Sept. 27, 1949. G. H. HELMER 2,483,138

AUTOMATIC ACCESSORY FOR SEWING MACHINES

Filed April 23, 1947

5 Sheets-Sheet 1

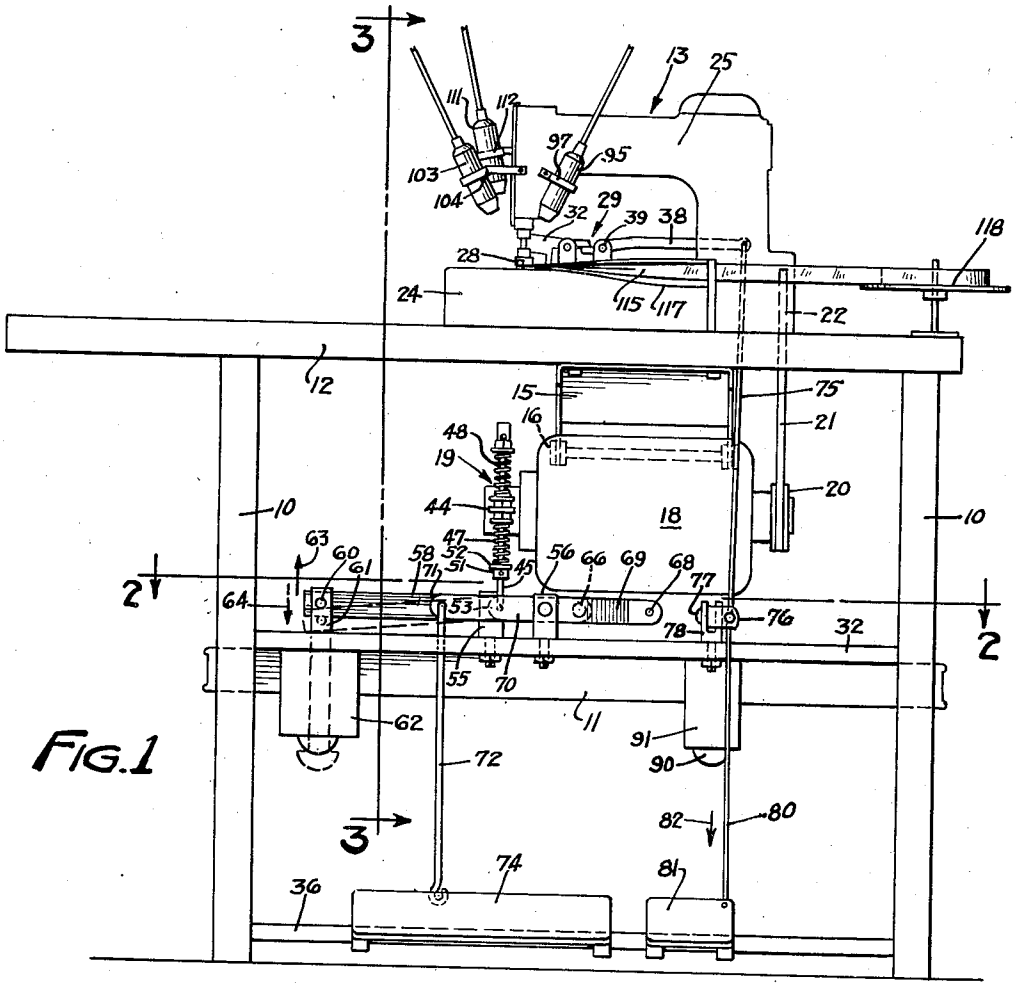


FIG. 1

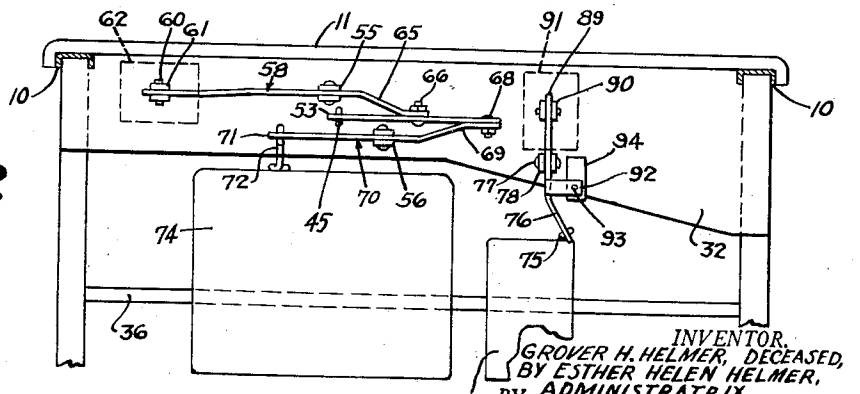


FIG. 2

INVENTOR,
GROVER H. HELMER, DECEASED,
BY ESTHER HELEN HELMER,
BY ADMINISTRATRIX.

Paul, Paul & Moore

ATTORNEYS

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Filed April 23, 1947 5 Sheets-Sheet 2

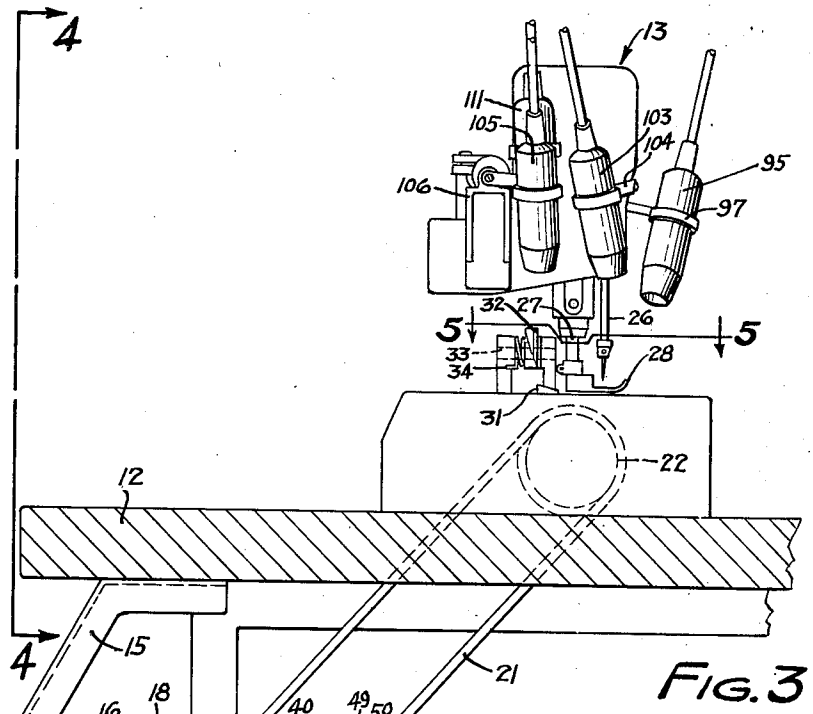


FIG. 3

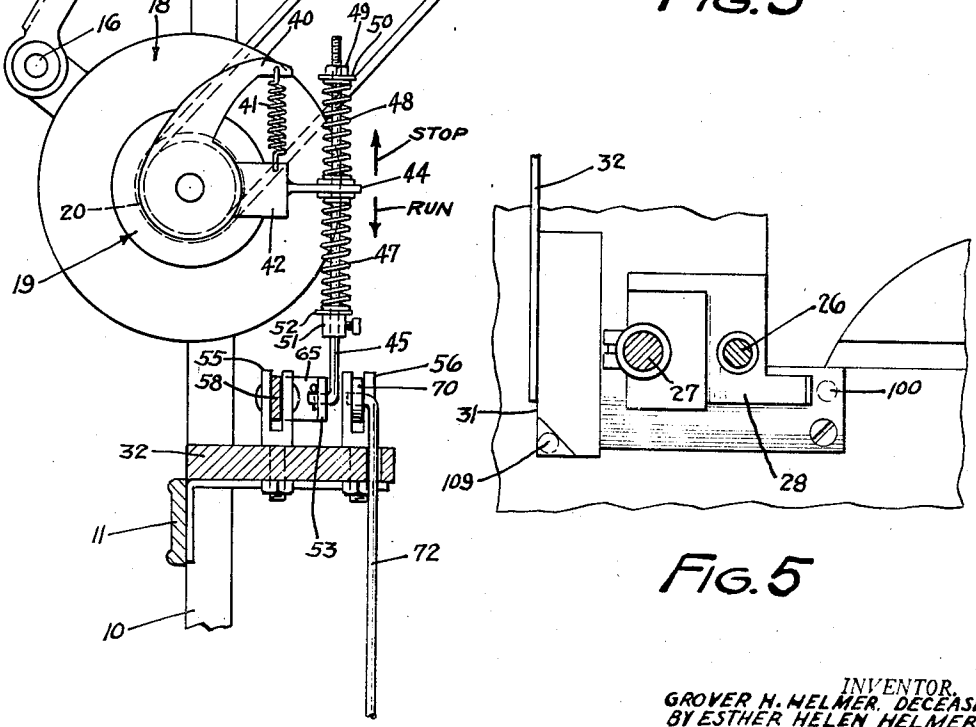


FIG. 5

INVENTOR,
GROVER H. HELMER, DECEASED,
BY ESTHER HELEN HELMER,
BY ADMINISTRATRIX.
Paul, Paul & Moore
ATTORNEYS

Sept. 27, 1949. G. H. HELMER 2,483,138

AUTOMATIC ACCESSORY FOR SEWING MACHINES

Filed April 23, 1947 5 Sheets-Sheet 3

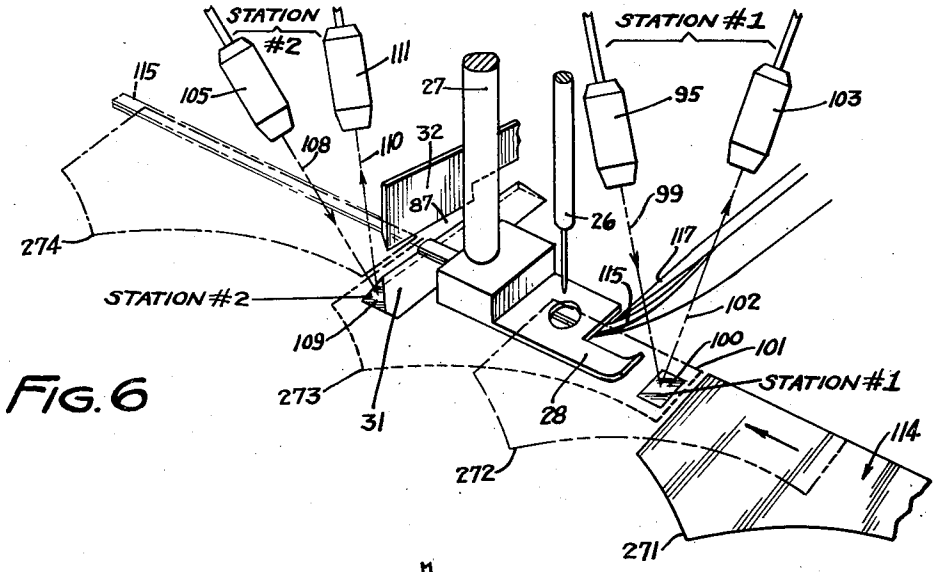


FIG. 6

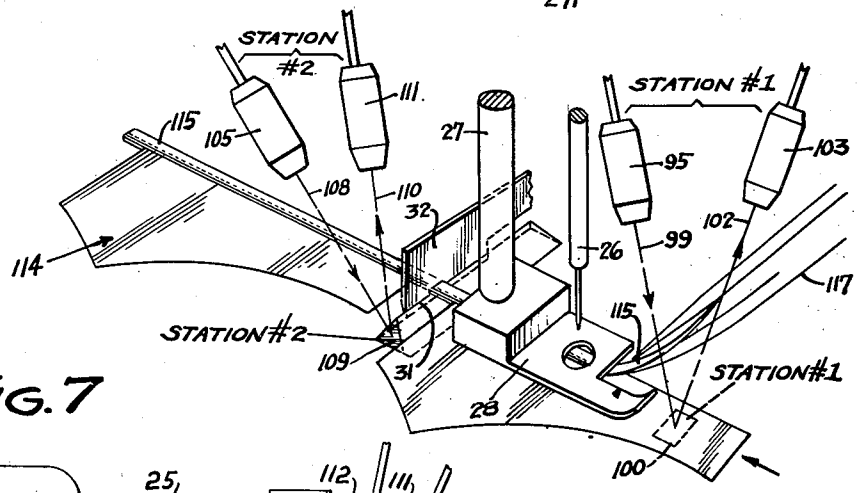


FIG. 7

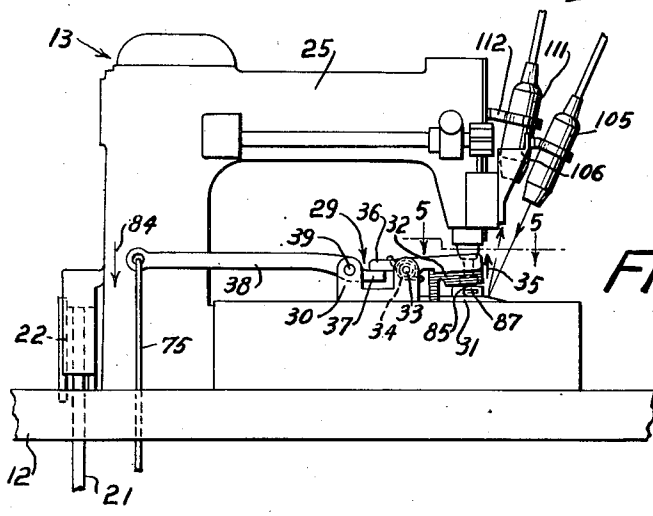


FIG. 4

INVENTOR.
GROVER H. HELMER, DECEASED.
BY ESTHER HELEN HELMER,
ADMINISTRATRIX.
BY
Paul, Paul & Moore
ATTORNEYS

Sept. 27, 1949. G. H. HELMER 2,483,138

AUTOMATIC ACCESSORY FOR SEWING MACHINES

Filed April 23, 1947 5 Sheets-Sheet 4

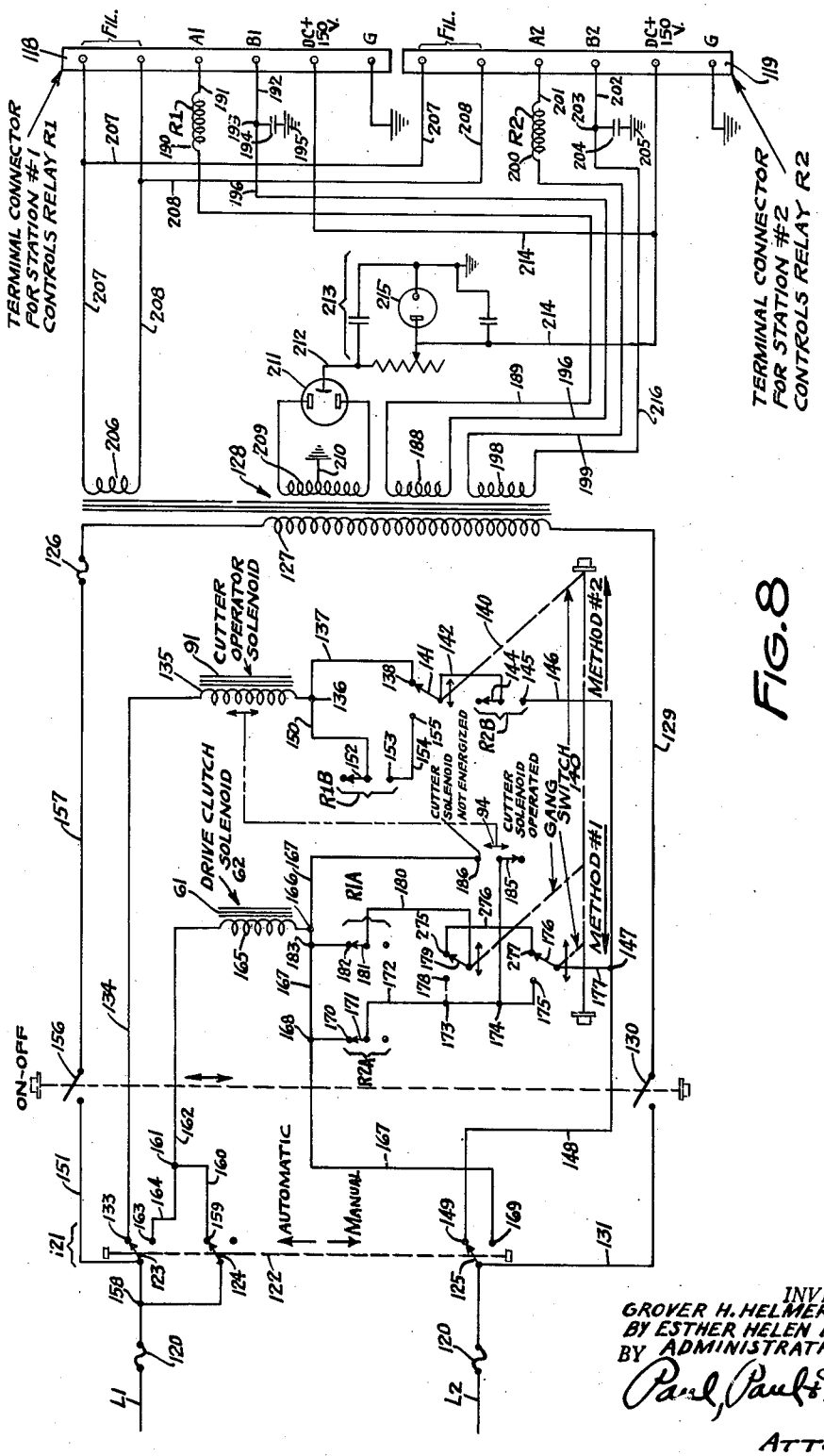


FIG. 8

INVENTOR.
GROVER H. HELMER, DECEASED.
BY ESTHER HELEN HELMER,
BY ADMINISTRATRIX.
Paul, Paul & Moore
ATTORNEYS

Sept. 27, 1949. G. H. HELMER 2,483,138

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Filed April 23, 1947 5 Sheets-Sheet 5

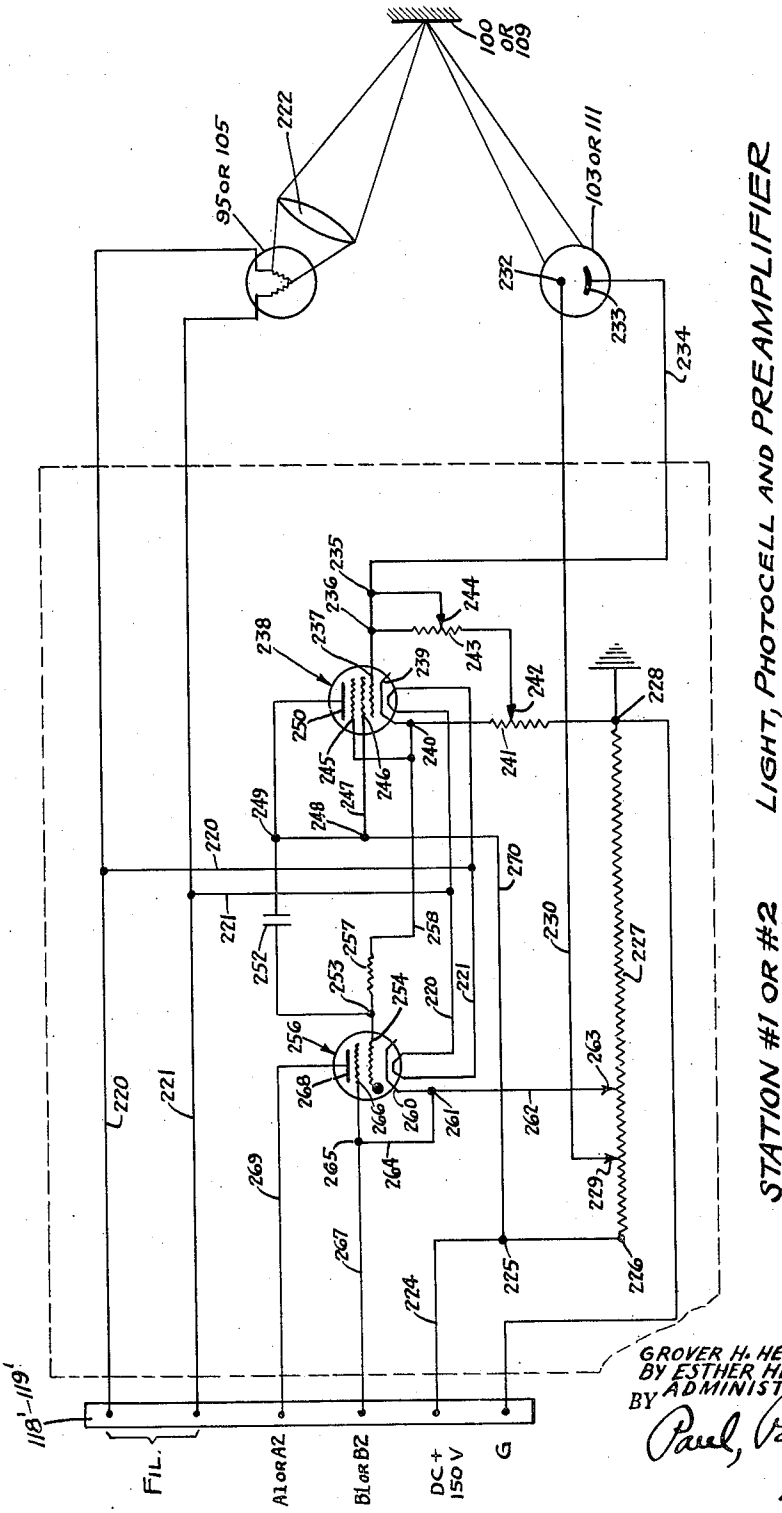


FIG. 9

STATION #1 OR #2 LIGHT, PHOTOCELL AND PREAMPLIFIER

INVENTOR.
GROVER H. HELMER, DECEASED.
BY ESTHER HELEN HELMER.
ADMINISTRATRIX.
BY Paul, Paul & Moore
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,483,138

AUTOMATIC ACCESSORY FOR SEWING MACHINES

Grover H. Helmer, deceased, late of St. Louis Park, Minn., by Esther Helen Helmer, special administratrix, St. Louis Park, Minn., assignor to Munsingwear, Inc., Minneapolis, Minn., a corporation of Delaware

Application April 23, 1947, Serial No. 743,300

12 Claims. (Cl. 112—219)

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This invention relates to improvements in control and auxiliary mechanisms of sewing machines and more particularly to automatic and combined automatic-manual control and auxiliary mechanism for starting the machine, stopping the machine and, optionally, severing or notching at least a portion of the material, in a plurality of modes of operation.

Heretofore, in garment stitching operations it has been customary to provide manual (or pedal) controls for starting and stopping the sewing machine. Thus, in routine stitching operations, it is not only necessary for the operator to insert the material but then to start the machine at the leading edge of the material, guide the same during stitching, and then to stop the machine at the trailing edge. Close coordination and considerable manual dexterity has been a prerequisite for operators doing these routine tasks.

It is an object of the invention to provide improved controls for initiating starting when the material is inserted to be sewn and for providing a controlled stop as soon as the trailing garment edge has passed beyond the stitching position in the machine.

In other routine operations, as in applying bindings, headings, decorations, strips or the like, or where certain seam operations are carried out, it is desirable to cut the binding or trim or to cut or notch the garment edge just as the trailing edge of the garment or garment piece passes beyond the stitching position. To accomplish this it has previously been the practice to provide a cutter in the form of a stationary and cooperating movable shear blade situated immediately behind the position of the needle bar or presser foot and to provide a manual or pedal actuator by means of which the operator may accomplish the severance or notching as the trailing garment edge has been stitched. The timing of this operation has been entirely under operator control and consequently this added, necessarily precisely timed operation has imposed still another burden on the already burdened operator, with the result that irregular work and excessive waste (which has had to be removed in subsequent operations) has more frequently been the result than otherwise.

It is another object of the invention to provide an improved control for sewing machines and auxiliaries capable of not only precise stopping and starting in response to movement of the material during the sewing operation, but also capable of accurately carrying out cutting or notching operations and capable too of severing or

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cutting or notching of individual pieces of material or the pieces in a series while sewing is carried out.

In addition to the foregoing, it is also an object to provide a combined automatic and superimposed operator control so that the operator may instantly superimpose operator control upon the automatic operations.

Additional objects include the provision of improved control, photo-electric and combined electrical and mechanical mechanism.

Other and further objects of the invention are those inherent in the apparatus herein illustrated, described and claimed.

The invention is illustrated with reference to the drawings in which

Figure 1 is a front elevational view of a sewing machine in which the invention is incorporated;

Figure 2 is a partial sectional view taken in the direction of arrows 2—2 of Figure 1, illustrating certain of the controls;

Figure 3 is a fragmentary side sectional view taken in the direction of arrows 3—3 of Figure 1;

Figure 4 is a partial rear elevational view taken in the direction of arrows 4—4 of Figure 3;

Figure 5 is a fragmentary sectional plan view taken in the direction of arrows 5—5 of Figures 3 and 4;

Figures 6 and 7 are a pair of isometric views of the stitching, feeding and cut-off mechanisms and certain of the photo-control devices, illustrating various phases of operation of the invention; and

Figures 8 and 9 are related wiring diagrams of the apparatus.

Throughout the drawings corresponding numerals refer to the same parts.

Referring to the drawings, particularly Figures 1 through 5, the factory type or high-speed sewing machines to which the invention is applicable consist of a usual frame composed of legs 10 which are fastened together by a rear frame 11 and a top work board 12 upon which the sewing machine head mechanism generally designated 13 is mounted. A frame 15 carries a hinge mounting 16 of the drive motor generally designated 18. As usually constructed, the drive motor is of the constantly rotating type and is provided with a built-in clutch-brake mechanism 19 operating through suitable controls, hereinafter described, quickly to start and stop the drive pulley 20 which, through the belt 21, drives the sewing machine operating pulley 22.

The sewing machine head mechanism has the

usual base 24 and arm 25 which carries the vertically oscillating needle bar 26 and presser foot bar 27. The presser foot bar 27 is spring pressed downwardly and resiliently holds the presser foot 28 in contact with the material being sewn. No separate control is provided for raising the presser foot, the reaction of the material entered thereunder being sufficient to raise it for the passage of the material through the sewing operation. If desired, a presser foot lifter mechanism can be used.

The quick-starting, high-speed operation and quick-stopping of the pulley 20 is accomplished by the clutch-brake mechanism generally designated 19. Upon the motor there is fixedly mounted a bracket 40 which serves as an anchor for the spring 41. The lower end of the spring 41 is connected to the clutch-brake operating member 42 which has an outwardly extending apertured extension 44 through which a control rod 45 extends. The control rod 45 is coupled to the member 44 by a pair of initially compressed springs 47 and 48, the spring 48 being adjustably tensioned by the nut 49 which holds the spring through the washer 50. Similarly, spring 47 is held by the adjustably positionable stop collar 51 which holds the washer 52. The lower end of rod 45 hooks into an eye in lever 53.

Referring to Figures 1, 2 and 3 particularly, it will be noted that the mounting board 32, which is a part of the machine frame, is provided with two bifurcated pivot brackets, viz. brackets 55 and 56. Upon the bracket 55 there is pivotally mounted a lever 58 which has its left end, as shown in Figures 1 and 2, pivoted at 60 to the movable core 61 of a solenoid 62, the solenoid 62 being mounted underneath the board 32. When the solenoid 62 is energized the lever 58 is moved up in the direction of arrow 63 to the position shown in Figure 1, and when de-energized the lever 58 falls in the direction of arrow 64, thus allowing the core of the solenoid to drop to the dotted line position. The end 65 of the lever 58 carries a pivot bolt 66 which serves as a floating or movable pivot for the lever 53 to the left end of which, as shown in Figure 2, the clutch-brake operating rod 45 of the motor drive is attached. The right end of lever 53, as shown in Figure 2, is pivotally connected at 68 to the right end 69 of a lever 70 which is pivoted at its mid-portion to the bifurcated mounting bracket 56. The left end 71 of the lever 70 is connected by means of the link 72 to the clutch-brake pedal control 74 which is also pivoted for pedal operation on frame rod 36.

The operation of these linkages is as follows: Since lever 53 is pivotally mounted at 66 and 68 upon the levers 58 and 70, respectively, it follows that the left end of lever 53 is under the joint control of the levers 58 and 70. When the solenoid 62 is de-energized, there is no appreciable retaining force on the core 61, and hence the left end of the lever 58 is free to move up and down, and due to its weight and to the reactions hereinafter explained, it moves downwardly in the direction of arrow 64 to the dotted line position of core. Under these conditions, if the pedal 74 is depressed to the "Run" position, the machine nevertheless does not start. Depressing pedal 74 pulls rod 72 downwardly and moves the left end 71 of the lever 70 downwardly and raises the right end 69, which accordingly tends to pivot the lever 53 about either the control link 45 or the pivot bolt 66. The resistance of spring 41 (motor control Figure 3) is sufficient that it holds

the clutch-brake operating member 44 at a datum position (brake on; clutch disengaged), as shown in Figure 3. Accordingly, the rod 45 is fairly well held and, therefore, the movement of the pivot 66, Figure 2, upwardly due to pedal movement as explanied merely causes the pivot 66 to move upwardly a proportionately smaller amount and the solenoid 61 depressed a little lower. Therefore, unless solenoid 62 is energized, the depression of operator pedal 74 does not initiate operation of the machine.

When solenoid 62 is energized, the core 61 is pulled upwardly in the direction of arrow 63 to the full line position shown in Figure 1, which then establishes the pivot 60 at a fixed position, and hence, since the bracket 55 is likewise fixed, the pivot 66 therefore also becomes "fixed" so far as this phase of the operation is concerned. If, under these conditions, the pedal 74 is depressed to the "Run" position and the rod 72 drawn down, the upward movement of the right end 69 of the lever 70 causes the corresponding right end of lever 53 likewise to be moved upwardly, and since the pivot 66 is "fixed," the left end of the lever 53 is depressed and the operating rod 45 drawn down until the spring 48 overcomes the resistance of spring 41 and moves the lever mechanism 44—42 downwardly in the direction of the arrow marked "Run." When this occurs, the clutch of drive 19 is engaged and the brake of the drive is released with the result that rotation of the constantly rotating motor is transmitted through the operating clutch to the pulley 20 and the sewing machine is rapidly driven. Likewise, assuming the solenoid 62 to be energized, if the pedal 74 is lifted to the "Stop" position, the rod 45 and intervening linkages move the lever 44 in the direction of the arrow marked "Stop" (Figure 3) and the clutch of drive 19 is disengaged, the brake of the drive mechanism is engaged and the pulley 20 is brought rapidly to a complete stop. If, while the machine is running and while pedal 74 is held down in the "Run" position, the solenoid 62 should be de-energized, the effect of springs 48 and 41, as transmitted through the linkages, immediately causes the left end of lever 58 to move downwardly even though pedal 74 is continued in the depressed or "Run" condition. This allows the pivot 66 on lever 58 to move upwardly and permits the rod 45 to move upwardly to the "Stop" position, thereby causing the drive pulley 20 to stop, regardless of whether the foot pedal 74 is or is not likewise raised. It will thus be apparent that deenergization of the solenoid 62 causes immediate stopping of the machine and that the operator can likewise immediately stop the machine by raising pedal 74. In order that the machine may operate it is necessary that the solenoid 62 be energized and that the pedal 74 be simultaneously depressed to the "Run" position.

When in the sewing operation, it is desirable to cut off or notch a portion of the material at a definite place with reference to the trailing edge or a portion of the trailing edge of the material, there is provided a cut-off mechanism generally designated 29. The cut-off mechanism consists of a bracket 30 which is solidly mounted upon the machine frame. Upon the bracket there is a solidly mounted stationary cutting knife 31 and a pivotally mounted cooperating cutting knife 32. The knife 32 is pivoted at 33 and is provided with a coil spring 34 which normally raises the cutting end of the knife 32 in the direc-

tion of the arrow 35. Opposite the cutting end, the knife 32 is provided with an operating foot 36 under which the end 37 of the operating lever 38 protrudes, the lever 38 being pivoted at 39 to the frame 30 of the cut-off mechanism. The free end of the lever 38 is connected by an operating rod 75 which extends downwardly and is connected to the front end of a lever 76 that is pivotally mounted at 77 on the bracket 78. From this same end of the bracket there is a downwardly extending rod 80 which is coupled to the operator treadle 81, the treadle 81 being pivoted on the frame rod 36 so that when the rear portion of the treadle is depressed so as to pull the rod 80 downwardly in the direction of arrow 82, the motion is transmitted through the links 80 and 75, thus causing the free end of lever 38 of the cut-off mechanism to be likewise drawn down in the direction of arrow 84. This lifts the end 37 of that same lever and lifts the operating foot 36 of the cut-off blade 32, thus causing the cutting edge 85 to be moved downwardly scissors-like against the cooperating cutting knife 31. Accordingly, any material running through the space 87 between the cutting edges is cut. If the edge only of a wide strip of material is running through this space, it is notched or slit. The cooperating cutting knives 31 and 85 may be shaped as desired to cut merely a slit or to form any configuration of notch needed for the particular garment operation.

The operating lever 76 has its rear portion 89 connected to the core 90 of a "cutting solenoid" 91. When the solenoid 91 is energized, the core 90 is pulled upwardly, and this causes the front end of the lever 76 to be pushed down in the same manner as would be accomplished by treadle operation, and the cutting blades are likewise actuated for the cutting operation. The lever 76 is provided with a side arm 92 which is arranged to press downwardly upon the operating stem 93 of a microswitch 94 when the lever 76 is actuated to cutting position. Thus, when the treadle 81 is depressed or when the solenoid 91 is energized, the lever 76 is moved downwardly at its front end to accomplish the cutting operation and the microswitch 94 is simultaneously actuated to open the circuit it controls. When the cutter knife 32 is up (not cutting) switch 94 is closed.

The photo-electric controls for the starting, stopping and cutting operations include a first or station No. 1 light source 95 which is suitably mounted by means of bracket 97 on the head of the machine. The light source 95 projects a light beam 99 downwardly upon the highly polished spot 100 on the sewing machine. If desired, a metal part of the sewing machine may be chromium plated and polished to high brilliance or a mirror may be set in at the spot 100. The spot 100 is in the path of movement of the material being sewn as it moves along the line 101 against the presser foot 28 to the stitching station defined by the needle bar 26. The light of beam 99 is normally reflected by the spot 100 so long as no material is passing through the machine and after reflection follows along the path 102 to the station No. 1 photocell 103. The photocell 103 is likewise suitably mounted by means of bracket 104 on the sewing head.

A second light source 105 at station No. 2 is mounted by means of bracket 106 on the sewing head and projects light in the direction of beam 108 against a highly polished surface 109 closely adjacent the end of the stationary cutting knife 31 and from the reflected surface 109 the light is returned in the direction of beam 110 to the second or station No. 2 photocell 111 which likewise is mounted by means of bracket 112 upon the cutter head. The polished reflective surface 109 may likewise be a chromium plated or silvered mirror or reflecting prism and is in a position such that it is normally covered by the material being sewn as the material leaves the presser foot 28. The reflective surface 109 is positioned so that when the trailing edge of the garment uncovers the reflective surface and light is again transmitted from light source 105 to the photocell 111, actuation of the cutting or notching knife 32 ensues. The knife 32 is down when the station No. 2 photocell is lighted and up when that photocell is dark.

For purposes of illustration herein, a garment 114 is illustrated as having an edging strip or heading 115 in the process of being attached thereto. The heading material 115 is arranged to be fed by means of a guide 117 which feeds the heading material as a flat strip to the material piece 114 immediately in advance of the presser foot 28. The guide 117 extends around to the front and to the right, as shown in Figure 1, to a spool stand 118 upon which the edging or heading strip 115 is carried in spool form. It will be appreciated, of course, that the specifically illustrated operation is only one of a wide number of operations which can be carried out in accordance with the principles of this invention. Thus, decorative material in strip form may be applied at the edge or at any portion of a garment. Also, headings or edgings may be applied or the edge of a garment merely folded over to form a seam edge, all depending upon the particular operation carried out.

Referring to the wiring diagrams, Figures 8 and 9, Figure 8 illustrates the power supply relays and various controls and the method in which they operate the clutch and cutting solenoids to manage the operation of the machine. At the right, as shown in Figure 8, there are provided two terminal blocks 118 and 119 having six terminals each. Terminal block 118 connects to terminal 118' of station No. 1 and terminal block 119 connects to terminal 119' of station No. 2. There is a light source, photocell and preamplifier for each station No. 1 and No. 2, and as these are identical, only one need be described. Figure 9 illustrates the photocells, light sources and pre-amplifiers of each of the stations No. 1 and No. 2. It will be understood that two diagrams, as shown in Figure 9, are required to complete the entire circuit arrangements, one being connected to the terminal block 118 of Figure 8 and the other being connected to the terminal block 119 of Figure 8, one of the diagrams of Figure 9 being for the first light source 95 and the first photocell 103 and the other being for the second light source 105 and the second photocell 111.

Referring to Figures 8 and 9, the circuits are supplied through an ordinary 110-volt or 220-volt alternating current power source L1 and L2 which feed through fuses 120 to a three-pole, double-throw manual switch indicated under the bracket 121 which serves to connect the apparatus for "automatic" or "manual" operation, as hereinafter described. When the common operating lever 122 of switch 121 is pushed, the individual switches 123, 124 and 125 are simultaneously moved downwardly from the "automatic" to the "manual" contacts, and when in

the down position the circuits are energized for purely manual operation.

Line L1 is connected to switch blades 123 and 124, whereas line L2 is connected to switch blade 125. Line L1 also extends at 151 through the amplifier "on-off" switch 156 and thence through line 157 and fuse 126 to the primary winding 127 of transformer generally designated 128 and thence by line 129 and then through the second pole 130 of the "on-off" switch and line 131 to the power supply L2. Whenever the machine is to be used for automatic operation, the amplifier "on-off" switch 124–130 is closed and the transformer 128 and amplifier circuits are energized. From the "automatic" contact 133 of the switch 121, line 134 extends through the coil 135 of the cutter operating solenoid 91 and thence to junction 136 from which the circuit continues through line 137 to contact 138 of three-pole, double-throw gang switch generally designated 140, thence through blade 141 of said switch and line 142 to the blade 144 of relay contacts generally designated R2B (relay R2B contacts). The blade 144 of relay R2B is in the up position when the station No. 2 photocell 110 adjacent the cutter blade is darkened, as when material is passing through the machine; the circuit is continued through contact 145, line 146, junction 147 and thence through line 148 to "automatic" terminal 149 of switch 121 and thence to line L2. Referring back to junction 136 (shown in Figure 8 immediately under cutter operator solenoid), a circuit also extends over line 150 to the movable contact blade 152 of the relay contact group generally designated R1B (relay 1; B contacts), which is responsive to the lighting of the station No. 1 photocell 103. When the photocell 103 is dark, which occurs when material is passing into the machine to be sewn, the contact blade 152 of relay R1 is likewise in the up position and thus in engagement with the contact 153 from which a circuit extends through line 154 to the contact 155 which cooperates with blade 141 of the gang switch 140.

From junction 158 on line L1 a circuit extends to contact blades 124 of the "automatic-manual" switch 121, and from blade 124 a circuit continues when the switch 121 is in the up or "automatic" position to contact 159 and thence over line 160 to the contact 161 on line 162. A circuit is also established from line L1 to junction 161 when the automatic-manual switch 121 is in the depressed position, in which case the blade 123 of that switch is in contact with the "manual" setting contact 163, which is connected by line 164 to the junction 161. Hence, junction 161 is energized at the potential of line L1 for either "automatic" or "manual" condition and a circuit extends over line 162 to the coil 165 of the drive clutch colenoid 62 which, when energized, lifts its solenoid core 61 upwardly, as previously described. From the coil 165 the circuit extends to junction 166. From junction 166 there are four circuits. Thus, a circuit extends from over line 167, junctions 183 and 158, through continuation of line 167 to the "manual" contact 169 which cooperates with the switch blade 125 of the manual-automatic switch 121.

When the switch 121 is depressed to the "manual" position, the blade 125 is brought into engagement with contact 169 and line L2 potential is thus applied to the drive clutch solenoid coil 165. As previously explained, line L1 potential is also applied through contact 163 and hence in the "manual" position of switch 121 the drive clutch solenoid coil is continuously energized.

From junction 166 a circuit also extends through line 167 to junction 168, thence to contact 170 of the relay contacts generally designated R2A (relay R2; A contacts). When the relay contact 171 of the group R2A is in the up position (which occurs when the station No. 2 photocell 110 is dark, as when material is passing through that station), contact 171 is in engagement with contact 170 and the circuit thence continues over line 172 to junction 173, thence through junction 174 to contact 175 of the gang switch 140. When the gang switch is moved to the left, viz. to the method No. 1 position, the cooperating blade 176 engages contact 175 and the circuit then continues over line 177 to junction 147 from which the circuit continues via line 148 to "automatic" contact 149 of switch 121 and then through blade 125 to line L2.

From junction 173 the circuit extends to the method No. 1 contact 178 which cooperates with the blade 179 of the gang switch 140. From blade 179 the circuit extends through line 180 to the contact blade 181 of the relay contact group R1A (relay R1; A contact) which is in the up position when the first photocell 103 of station No. 1 is in the darkened condition which occurs when material is in the machine to be stitched. The circuit continues from blades 181 to contact 182 and thence to junction 183 on line 167.

From junction 174 on line 172 a circuit extends to the contact blade 185 of microswitch generally designated 94 which is operated by the lever 76 of the cutter solenoid, Figure 2, as previously described. When the cutter operating solenoid is energized, the contact blade 185 is down and no circuit is completed therethrough. When the cutter solenoid is not energized the contact blade 185 is up and completes a circuit through contact 186 to line 167.

In Figure 8 relay R1 has two contacts A and B. Likewise, relay R2 has two contacts A and B. All of these contacts are in their up positions when the photocells which control the energization of these relays are in their darkened condition, as occurs when material interrupts the light supply to the corresponding photocell.

The transformer 128 is provided with a secondary coil 188 which is connected through line 189 to the coil 190 of relay R1, the opposite terminal of which is connected through line 191 to terminal A1 of the connector block 118 for station No. 1. From terminal B1 of the connector block a circuit extends through line 192 to junction 193 (which is connected through condenser 194 to ground 195) and from junction 193 through line 196 to the opposite terminal of the secondary winding 188. The transformer likewise has a secondary winding 198 which connects through the line 199 to one terminal of the relay coil 200 of relay R2 which is connected through line 201 to the contact A2 of the connector block 119 for station No. 2. From contact B2 of the connecting block a circuit extends over line 202 to junction 203 (which is connected through the condenser 204 to ground 205) and from junction 203 the circuit extends over line 216 to the opposite terminal of the secondary winding 198.

The remaining terminals of the connector blocks 118 and 119 are voltage supply terminals. Thus, the filament winding 206 of the transformer is connected through lines 207 and 208 to the filament terminals Fil. of both of the connector blocks 118 and 119 and thus supply fila-

ment voltage to the light sources and all tubes in the pre-amplifiers at stations No. 1 and No. 2. It will be understood, of course, that the filament transformer also supplies the filaments of all tubes in the control apparatus. The transformer secondary winding 209, which is grounded at its mid-point 210, operates through the full wave rectifier tube 211 to supply direct current to line 212 which is smoothed out and regulated through the network 213 and voltage regulator tube 215 so as to supply direct current positive at about 150 volts to line 214 which is connected to the D. C.+ terminal of each of the connector blocks 118 and 119. The ground terminal G of the connector block is the negative line of the direct current supply.

Referring to Figure 9, from the filament terminals of the connector blocks 118' (or 119') lines 220 and 221 extend to the light source 95 (or 105) at stations No. 1 and No. 2. It must be understood that an identical diagram as in Figure 9 is used for each light source photocell and pre-amplifier, stations No. 1 and No. 2. The light from source 95 (or 105) is projected through the lens system 222 onto the reflective surface which is either the surface 100 or surface 109, Figures 6 and 7, and is thence reflected back against the photocell 103 (or 111). The direct current positive terminals of the connector block 118' or 119' is connected through line 224 and junction 225 to the positive terminal 226 of a potentiometer resistor 227 which is grounded at terminal 228 within the apparatus and also to the ground terminal G of the connector block. From midpoint 229, line 230 extends to the anode 232 of the photocell 103 (or 111) and from the cathode 233 of the photocell the line 234 extends through junctions 235 and 236 to the control grid 237 of the pentode amplifier tube generally designated 238. The cathode 239 of the tube is connected through junction 240 and resistor 241 to terminal 228. Grid bias potential is maintained by an adjustable point 242 on the resistor 241 from which a line extends through the resistor 243 to junction 236. The resistor 243 is variable by means of the shunt 244 connected to junction 235. Suppressor grid 245 of the pentode is connected to the cathode. Screen grid 246 which is maintained positive via line 224, junction 225 and line 270, is also connected through line 247 and junctions 248 and 249 to the anode 250. The anode 250 of tube 238 is coupled by condenser 252 to junction 253 on the control grid 254 of second stage amplifier generally designated 256. Negative bias of grid 254 is maintained by a circuit extending from junction 253 through the resistor 257 and line 258 to junction 240 and thence through resistor 241 to negative terminal 228 of the potentiometer. The cathode 260 of tube 256 is connected through junction 261 and line 262 to variable tap 263 on the resistor 227 and from tap 261 a circuit extends by line 264 to junction 265 which is connected to the shield grid 266 and also by line 267 to the terminals B1 (or B2) of the connector block 218' (or 219'). From the anode 268 a circuit extends over line 269 to the terminal A1 (or A2) of the connector block 118' (or 119'). The heater filaments of each of the tubes 238 and 256 are energized through the lines 220 and 221.

Operation

Figure 9 is representative of the light sources, photocells and pre-amplifiers of both stations Nos. 1 and 2, and as they operate in the same manner only one need be explained. The explanation will, therefore, refer to station No. 1 having light source 95 and to cooperating cell 103 which ultimately control relay R1 through circuits established through the connector block 118—118'. In the following explanation it will be assumed that the on-off switch 156, Figure 8, is closed and with the automatic-manual switch 121 in the upper or "automatic" position. The transformer 128 of Figure 8 and all circuits served by it are therefore energized, and filament voltage is accordingly impressed upon the terminals "Fil." of Figures 8 and 9 with the result that the cathodes of the amplifier tubes 238 and 256 and the light sources of both stations Nos. 1 and 2 are energized. The operation of the stations No. 1 and No. 2 light sources and pre-amplifiers is therefore as follows:

A light beam is normally returned against the photocell 103 of station No. 1 when no material is passing through the machine and the photocell signal from photocell 103 is impressed upon the grid of tube 238 and is amplified and the amplified signal impressed upon the control grid 254 of tube 256 causing the latter tube to become conductive or to fire (thyratron tube), thereby in effect establishing a circuit between terminals A1 and B1. A circuit is thus completed from terminal A1 of connector 118 through line 191, coil 190 of relay R1, line 189, transformer secondary 188, line 196 to terminal B1 and is closed through the cathode-anode circuit of tube 256 in the pre-amplifier Figure 9. Relay winding 190 of relay R1 is accordingly energized and moves its R1A contacts 181 and its R1B contact 152 to the down position in Figure 8. It may be noted parenthetically that all of the relay contacts 171, 181, 152 and 144 for both relays are in the down position of Figure 8 when the photocells which actuate them are lighted and are up when the photocells are dark.

Photocell 111 of station No. 2, being similarly illuminated, in effect establishes a circuit between terminals A2 and B2 of connector 119, thus similarly energizing the coil 200 of relay R2. This serves to move the R2A movable contact 171 and the R2B movable contact 144 to the down position in Figure 8.

Method No. 1.—In the following explanation it will be further assumed that the gang switch 140 is moved to the left as shown in Figure 8 to the method No. 1 position, in which position contact 141 engages 155, 176 engages 175 and 179 engages 178. It is also assumed that the operator holds treadle 74 in the down position. In the method No. 1 mode of operation one piece at a time is handled by the machine. The piece is entered into the machine and a tape, decorative strip or heading is stitched on, the machine being automatically started as the leading edge of the piece is entered at station No. 1 and the piece is then run through until the trailing edge of the piece reaches the station No. 2 photocell 111. The machine then automatically stops and the trim, binding or heading 115 is automatically cut off. This mode of operation is accomplished as follows:

With the photocells both illuminated and before the material 114 is entered (position 271, Figure 6), both relays R1 and R2 are energized and their contacts therefore assume the down position of Figure 8. Under these conditions a circuit is established from line L1, contact 123 of switch 121 to contact 133, line 134, coil 135 of the cutter operating solenoid, junction 136, line 150, relay contact 152 which is then down

and in engagement with contact 153, line 154, contact 155, which is then engaged by gang switch contact 141, line 142, relay contact 144 (R2B) which is likewise down and in engagement with contact 145, lines 146 and 148, through contacts 149 and 125 to line L2. The cutter solenoid is hence energized and the knife blade 32 is down. When the cutter solenoid 135 is energized, the microswitch 94 has its contact 185 in the down position (Figure 8) and hence does not establish any circuit through line 167.

The garment 114 of Figure 6 is initially held in the full line position 271 of Figure 6. In this position both photocells are illuminated and the previously described relay positions therefore are maintained. As the garment is entered to position 272 it covers reflecting surface 100 and therefore darkens photocell 103. Consequently, the coil 190 of relay R1 is deenergized and relay contacts 181 (R1A) and 152 (R1B) are moved to their up positions in Figure 8, the relay contacts 171 (R2A) and 144 (R2B) meanwhile being maintained in the previously described down positions. As relay R1 de-energizes and R1A contact 181 closes upon 182, a circuit is established from line L1, junction 158, switch 121, contacts 124—159, line 160, junction 161, line 162, clutch solenoid coil 165, junction 168, junction 183, contacts 182 and 181 (R1A), line 180, contacts 179 and 178 of gang switch 140, through junctions 173 and 174 and contacts 175 and 176 of gang switch 140, line 177, junction 147, line 148, contacts 149 and 125 to line L2. The clutch and brake mechanism 19 is therefore operated and the sewing and material feeding operations ensue. At the same time the opening of R1B contacts 152 and 153 breaks the cutter solenoid circuit previously described, thus permitting the cutting knife 32 to lift as the leading edge of the material 114 and the binding 115 approach station No. 2. The de-energization of the cutting solenoid also operates microswitch 94 causing its contact 185 to close on contact 186, which establishes a shunt circuit from terminal 169 of the clutch solenoid winding 165, through line 187, contacts 185 and 186 of the microswitch, to junction 174. This parallels the previously described circuit through contacts 181 and 182 (R1A), line 180 and contacts 178 and 179 of gang switch 140.

As the material 114 assumes position 273, photocell 111 of station No. 2 is also darkened causing relay R2 to de-energize and move its contacts R2A and R2B to the up positions of Figure 8. Contact R2A establishes another shunt circuit to maintain the clutch solenoid energized, this circuit being from terminal 166 of the clutch solenoid winding 165, through line 167 to junction 168, thence through contacts 170 and 171 (R2A), line 172, etc., as previously described. This has no immediate effect. Relay contacts 144 and 145 (R2B) also open, but this likewise has no immediate effect because the cutter solenoid circuit was previously opened by the opening of contacts 152—153 (R1B) when relay R1 was de-energized.

As the trailing edge of the material passes beyond station No. 1, thus uncovering reflective surface 100, relay R1 is again energized. This causes contacts 181 and 182 (R1A) to open, but since the clutch solenoid circuit is maintained via contacts 170 and 171 (R2A) and also by microswitch contacts 185 and 186, the clutch solenoid remains energized and the sewing operation continues. The closure of relay contacts 152 and 153 (R1B) prepares but does not establish the previously described circuit to the cutting solenoid winding 135 since this circuit is still maintained open at contacts 144 and 145 (R2B).

As the stitching of the material 114 is completed and it reaches position 274 of Figure 6, the trailing edge of the material uncovers the reflective surface 109 of station No. 2, thus causing relay R2 to be re-energized and its contacts R2A and R2B to be moved to their down positions of Figure 8. When this occurs, contacts 170 and 171 (R2A) open to break one of the two remaining previously described parallel circuits which has maintained the clutch solenoid winding 165 energized. The closure of the R2B contacts 144 and 145 of relay R2 establishes a circuit for the cutter solenoid winding 135 as follows: From line L1 switch contacts 123 and 133, line 134, winding 135 of the cutter solenoid, terminal 136, line 150, R1B contacts 152 and 153, line 154, contacts 141 and 155 of gang switch 140, line 142, R2B contacts 144 and 145, line 146, junction 147, line 148, switch contacts 149 and 125 to line L2. The cutter solenoid then operates and cuts the material 114 and/or the binding, heading or decorative strip 115. The energization of the cutter solenoid 135 also causes the opening contacts 185 and 186 of microswitch 94 and the clutch solenoid 165 is therefore de-energized to stop the machine and hold the stop.

The operation is thus completely automatic and can be repeated time after time. The operator may, however, superimpose control on the operation by movement of treadle 74, for upward movement of treadle at any time causes the sewing operation to stop and starting can be delayed as desired until the treadle 74 is depressed.

Method No. 2.—In this type of operation the pieces of material being sewn are fed in one at a time as the work progresses with a little space, preferably one-half inch to three-quarters inch, between the trailing edge of one piece and the leading edge of the preceding piece so as to allow a little opening between them. The binding, heading or trim 115 is, of course, continuous and the material pieces sewed to it thus form a continuity up to station No. 2. In this operation the leading edge of the first piece initiates the sewing operation by covering the reflective spot at station No. 1 and sewing continues (of course, under operator control by treadle 74) as long as subsequent pieces of material continue to cover station No. 1. As each break between the pieces reaches station No. 2, the strip 115 is automatically severed and as the trailing edge of the last piece reaches station No. 2, the operation ceases. This operation is achieved as follows:

The gang switch 140 is moved to the right to the method No. 2 position with the result that contact 179 closes upon contact 275, contact 176 closes upon contact 277 and contact 141 closes upon contact 138. It will be observed that this isolates relay contact R1B (152 and 153), relay contacts R2A (170 and 171) and the mircoswitch contacts 185 and 186, all of which serve no purpose in method No. 2 operation. The automatic-manual switch 121 is, of course, still in the up or "automatic" position and switch 156—130 is closed. It is also assumed that the operator holds treadle 74 down, thus conditioning the clutch control for starting or pushes treadle 74 down after the first piece of material in the series is positioned in place adjacent the tape binding or strip 115 and starts the operation, which is initiated by the joint operation of the operator treadle 74 and the energization of clutch

solenoid 62 (winding 165), the circuit for which is as follows:

Before the first piece of material is moved into position, the photocells at both stations No. 1 and No. 2 are illuminated and relays R1 and R2 are energized, as previously described, causing contacts R1A (contacts 181 and 182) and R2B (contacts 144 and 145) to move to the down position. The cutter solenoid is thus energized through a circuit from line L1, contacts 123 and 133, line 134, winding 135, line 137, gang switch contacts 138 and 141, line 142, relay contacts 144—145 (R2B), line 146, junction 147, line 148, switch contacts 149 and 125 to line L2. The cutter solenoid winding 135 is thus energized and the knife 32 is down. With contacts R1A (181 and 182) in the down position, the clutch solenoid is de-energized, with the result that the machine is stopped, but as soon as the leading edge of the first piece of material 114 is in place (position 272, Figure 6), the photocell 103 at station No. 1 is darkened, relay R2 is de-energized and contacts R1A (181 and 182) close and establish a circuit to the clutch solenoid from line L1, contacts 124 and 159 of switch 121, line 160, junction 161, line 162, clutch solenoid winding 165, junction 166, line 167 to junction 183, R1A contacts 181 and 182; line 180, gang switch contacts 179 and 275, line 276, gang switch contacts 277 and 176, line 177, junction 147, line 148, contacts 149 and 125 of switch 121 to line L2. This energizes the clutch solenoid and if the operator then moves treadle 74 to the down or "Run" position, or does so as the material is arranged, the sewing operation starts.

As the leading edge of the material reaches station No. 2 and covers the reflective surface 109, photocell 111 is darkened and relay R2 is de-energized, thus breaking the previously described circuit through contacts R2B to the cutter solenoid winding 135. This raises knife 32 and the leading edge of the material 114, and strip 115 sewed thereon enters space 87 between the cutter elements.

The sewing operation continues until the trailing edge of the first piece of material 114 uncovers the reflective surface 100 of station No. 1, whereupon photocell 103 is illuminated and relay R1 is energized and R1A contacts 181 and 182 open, thus stopping the sewing operation with the trailing edge of the first piece of material 114 just beyond the reflective spot 100. The operator then inserts another or second piece of material immediately behind the first piece with just a little space therebetween (one-half inch to three-quarters inch) and as photocell 103 of station No. 1 is again darkened, relay R1 is again de-energized and contacts R1A (181 and 182) close, to again energize the clutch solenoid winding 165 and sewing is resumed. Skillful operators become so adept at inserting successive pieces of material that there is scarcely a halt in the sewing operation, yet the machine does halt for the unskillful or tired operator so that there is never an excessive amount of space between successive pieces.

As the trailing edge of each piece in the succession reaches station No. 2, light is momentarily reflected from mirror 109, thus illuminating photocell 111 at station No. 2. This causes energization of relay R2 and consequent closure of contacts R2B (144 and 145) to re-establish the circuit to cutting solenoid winding 135 which, therefore, operates to move knife 32 downwardly to sever the strip 117 between successive pieces. The severance is made while sewing continues, since operation of the cutting solenoid does not interrupt the clutch solenoid circuit.

Manual operation.—For purely manual operation switch 121 is moved to the down or "manual" position which establishes a circuit from line L1, through switch contacts 123 and 163, line 164, line 162, clutch solenoid winding 165, junction 166, line 167, switch contacts 169 and 125 to line L2. The clutch solenoid is thus energized and moves the clutch control linkages so that by appropriate operation of treadle 74 the machine can be started and stopped at will. When thus operating manually, any cutting or severing action is accomplished by treadle 81, since the cutting solenoid winding is maintained open at contacts 133 and 149 of switch 121. Switch 156—130 is, of course, opened to de-energize transformer 128 and all circuits served thereby.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood the invention is not limited to the specific embodiments herein except as defined in the appended claims.

What is claimed is:

1. In a sewing machine having means for feeding the material therethrough and simultaneously sewing it, the combination comprising a cutting device mounted on the machine for cutting the material after it has been sewn, and spaced light source means and cooperating photocell means having a light path between them that is in the path of movement of the material when it is moved through the sewing machine, and means responsive when the material fed through the machine changes the amount of light transmitted from the light source to the photocell for operating said cutting device.

2. The apparatus of claim 1 further characterized in that the light source and photocell are both mounted above the path along which the material is fed through the machine, and a light reflective surface is mounted below said path for reflecting the light from the light source back to the photocell when not covered by the material fed through the machine.

3. In a sewing machine having a power source, stitching and material feeding mechanisms operated by the power source, the combination comprising a first light source and photocell mounted on the machine and having a first light path therebetween which is capable of being interrupted by the material fed through the machine as it approaches the stitching mechanism, a second light source and photocell mounted on the machine and having a second light path therebetween which is capable of being interrupted as the material leaves the stitching mechanism, cooperating means responsive when the material fed through the machine interrupts the first light path for causing the power source to operate the material feeding and stitching mechanism and responsive when neither the first or second light paths are interrupted for discontinuing the operation of the machine.

4. The apparatus of claim 3 further characterized in that the power source is constantly rotatable and the stitching and feeding mechanisms are driven therefrom through a clutch controlled by said cooperating means.

5. The apparatus of claim 4 further characterized in that said clutch is provided with a manual control which in one position enables the cooperating means to effect operation of the machine and in another position stops the ma-

chine regardless of the operating conditions of said photocells and cooperating means.

6. The apparatus of claim 3 further characterized in that material severing means is provided for severing at least a portion of the material as it leaves the stitching means, said cooperating means being operable to cause operation of said material severing means while the feeding and stitching are in progress when a discontinuity in the material causes a change in light transmitted along the second light path as the material is fed through the machine.

7. The apparatus of claim 6 further characterized in that manual means is provided which in one position enables the cooperating means and light sources to control the operation of the feeding, stitching and severing mechanisms and which in another position completely stops the operation of the machine.

8. In a sewing machine having a constantly rotating power source, stitching and material feeding mechanisms, a clutch connecting said power source and mechanisms for operating the same, an operator control, a photo-electric control having a light source means and light responsive means with light paths therebetween, said photo-electric control being characterized in that the light source means and light responsive means include a first light source and a cooperating photocell positioned so that a first light path therebetween is in a position to be interrupted by the leading edge of a piece of material being entered into the machine for sewing and a second light source and cooperating photocell positioned so that a second light path therebetween is in a position to be interrupted as the leading edge of a piece of material being sewn leaves the stitching mechanism and which interruption ceases when the trailing edge of the material leaves said stitching mechanism, and means connecting the operator control, the photo-electric control and the clutch which is conditioned to engage the clutch when the operator control is operated and the first light path is interrupted by movement of a piece of material to be sewn through the normal path of movement for sewing and to disengage the clutch when either the operator control is operated to disengaging position or the material being sewn

moves so as to leave the second light path free as the material leaves the sewing position.

9. The apparatus of claim 8 further characterized in that the machine is equipped with a material severing arrangement in the path of movement of the sewn material as it leaves the stitching mechanism and means operable when the second light path is not interrupted to actuate said material severing arrangement.

10. The apparatus of claim 9 further characterized in that the material severing arrangement comprises a stationary knife mounted in the path of movement of sewn material and immediately behind the stitching mechanism and a cooperating movable cutter knife actuated by electromagnetic means, said second light path including a light reflective surface adjacent the tip of the stationary knife.

11. The apparatus of claim 10 further characterized in that the material severing arrangement is also provided with a mechanical connection to a foot treadle for direct mechanical operation.

12. The apparatus of claim 8 further characterized in that the means connecting the operator control, the photo-electric control and the clutch includes a levering arrangement comprising a first lever pivoted to the machine and connected to the operator control so as to be operated thereby, a second lever likewise pivoted to the machine and operated by electromagnetic means which is connected to and responsive to change in condition of the light path of the photo-electric control, and a third lever pivoted to the first and second levers and linked to the clutch.

ESTHER HELEN HELMER,
Special Administratrix of the Estate of Grover H. Helmer, Deceased.

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