 79 are located on either side of the frame section 2 and are suitably supported by sprocket and idler gears 79'. These chain conveyors 78 and 79 are operated from a common drive shaft 80, through chain couplings 80' which shaft 80 in turn is connected to the motor 81 through a suitable chain and gear coupling 82 and gear box 83. Also operated from this motor 81 is the chain drive 37 for the cutting carriage. By proper selection of gear ratios, these carriages 58 and 8 may be simultaneously and synchronously moved over selected distances. It should also be noted in the structure that the motor 81 may if desired be a hydraulically operated motor so that both carriages will accelerate to maximum speed at a uniform rate, which in turn will of course reduce any unnecessary wear and tear on the unit.

In Figure 10 there is illustrated a schematic diagram of the circuit utilized to control the operation of the motor 81 and the magnetic clutches 13 and 14. In this circuit, microswitches 49 and 52 control respective relays 135 and 136. These relays operate switches 137 which are connected on the lines 138 and 139 respectively. Dependent upon which relay has last been actuated, the switches 137 will connect the lines 138 and 139 to the power source 140 to operate the motor 81 in a selected direction of rotation. Thus the lines are arranged to cause the motor 81 to operate the cutting carriage in the direction A when microswitch 49 is actuated and in the direction B when microswitch 52 is actuated. Microswitches 50 and 51 are connected to a relay such as the differential relay 141 which operates to open and close switch 142 dependent upon which of the microswitches 50 and 51 has been actuated. If microswitch 51 has been operated, the switch 142 is opened and the coils 143 and 144 of the magnetic clutches 13 and 14 are deenergized. If microswitch 50 is actuated, the switch 142 is closed and power is supplied to the coils for the purposes previously described. Microswitch 50 is also connected to and operates delay mechanism 90'. Power to these microswitches may be supplied by conventional means as is the case in other circuits when it is not specifically shown.

In Figure 8 there is illustrated a circuit for operation of the photo-tube. In this circuit photo-tube 26, is maintained at a suitable bias and has its plate suitably connected to a grid 150 of an amplifier tube 151. This amplifier tube is maintained at a proper bias determined by the light intensity on the phototube 26 by the bias control 152 in the cathode circuit of this amplifier. The output of this amplifier is connected to the grid input of the tube 153. This tube 153 further amplifies and also maintains this input signal at a selected bias. The tube 153 acts as an analyzer and thereby feeds a signal to the coils 154 which will operate to close the switch 156 of the clutch circuit in either direction, dependent upon the magnitude of current passing through the coil 154. This switch 156 may be connected into the circuit of Figure 10 as indicated. In Figure 8 there is shown typical values for the various resistors and bias voltages which may be used in this circuit as well as tube types.

Figure 11 shows a further modification of the electrical circuit by which the phototube 26 operates the cutting implement. In this circuit an exciter section 158 provides an input D.C. bias to the bridge circuit 159. This bridge circuit 159 has the photo-cell 26 formed as one leg of the bridge, with a balancing resistor in the opposite leg. The output of this bridge circuit 159 is fed into a comparator circuit 160. This comparator circuit 160 separately amplifies the signals of different polarity received from the bridge circuit 159 and feeds these amplified signals through a blocking condenser 161 into the amplifier section 162. The signal when amplified is then fed from this amplifier section 162 into one of either of the thyatron tubes 163 or 164, depending upon the polarity of the error signal. These thyatron tubes are connected into the circuit for operating the clutches and have connected to them in electrical series the transformer coils 143 and 144 respectively. Depending upon the particular tube fired, current will pass in the circuit of either coil 143 or coil 144 thus causing one or the other clutch to engage and operate the lead screw in the selected direction. This modification is of particular advantage as the instantaneous action of the thyatron tubes aid substantially in cutting down the over-running of the lead screw.

In this circuit when a proper balance is obtained and the photo-cell is on the line which determines the thicker from the thin section, a proper balance is obtained and no signal is derived from the bridge. However, as soon as the phototube moves to one side or the other, an unbalanced signal is created in this bridge which is ampli-

fied on one or the other half of the comparator and then fed through a second stage amplifier into the thyatron section as described.

It should be noted that the thyatrons are arranged in phase opposition for proper operation of this circuit. Various resistors and condensers not specifically explained are conventional for balance, blocking and similar purposes. In Figure 12 there is shown a modification of the circuit of Figure 11, in which the output error signal derived from the plate of tube 162 is fed into the grid inputs of the thyatrons 171 and 172. These thyatrons which are in phase opposition with one another, conduct on signals of opposite polarity derived from the error signal source. If thyatron 171 is conducting it will cause a current to flow in the coils of transformer 173 and if thyatron 172 is conducting it will cause current to flow in the coils of the transformer 174. The secondary of these transformers 173 and 174 are connected in series with the opposite phases of the two phase motor 175. Thus, depending upon the tube which is conducting, either phase of the motor 175 will cause it to rotate in a direction opposite to the direction of operation by the other phase. In this modification the motor 175 is substituted for the pair of motors 11 and 12. Further this modification permits the elimination of the clutch mechanism previously described and allows a direct motor control and operation of the lead screw. This structure is of substantial benefit in avoiding the problems of overrunning caused by the characteristics of the clutches. In this modification almost instantaneous response is obtained thus minimizing the amount of hunting and overriding of the lead screw.

A further modification of the invention is illustrated in Figure 13, which illustrates a modification of the thyatron circuit illustrated in Figure 11 from the output of the amplifier tube 162. In this modification the error is fed through transformers 180 or 181. Current in transformer 181 is fed into the thyatron 183. These thyatrons which are analyzed in phase opposition operate to pass current through the transformers 185 and 184 respectively. These transformers supply power to the D.C. motor 186 in opposite polarity causing it to operate in opposite directions depending upon the transformer through which the current is being passed. When a signal is obtained in either one of the thyatrons, the motor begins to operate in a select direction. As the motor is electrically connected to the cathode of the tube, it acts to raise the bias of this cathode and thus as the lead screw begins to accelerate to a constant speed, the bias on the cathode increases. After it reaches a constant speed, the input signal decreases and the bias will remain approximately the same until the thyatron cuts off. This action occurs in opposite phase in either tube depending upon the direction of rotation. By this action the motor 186 will be deenergized slightly before a zero error thus providing an additional means for avoiding or minimizing hunting and overrunning.

A further modification of the electrical circuit of the present invention is shown in Figure 15. In this circuit the photo tube 300 detects a change in density in the toweling passing under it, and thereby changes the bias on the grid 301 of the tube 302. This change in bias is amplified and inverted and applied through the line 303 to the grid of thyatron 304. An input to the grid of this thyatron causes it to conduct thus engaging the clutch 305. A portion of the signal derived on the plate 306 of the tube 302 is fed back into the grid 307 of the tube 302 through the resistor 310. This is in turn amplified and inverted and fed into thyatron 309. Depending upon the balance 310 and the bias level of the thyatrons 304 and 309, either clutch 305 or 311 may be engaged.

Because of the characteristics of the clutches involved including the inertia, time lag and inductance characteristics, the clutches are placed in the plate circuits of the thyatrons. The circuit indicated at 315 in Figure 15

provides a 90° lagging A.C. bias to the thyatron grid, thus allowing a measure of proportional control of the clutches. This in turn results in a smoother operation and greater accuracy of the electrical circuit.

This circuit is connected at points C and D, indicated in both portions of Figure 15.

In Figure 16 there is shown a schematic modification of a portion of the invention. In this schematic modification, provision is made for the occasional section of toweling in which the thin section 330 of the toweling 331 is much wider than the usual thin section. This generally occurs approximately every fiftieth towel when the continuous lengths are stitched together. In this modification an additional photo tube 332 is mounted on the carriage 8, upon which is also mounted the cutting blade 23. This photo tube 332 detects the light differential through the toweling 331 with the light being derived from the fluorescent tube 333. The signal thus derived is fed into a suitable amplifier of the type previously described 334 where a signal is derived capable of operating the solenoid 335. This solenoid 335 controls the opening of the jaws of the clamps 65. Thus in the operation of this circuit, as the toweling 331 is drawn forward by the jaws 65, the phototube 332, will detect the leading edge of the thin portion. When this occurs a signal will be derived which will cause the solenoid 335 to open the jaws of the clamps 65, thus stopping the toweling with the edge of the thin section positioned below the phototube 332. The cutting blade 23 may then cut the section in a manner as previously described. If the blade 23 is close to the phototube 332, and just behind it, this cut will leave the larger thin section of the toweling 331 on the section of toweling due to be cut on the next cycle. This section of toweling may subsequently be removed by hand operation when the towels are hemmed. This modification however, provides means for maintaining a continuity of operation despite the intermittent occurrence of the wider sections of thin material 330, or variation of length of toweling between the thin sections.

Other types of photo-tubes than those mentioned previously may also be used and adapted for the present invention. Thus, photo-tubes which detect light reflection may be used provided sufficient light contrast may be detected upon the material being processed. Thus in certain applications the phosphorescent tubes beneath the glass plate may be eliminated.

It is further noted that the present invention may be used to process materials other than fabrics.

I claim:

1. A machine for severing individual pieces from a continuous length of fabric at successive transverse defining lines on said length, having means for advancing said length of fabric, cutting means for severing said pieces at said line, and photoelectric means for guiding said cutting means including a photo tube and light source photoelectrically responsive to light differentials on either side of said line, and carriage means for conveying said photoelectric and cutting means across said fabric whereby said photoelectric means may track and said cutting means may sever said fabric at said line.

2. A machine for severing individual pieces from a continuous length of fabric at successive transverse defining lines on said length, having means for successively advancing said length of fabric, cutting means for successively severing said pieces at said lines, means for transversely moving said cutting means, means in its transverse movement across said length of said fabric, for moving said cutting means transversely of its path of movement and means, including a light differential detecting means for detecting light differences on either side of said line and for controlling said means for moving transversely of its path of movement to follow said line during its movement across said fabric.

3. A machine for severing individual pieces from a continuous length of fabric, having transverse bands of

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different light transmitting qualities, having cutting means for transversely severing said pieces from the length, light differential detecting means for detecting light differences in adjacent bands, means for tracking said detecting means over said fabric at the edge of said bands, with said cutting means in a fixed relationship to said detecting means whereby said fabric may be severed along a line determined by said edge.

4. A machine for severing individual pieces from a continuous length of fabric having transverse bands of different light transmitting qualities, having a plate, means for advancing the edges of successive bands to positions of rest over said plate, tracking means including a carriage adapted to be moved over said plate having secured thereto a light detecting device adapted to detect light variations on either side of the said edges and a cutting device for cutting said fabric on a line determined by said edge, and means for transversely moving said carriage in synchronism with said advancing means.

5. A device as set forth in claim 4, wherein said plate is transparent and a light source is positioned longitudinally of and below said plate whereby said detecting device is activated by light emanating from said source.

6. A device as set forth in claim 4, wherein said means for advancing the edges of successive bands comprises a carriage adapted to move longitudinally of said length with a rearwardly projecting clamp member having lower and upper jaws, means adapted to tension the lower jaws against the plate and the upper jaws open when said carriage moves rearwardly over said plate towards the leading edge of said length and adapted to close said jaws as the carriage moves forwardly.

7. A device as set forth in claim 4, wherein said means for advancing the band edges comprises an advancing carriage having clamp members for gripping the leading edge of said length and operating means for said carriages adapted to cause alternate cutting and advancement of said length of fabric.

8. A device as set forth in claim 4 wherein said length of material may be secured over said plate during the cutting operation comprising finger members at opposite sides of said plate and adapted to be positioned over said length, and means for closing said fingers toward said plate during the time interval said bands are positioned at rest over said plate.

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9. A device as set forth in claim 4, wherein said length of material may be secured over said plate during the cutting operation comprising a pair of clamping members positioned at opposite sides of said plate and adapted to be positioned over said length, means for closing said clamping members toward said plate and applying an outwardly directed tension on said length on the portion over said plate whereby said bands may be held in a flat stretched position during said cutting operation.

10. In a device for severing individual pieces from a continuous length of fabric having transverse bands of different light transmitting qualities, photoelectric means for detecting the edges of said bands for tracking purposes, means mounting the photoelectric means for self guiding tracking along the edges of said bands and means for operatively moving said last mentioned means across the fabric including delay means for delaying the moving until said photoelectric means has detected the desired edge.

11. In a device for severing individual pieces from a continuous length of fabric having transverse bands of different light transmitting qualities, with a severing element guided in successive cycles by photoelectric means detecting the edges of said bands, a delay means for delaying the severing during each cycle until said photoelectric means has detected an edge of said band.

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