April 9, 1963 F. A. HAYES ET AL 3,084,640

AUTOMATIC SEWING MACHINES

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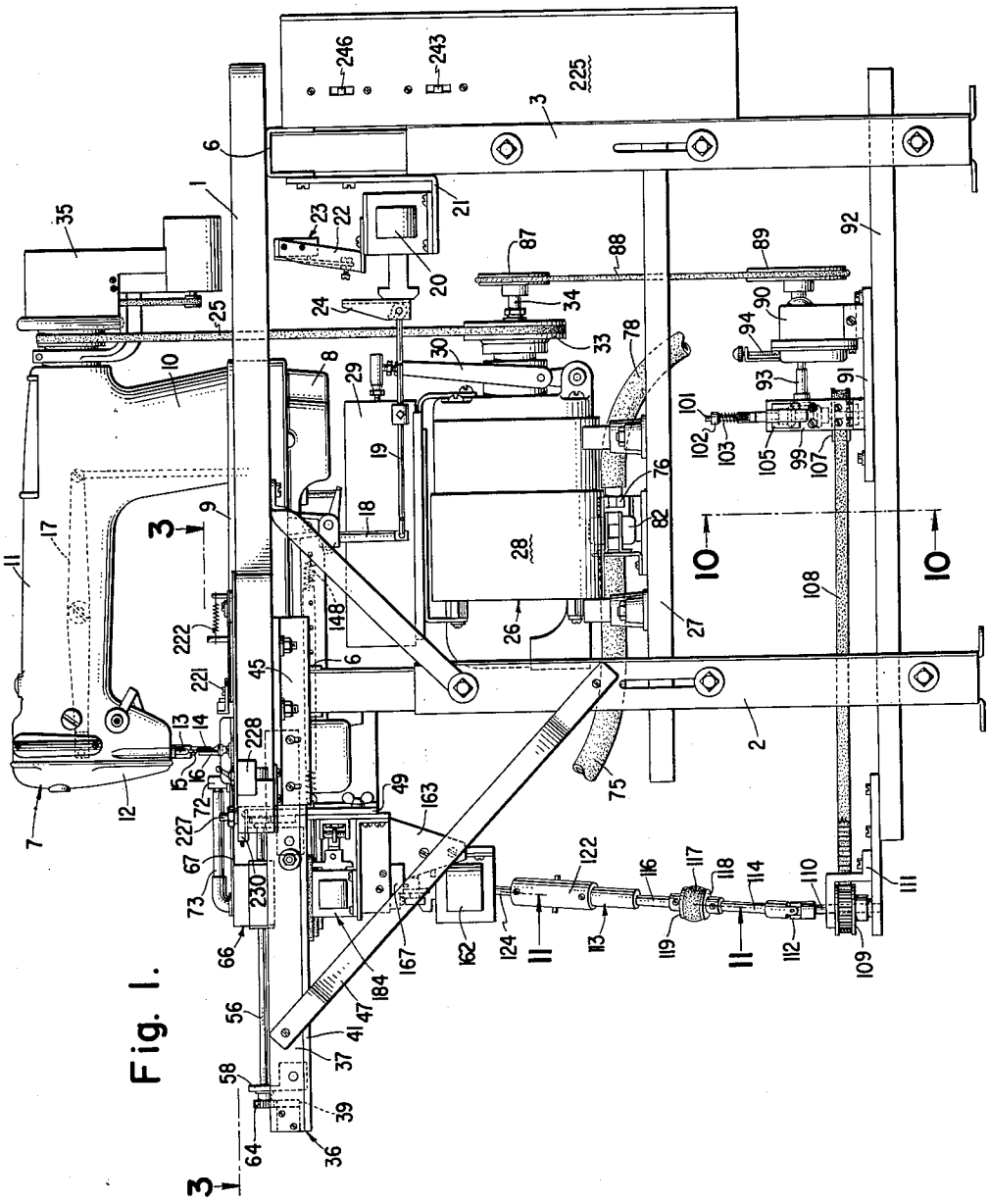


Fig. 1.

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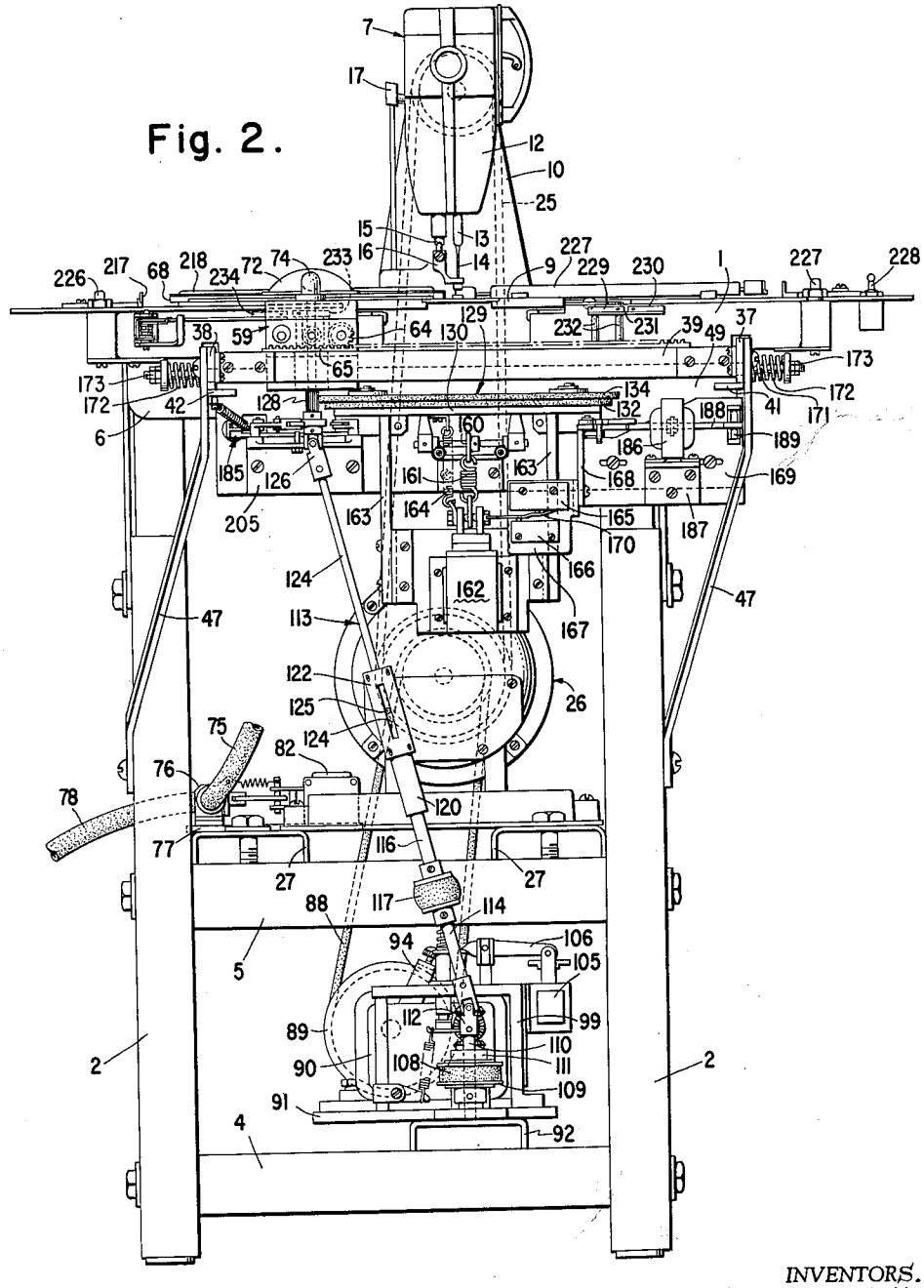
WITNESS
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April 9, 1963 F. A. HAYES ET AL 3,084,640

AUTOMATIC SEWING MACHINES

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Fig. 2.



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AUTOMATIC SEWING MACHINES

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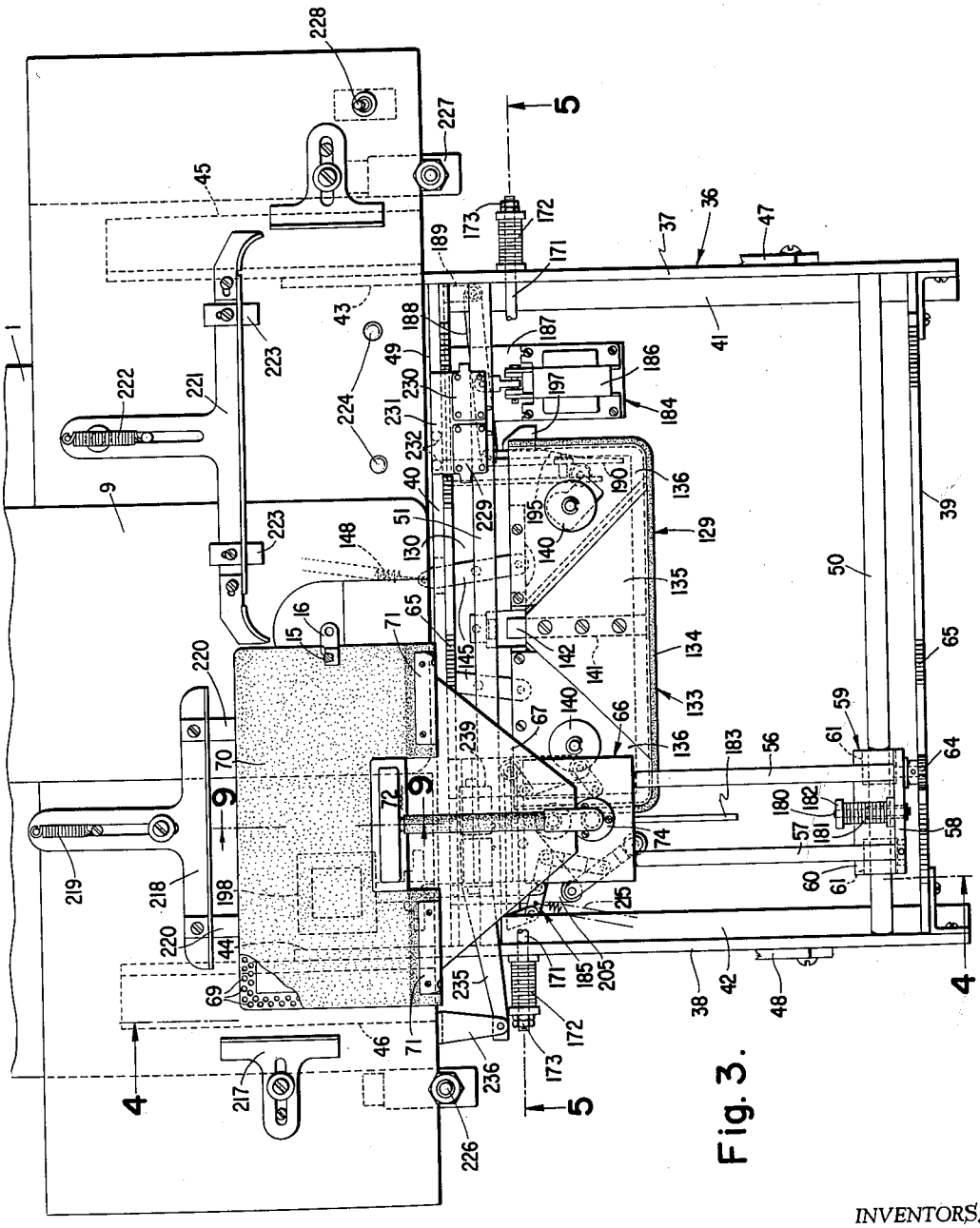


Fig. 3.

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AUTOMATIC SEWING MACHINES

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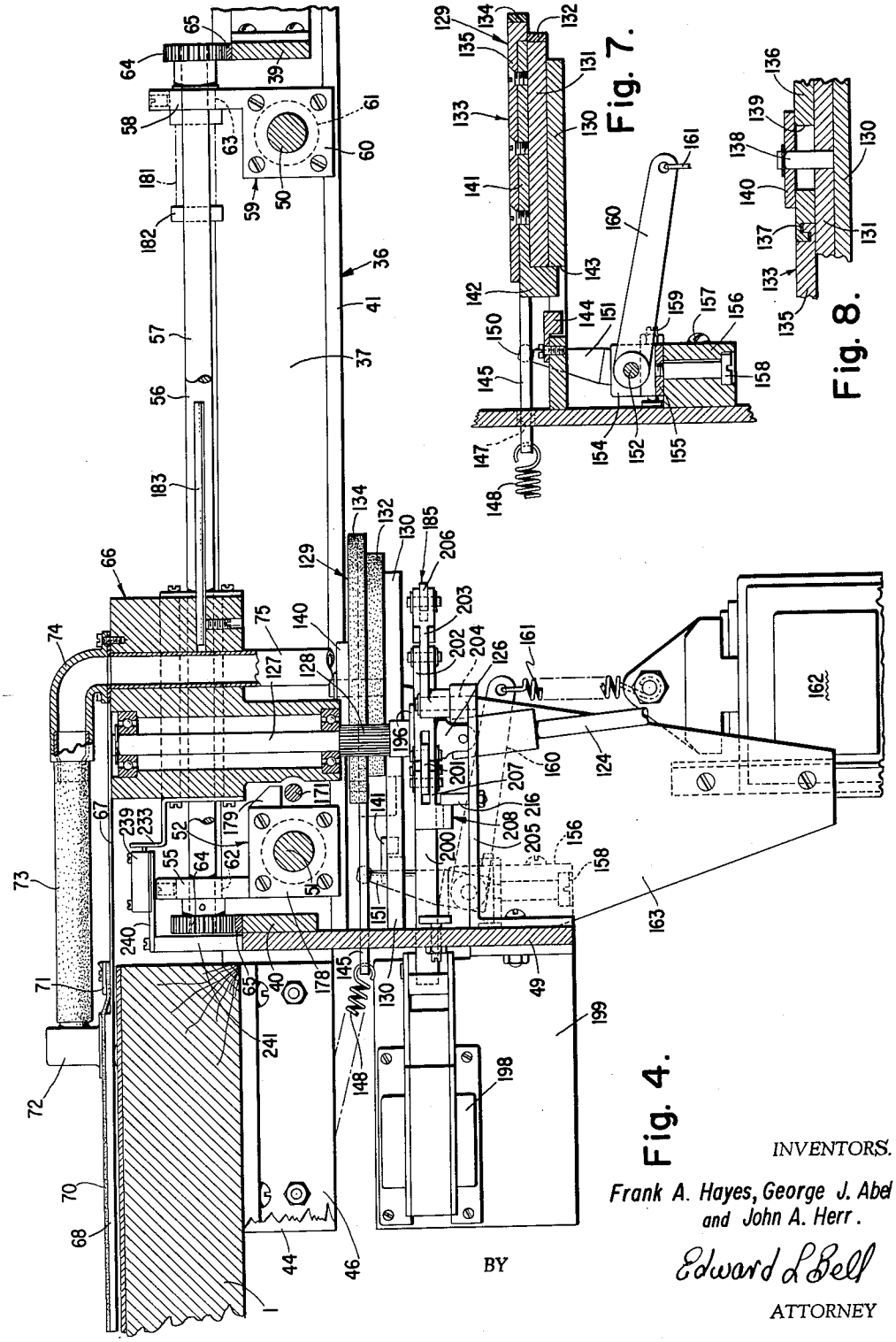


Fig. 4.

Fig. 7.

Fig. 8.

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AUTOMATIC SEWING MACHINES

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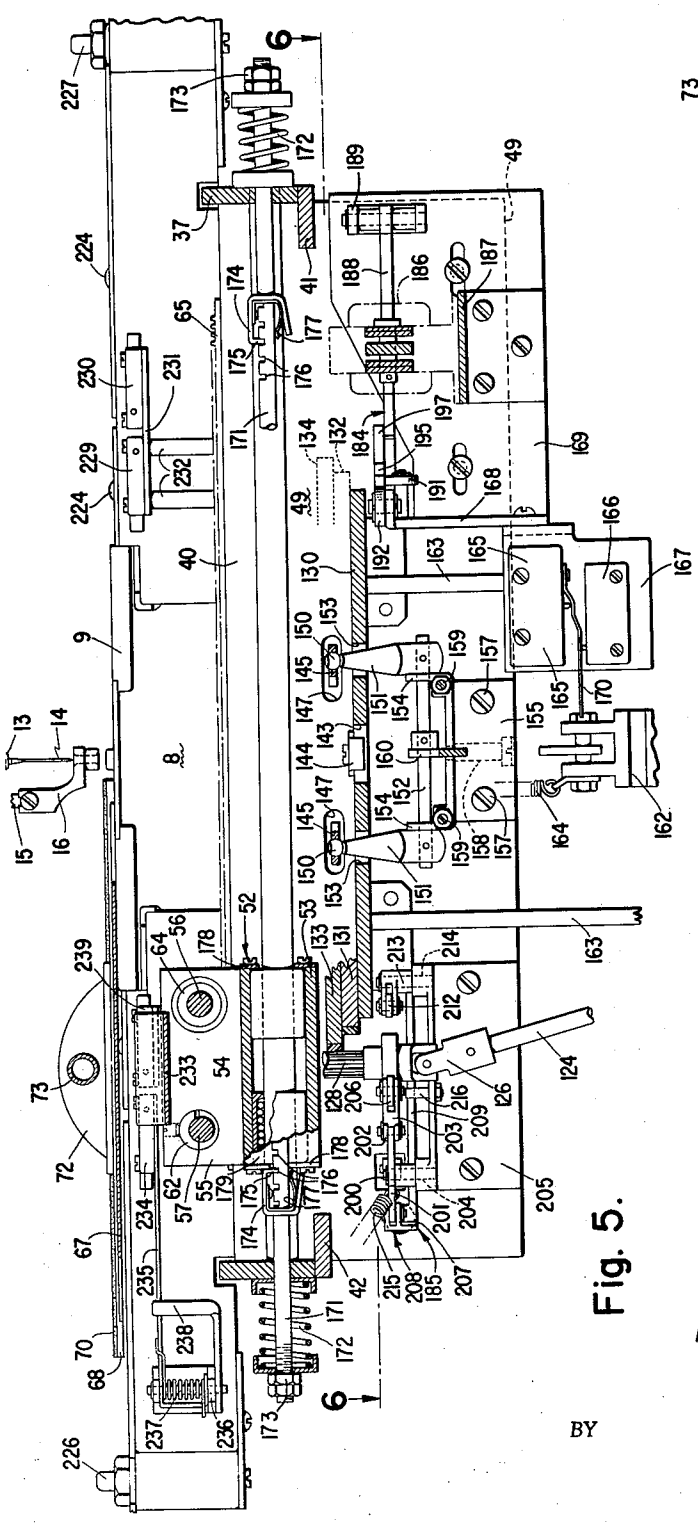


Fig. 5.

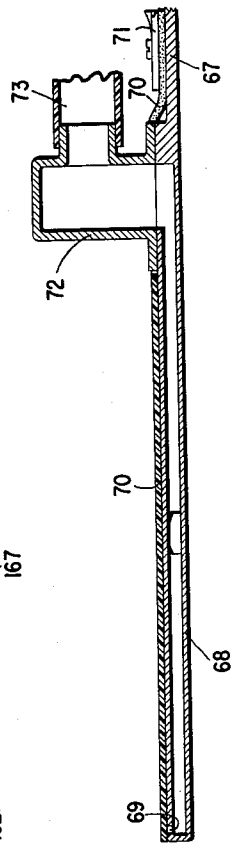


Fig. 9.

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AUTOMATIC SEWING MACHINES

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Fig. 6A

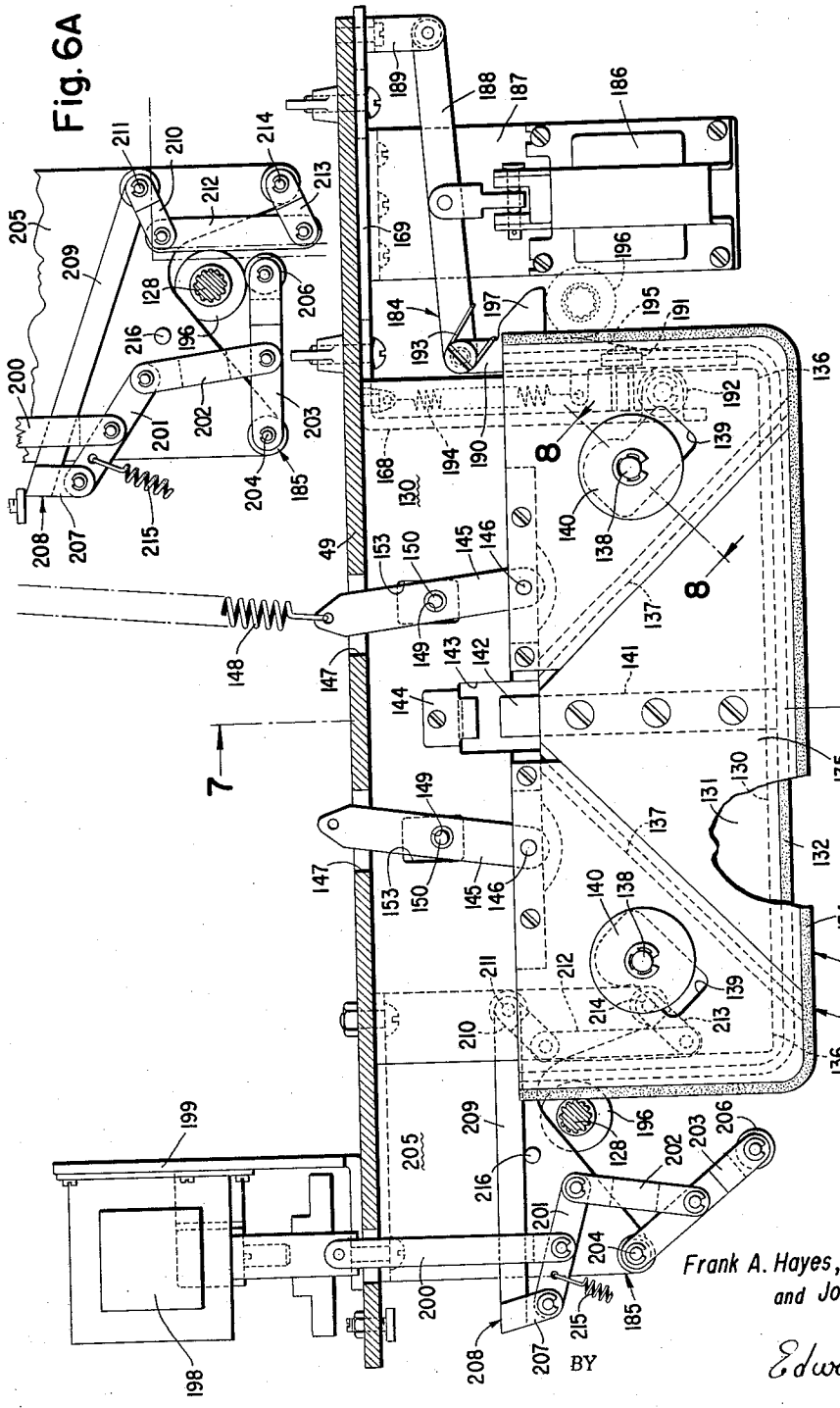


Fig. 6.

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AUTOMATIC SEWING MACHINES

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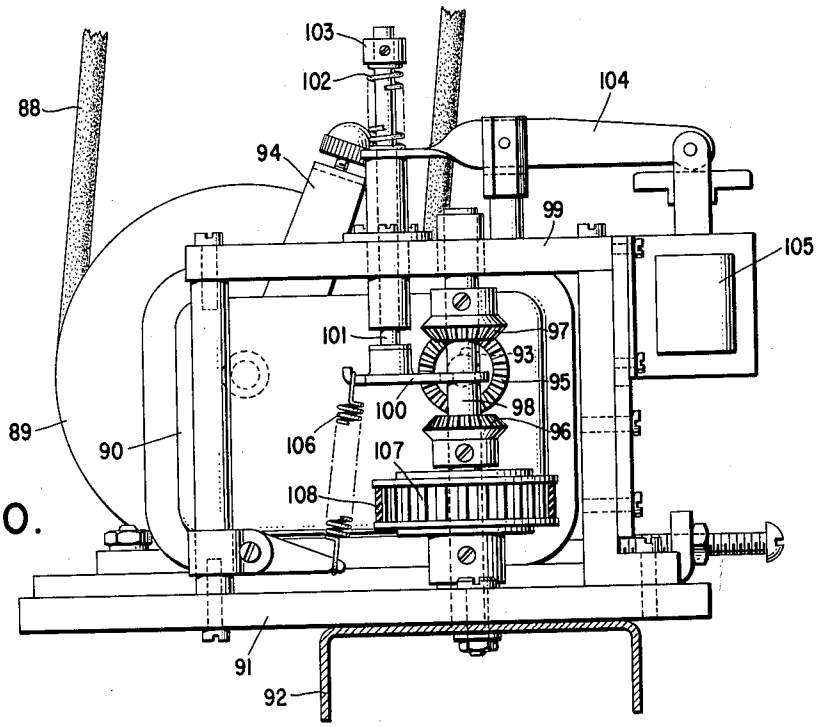


Fig. 10.

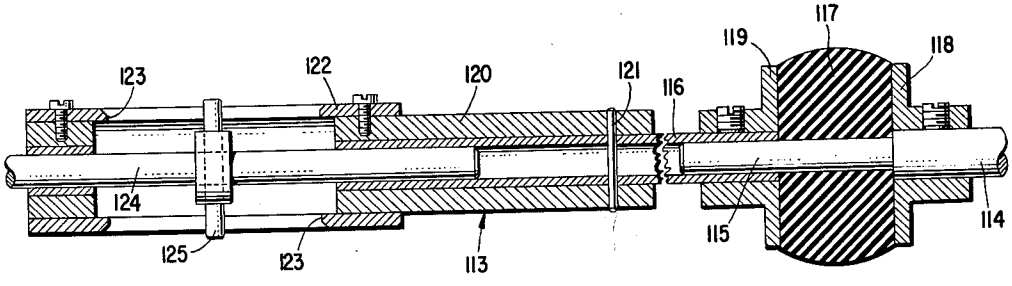


Fig. 11.

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April 9, 1963 F. A. HAYES ET AL 3,084,640

AUTOMATIC SEWING MACHINES

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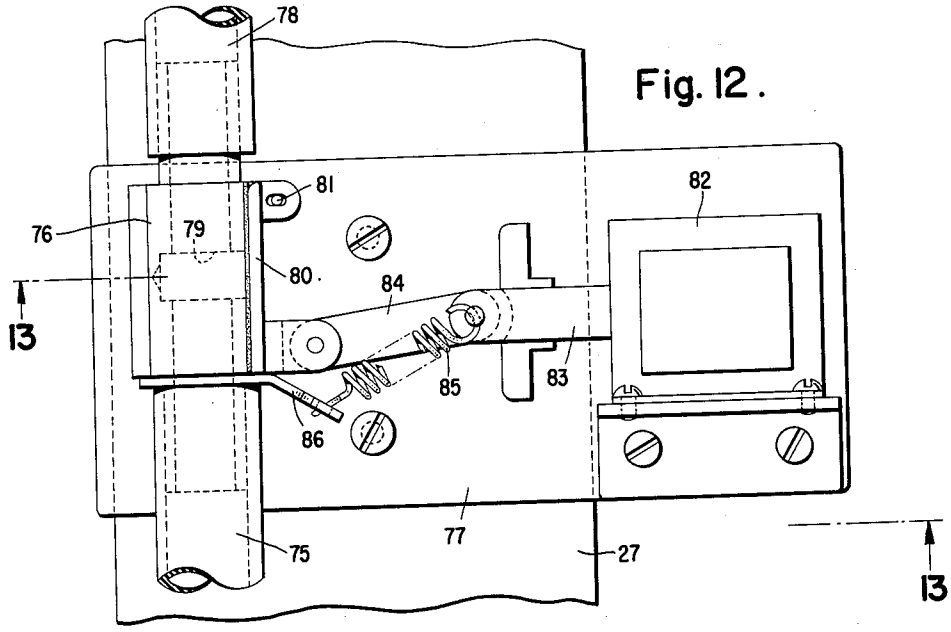


Fig. 12.

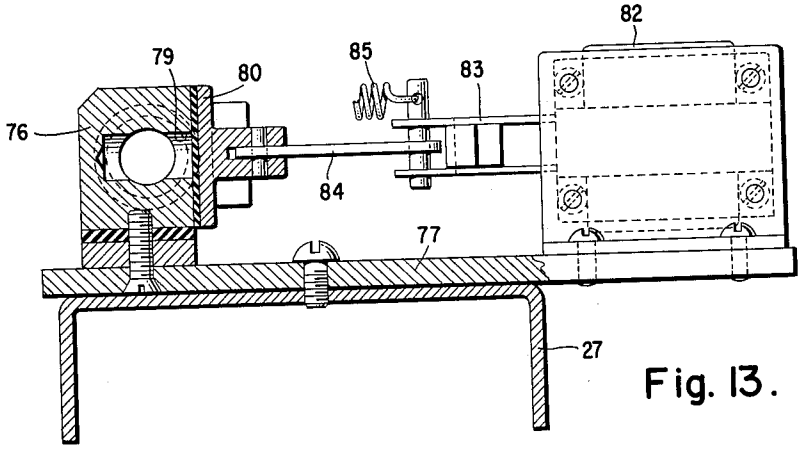


Fig. 13.

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AUTOMATIC SEWING MACHINES

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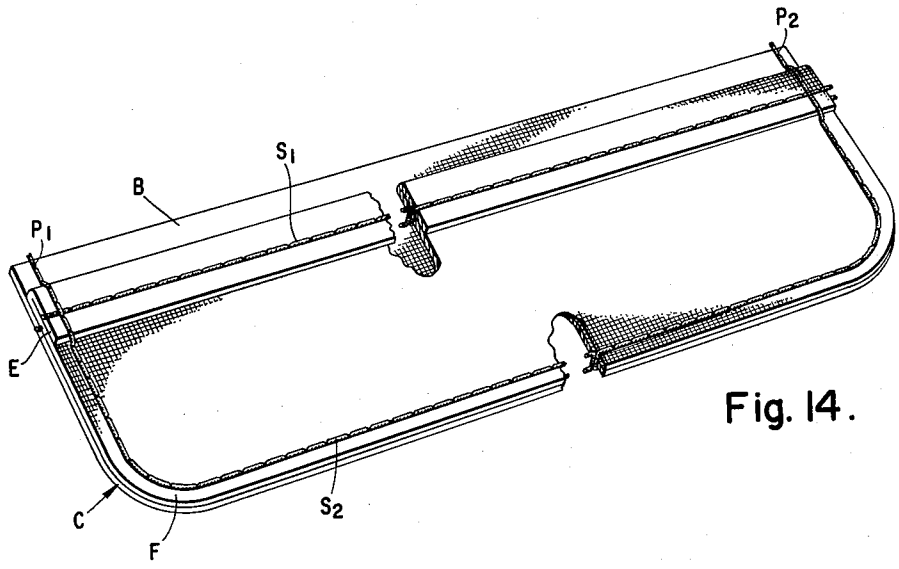


Fig. 14.

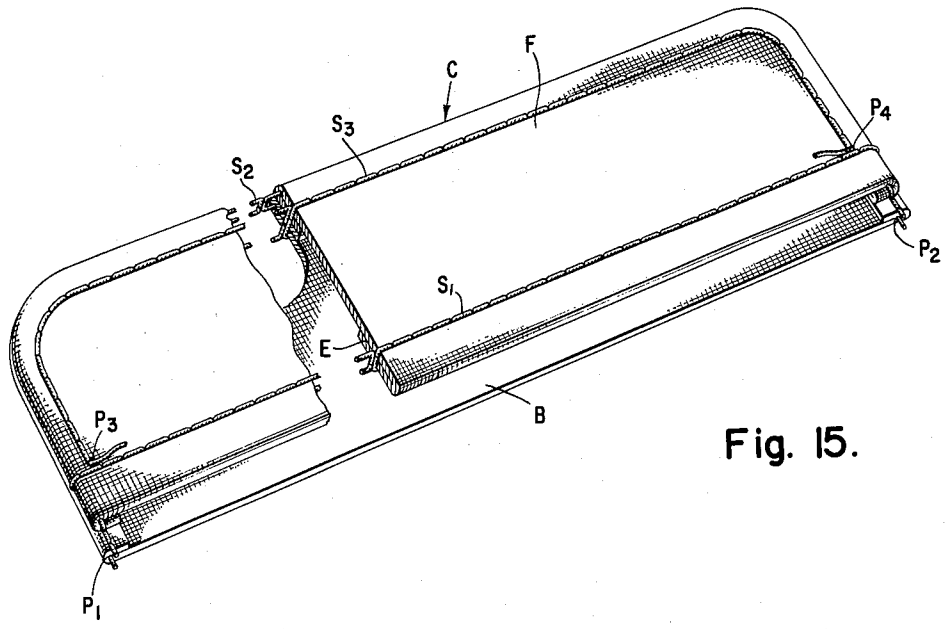


Fig. 15.

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AUTOMATIC SEWING MACHINES

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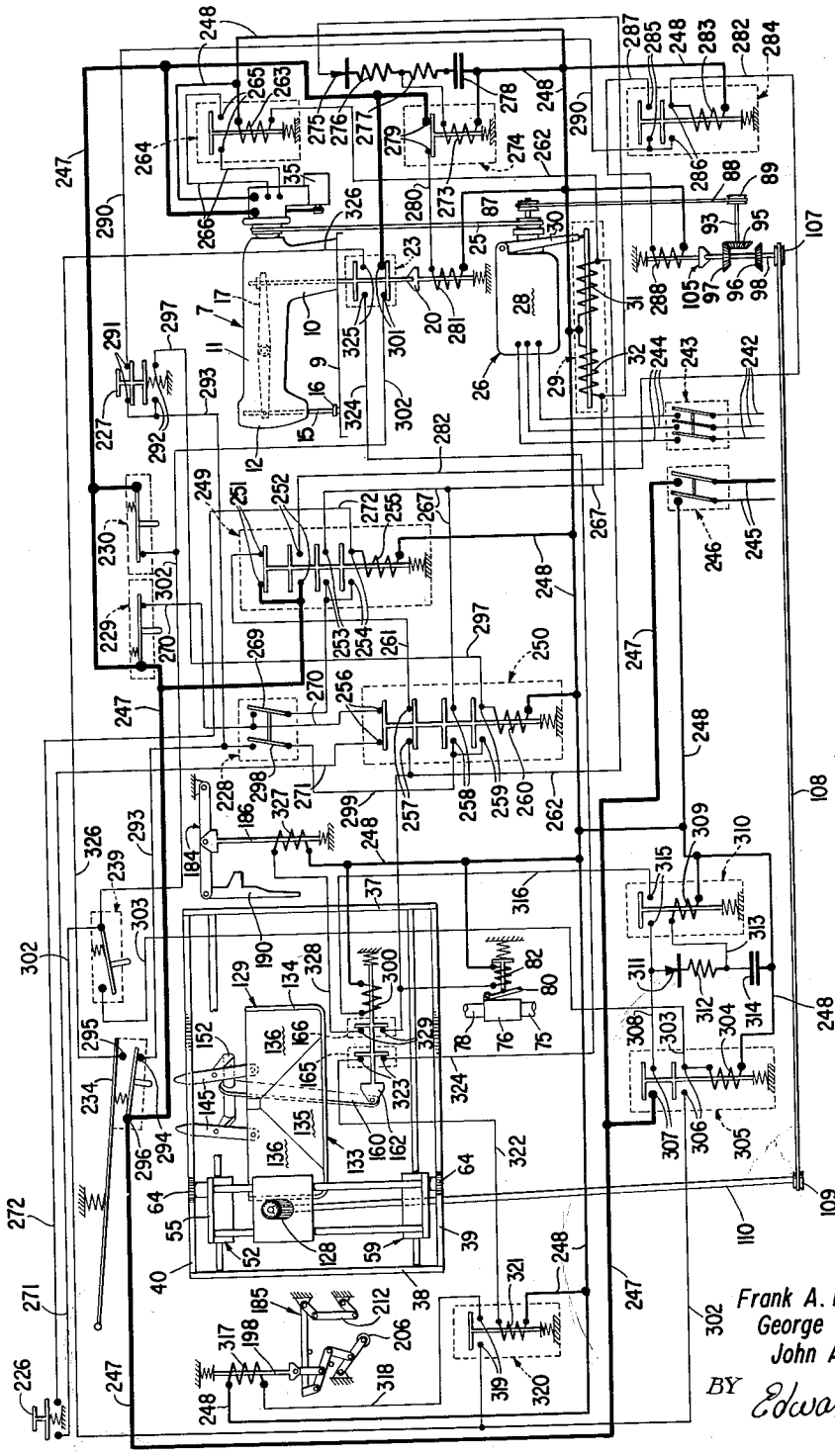


Fig. 16.

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United States Patent Office 3,084,640 Patented Apr. 9, 1963

3,084,640

AUTOMATIC SEWING MACHINES

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Filed Dec. 12, 1958, Ser. No. 780,088
16 Claims. (Cl. 112—2)

The present invention relates to sewing machines and more particularly to an automatically operated sewing machine.

It is an object of this invention to provide a new and improved traverse mechanism for an automatically controlled sewing machine for moving work relatively to the point of stitch formation of a sewing machine to define a seam, and more particularly, to provide such a traverse mechanism that is economical, dependable, durable, and which is useful for sewing a discontinuous seam.

It is a further object of this invention to provide a pattern controlled traverse mechanism for an automatically controlled sewing machine which is variable for sewing two different sewing operations, and more particularly one that is automatically varied for sewing two different successive seams on a work piece.

It is also an object of this invention to provide a work holder for the traverse mechanism of a sewing machine for securely holding the work as it is moved.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view of the machine constructed in accordance with this invention,

FIG. 2 is an end elevational view of the machine of FIG. 1,

FIG. 3 is a fragmentary horizontal sectional view taken substantially on the line 3—3 of FIG. 1, and illustrating in plan the traversing mechanism of the machine,

FIG. 4 is a fragmentary vertical sectional view taken substantially on the line 4—4 of FIG. 3,

FIG. 5 is a fragmentary vertical sectional view taken substantially on the line 5—5 of FIG. 3,

FIG. 6 is a fragmentary horizontal sectional view taken substantially on the line 6—6 of FIG. 5,

FIG. 6A is a fragmentary detail view showing the left pattern shift mechanism in its operative position as distinguished from the inoperative position as seen in FIG. 6,

FIG. 7 is a detail sectional view taken substantially on the line 7—7 of FIG. 6,

FIG. 8 is a detail sectional view taken substantially on the line 8—8 of FIG. 6,

FIG. 9 is a detail sectional view taken substantially on the line 9—9 of FIG. 3,

FIG. 10 is a fragmentary sectional view taken substantially on the line 10—10 of FIG. 1,

FIG. 11 is a detail sectional view taken substantially on the line 11—11 of FIG. 1,

FIG. 12 is a fragmentary detail view in plan showing the vacuum control means for the work holder of the traversing mechanism.

FIG. 13 is a sectional view taken substantially on the line 13—13 of FIG. 12,

FIG. 14 is a perspective view of the work at the completion of the initial or rough sewing operation,

FIG. 15 is a perspective view of the work at the completion of the second or finish sewing operation,

FIG. 16 is a schematic-circuit diagram of the machine.

Briefly, and with reference to FIGS. 14 and 15, there is illustrated in the drawings a machine for performing the rough and finish contour sewing operations on cuffs, collars or the like. The cuff C comprises a facing material F and a backing material B, the facing material F having an infolded edge E that is stitched by a seam S1 in a previous sewing operation. For the rough contour sewing, the facing material F and the backing material B are superposed and aligned, and then introduced to the sewing machine in the left start position. The left start operation of the machine is then initiated by the operator. The machine includes a traversing mechanism which carries the work relatively to the point of stitch formation of the sewing machine to stitch the two pieces of the cuff together along the seam S2. At the completion of the left start or rough contour sewing operation, the machine stops in the right start position and the cuff C is removed from the machine by the operator, inverted as illustrated in FIG. 15, and reloaded in the right start position, after which the right start operation of the machine is initiated. The traversing mechanism then moves the cuff relatively to the point of stitch formation for sewing the seam S3, which is the finish contour sewing of the cuff, and upon completion of this sewing operation, stops in the left start position.

The machine has a support comprising a table top **1** having a two-part vertically adjustable leg at each of the four corners thereof, the legs including a pair of front legs **2** and a pair of rear legs **3**. The front pair of legs **2** are connected together, FIG. 2, by a lower cross piece **4** an intermediate cross piece **5** and an upper cross piece **6**, and the rear pair of legs **3** are connected together in a similar manner.

Mounted upon the table top **1** is a single needle high speed industrial lock stitch sewing machine **7** similar to that disclosed in the United States patent of Kaier, No. 2,206,285, July 2, 1940, the illustrated machine being a Singer Class 251 machine modified only in that the feeding mechanism has been removed. Briefly, the sewing machine **7** includes a bed closed by an oil pan **8** and having a bed plate **9**, the upper surface of which defines the work supporting surface of the machine. From one end of the bed plate **9** there rises the standard **10** carrying the bracket arm **11** that terminates in a head **12** overhanging the bed plate **9**. Mounted in the head **12** for endwise reciprocation is a needle bar **13** carrying a needle **14** that penetrates the work supporting surface upon reciprocation of the needle bar to define a point of stitch formation thereon. A presser bar **15** is also mounted in the head **12** and carries a presser foot **16**. The presser foot **16** is adapted to be lifted from the work supporting surface by the usual presser lifter mechanism including a rock lever **17** pivotally mounted at the rear of the bracket arm and connected at one end of the presser bar and at the other end to an actuating mechanism including an actuating lever **18** pivotally mounted on the underside of the oil pan **8**. The lever **18** is connected by a rod **19** to a solenoid **20** mounted upon a bracket **21** on the rear legs **3**. Mounted on the casing of the solenoid **20** is a bracket **22** carrying a double circuit push-button switch **23** adapted to be actuated by a tripping arm **24** on the armature of the solenoid **20**.

The sewing machine **7** is driven by a belt **25** from a double solenoid controlled electric power transmitter **26** such as disclosed in the United States patent of Turner et al., No. 2,860,748, November 18, 1958. The transmitter **26** is mounted upon a pair of channel members **27** extending between the intermediate cross braces **5** and briefly includes an electric motor **28** having a double

acting solenoid 29 mounted upon the casing thereof. The solenoid 29 is connected to a lever 30 that controls the clutch and brake mechanisms of the transmitter 26. With reference to FIG. 16, the solenoid 29 includes a brake solenoid 31 and a clutch solenoid 32. When the clutch solenoid 32 is energized, the lever 30 is pivoted to clutch the driving pulley 33 on the main shaft 34 of the transmitter 26 to the fly wheel of the transmitter, thus driving the sewing machine, and when the brake solenoid 31 is energized, the lever 30 is pivoted to bring the belt pulley against a stationary braking surface to bring the machine to a stop. The sewing machine 7 is fitted with a needle positioner 35 that acts always to bring the needle 14 to the raised position when the machine is stopped.

At the front of the machine, there is mounted a traversing mechanism for moving the work relatively to the point of stitch formation and thereby defining a stitch pattern. The traversing mechanism, FIG. 3, comprising an open rectangular frame 36 having a right side bar 37, a left side bar 38, a front cross bar 39 and a rear cross bar 40. For rigidity, the side bars 37 and 38 are provided with horizontal legs 41 and 42, respectively, thus forming angle bars. The side bars 37 and 38 are elongated beyond the rear cross bar 40 to provide extended ends 43 and 44 which are secured to the table top 1 by angle pieces 45 and 46, respectively. The frame 36 is further supported by braces 47 and 48, which are secured to the legs 2 and to the side bars 37 and 38. The frame 36 of the traversing mechanism also includes a rectangular horizontal mounting plate 49 in juxtaposed relation with the rear cross bar 40.

A pair of spaced parallel rods 50 and 51 extend between the side bars 37 and 38 of the frame 36 at the front and rear thereof. Mounted upon the rod 51, FIGS. 4 and 5, is a slide element 52 comprising a sleeve portion 53 having a pair of endwise rolling ball bearing units 54 mounted on the rod 51 and disposed in the sleeve portion 53. The slide element 52 also includes an upstanding arm 55 in which is journaled a pair of spaced parallel rods 56 and 57 arranged normal to the rods 50 and 51. At their opposite ends, the rods 56 and 57 are journaled in an upstanding arm 58 of a second slide element 59 similar to the slide element 52 and including a sleeve portion 60 having a pair of endwise rolling ball bearings 61 for slidably mounting the same on the rod 50. To provide for leveling the rods 56 and 57, the rod 57 is mounted in an eccentric bushing 62, FIGS. 4 and 5, in the arm 55, and in a similar eccentric bushing 63 in the arm 58. To insure right angular motion of the rods 56 and 57 on the rods 50 and 51, the rod 56 is extended at each end through the arms 55 and 58 and has secured on the ends thereof gears 64, which mesh with racks 65 on the top of the cross bars 39 and 40.

Mounted on the rods 56 and 57 for sliding movement endwise of the rods, is a trolley 66 substantially in the form of a block. Being mounted for movement endwise of the rods 56 and 57, which are in turn mounted for movement endwise of the rods 50 and 51, the trolley 66 is thus mounted for universal movement relatively to the point of stitch formation. Mounted upon the trolley 66 is an arm 67 having a work supporting portion or plate 68 upon which the cuff C is loaded. The plate 68 is formed substantially to the configuration of the cuff C, but is dimensioned smaller so that the edge of the cuff, which is to be stitched, extends beyond the edges thereof. For holding the cuff C on the plate 68, the plate is made hollow, FIG. 9, and is provided with a plurality of apertures 69, FIG. 3, about the periphery thereof on the three sewing edges. A flap 70 of flexible air-impervious material such as rubber, is secured to the top of the plate 68 by brackets 71 screwed down to the arm 67. The flap 70 substantially conforms to the configuration of the work supporting plate 68. A suction chamber 72, FIGS. 4 and 9, communicates with the hollow interior of the plate 68 and is connected by a tube 73 with a fitting 74 mounted on the trolley 66. The fitting 74 is connected to a tube 75 mounted in a bore in the trolley 66 and connected to any suitable source of vacuum (not shown). The flap 70 is laid back to load work onto the plate 68. When the work is loaded, the flap 70 is laid over it to seal the apertures 69 and thereby hold the flap down by suction and thus hold the work.

While vacuum may be continuously applied to the tube 75, in the disclosed preferred embodiment of the invention, the vacuum is controlled so that it is applied only during the sewing operation. For this purpose, the tube 75 is connected to a fitting 76, FIGS. 12 and 13, mounted on a bracket 77 on one of the channel members 27. The fitting 76 is connected by a tube 78 leading to the source of vacuum and is provided with a lateral opening 79 that is normally closed by a gate valve 80 pivotally mounted at 81 and adapted to be opened by a solenoid 82 having an armature 83 connected to the valve 80 by a link 84. A tension spring 85 is connected at its opposite ends to an ear 86 fast on the fitting 76 and the pivoted connection between the armature 83 and the link 84.

For driving the traversing mechanism there is provided a pulley 87, FIG. 1, on the shaft 34 of the motor 28, which pulley is connected by a belt 88 to a pulley 89 on a variable speed ratio control unit 90 mounted on a plate 91 which is in turn mounted on a channel member 92 mounted on and extending between the lower cross braces 4. The unit 90 has a power output shaft 93 and a control lever 94 for adjusting the speed out of the output shaft relatively to the speed of the pulley 89. The shaft 93 has mounted thereon a bevel gear 95, FIG. 10, that is adapted to mesh alternately with a first gear 96 and a second gear 97. The gears 96 and 97 are mounted upon a vertical axis shaft 98 supported at the lower end in the plate 91 and at the upper end in a frame 99 mounted on the plate 91. The shaft 98 is mounted for rotation and for limited endwise movement to bring either the gear 96 or the gear 97 into cooperation with the drive gear 95 and thus to provide for driving the shaft 98 selectively in either direction of rotation. For moving the shaft 98 endwise, there is an arm 100 secured on the shaft 98 and connected to a rod 101 slidably mounted in the frame 99. A spring 102 encircles the rod 101 and is arranged between a collar 103 and the top of the rod and one arm of a lever 104 pivotally mounted intermediate its ends on the frame 99 and at the other end connected to a solenoid 105. When the solenoid 105 is energized, the lever 104 acting through the spring 102 and collar 103 raises the rod 101 to lift the shaft 98 and thus bring the gear 96 into driving engagement with the gear 95. A tension spring 106 is connected between the arm 100 and the frame 99 to draw the shaft 98 downwardly when the solenoid 105 is de-energized, thus bringing the gear 97 into driving engagement with the gear 95.

Mounted on the shaft 98 is a pulley 107 connected by a belt 108, FIG. 1, with a pulley 109 on a vertical axis shaft 110 journaled in a bracket 111 that is mounted on the channel member 92. The shaft 110 is connected through a universal joint 112 to a torsionally resilient and endwise extensible sectional drive shaft 113. The shaft 113 comprises a shaft element 114 connected to the universal joint 112 and having a reduced end portion 115, FIG. 11, that telescopes into a tubular shaft element 116 and is connected thereto for rotation by a torsionally resilient connection comprising a resilient element 117 such as rubber that is bonded at its opposite faces to flanges 118 and 119 which are secured to the shaft elements 114 and 116, respectively. The shaft element 116 is fitted within a sleeve 120 and is secured thereto for unitary rotation by a pin 121. The end of the sleeve 120 is received within and secured to a sleeve 122 having oppositely disposed longitudinally extending slots 123. A third shaft element 124 telescopes into the shaft element 116 and

within the sleeve 122 is fitted with a transverse pin 125, the ends of which extend through the slots 123 to couple the shaft elements together for rotation while providing for endwise movement thereof.

At its upper end, FIG. 4, the shaft element 124 is connected through a universal joint 126 to the lower end of a drive shaft 127, FIG. 4, journaled for rotation in the trolley 66 on a vertical axis. The shaft 127 has a driving wheel 128 that is adapted to engage the periphery of a pattern 129.

The pattern 129 is supported by a horizontal mounting plate 130 that is carried by the mounting plate 49. A fixed template element or pattern 131 is mounted upon the plate 130 and has a covering 132 of a friction enhancing material such as rubber that defines the peripheral pattern surface. The pattern 131 is designed to provide the finish contour seam S3 which is smaller than the rough contour seam S2 by the amount that the seam S3 is spaced inwardly from the edge of the cuff. For the rough contour seam S2, there is provided an expansible pattern 133 having a covering 134 of a friction enhancing material defining the peripheral pattern surface. The pattern 133 is adapted to be enlarged beyond the periphery of the pattern 131 so that the wheel 128 will ride on the periphery of the pattern 133 for sewing the rough contour seam S2 and adapted to be collapsed within the periphery of the pattern 131 so that the wheel 128 will ride on the periphery of the pattern 131 for sewing the finish contour seam S3.

The pattern 133, FIG. 6, comprises a V-shaped center portion 135 and a pair of complementary wedge-shaped outer portions 136. The portions 135 and 136 are keyed together for relatively sliding movement along the edge of the center portion 135 by a tongue and groove connection 137, FIG. 8. The center portion 135 rests freely on the upper face of the pattern 131 and is held thereon by the outer portions 136 through the connection 137. The outer portions 136 are held on the pattern 131 while providing for sliding thereof by a stud 138 upstanding from the pattern 131 and extending through an enlarged aperture 139 in the outer portions 136 with an enlarged plate 140 mounted on the stud and overlying the outer portions 136. Sliding movement of the center portion 135 in the one direction is limited by an arm 141 mounted in a groove in the underface thereof and having a downturned end 142 extending into an aperture 143 in the mounting plate 130, and engaging the edge of the aperture 143. Sliding movement in the other direction is limited by an abutment 144 secured to the mounting plate 130 and adapted to be engaged by the arm 141.

A pair of connecting links 145 are provided, with each of the links pivotally connected to the rear edge of one of the outer portions 136 of the pattern 133 by a pivot pin 146. The links 145 extend rearwardly through apertures 147 in the vertical mounting plate 49. A tension spring 148 is connected at its opposite ends to the frame and to one of the links 145 to draw the same to the rear, thus biasing the pattern 133 to the collapsed position. For expanding the pattern 133, each of the links 145 have an aperture 149 in the center portion thereof which is entered by the end 150 of a crank 151 that is mounted on a shaft 152 and extends through an aperture 153 in the horizontal mounting plate 130. The shaft 152, FIGS. 5 and 7, is journaled in the upstanding ears 154 of a U-shaped bracket 155, that is mounted on a block 156 secured by screws 157 to the vertical mounting plate 49. To provide for aligning the edges of the outer portions 136 of the pattern 133, the bracket 155 is secured to the block 156 for angular adjustment, by means of a fastening screw 158 disposed substantially centrally of the bracket 155 and adjusting screws 159 at the base of the ears 154 which abut against the mounting plate 49. When the fastening screw 158 is loose, the adjusting screws 159 can be turned to adjust the bracket 155 angularly, after which the screw 158 is turned down to secure the bracket in its adjusted position.

A crank arm 160 is secured to the shaft 152 which, at the free end thereof, is connected through a spring 161, FIGS. 2 and 4, to a solenoid 162 carried by arms 163 depending from the horizontal mounting plate 130. A return tension spring 164 extends between the armature of the solenoid 162 and the horizontal mounting plate 130. A pair of switches 165 and 166 are mounted on a plate 167 that is carried by an arm 168 of a bracket 169 that is in turn mounted on the vertical mounting plate 49. An actuating arm 170 on the switch 165 is adapted to be moved by the actuation of the solenoid 162 for actuating the switches 165 and 166, the function of which will hereinafter appear.

In the operation of the pattern enlarging mechanism to expand the pattern, the solenoid 162 is energized, which, through the crank arm 160, shaft 152, crank 151 and links 145, advances the outer portions 136 of the expandable upper pattern 133. As the portions 136 are moved forwardly, they will initially advance the center portion 135 into the stop position determined by engagement of the end 142 of the arm 141 with the forward edge of the aperture 143. Thereafter, upon continued movement of the outer portions 136, they are forced outwardly by the connection 137. When the solenoid 162 is de-energized, the pattern is collapsed by the spring 148 which retracts the outer sections 136.

The trolley 66 is biased to maintain the wheel 128 in engagement with the peripheral pattern surfaces of the patterns 131 and 133 by a rod 171 arranged parallel to the rod 51 and extending loosely through the side bars 37 and 38 of the traversing frame 36. The ends of the rod 171 are extended beyond the side bars 37 and 38 to provide free ends upon which are mounted compression springs 172 that act between the side bars 37 and 38 and abutments 173 at the ends of the rod. The springs 172 are thus opposed and react to center the rod 171 resiliently or, in other words, to resist resiliently any endwise motion of the rod 171. Mounted on the rod 171 between the side bars 37 and 38 are a pair of abutments 174, FIG. 5, each having a finger 175 adapted to enter into any one of a plurality of transverse slots 176 in the rod 171 to hold the abutments in adjusted position endwise of the rod 171. A spring 177 acts to pivot the abutments 174 to hold the finger 175 in the selected one of the slots 176. The slide element 52 has end plates 178 at the opposite ends of the sleeve 53, which end plates are formed with laterally extending ears 179, FIG. 4, that are adapted to engage the respective one of the abutments 174. The abutments 174 are disposed in position to engage the ears 179 before the end of the lateral motion of the slide element so that the final lateral movement moves the rod 171 endwise against the action of the opposite spring 172. Thus, the rod 171 is resiliently biased laterally to hold the wheel 128 against the pattern surface of the operative one of the patterns 131 and 133 during the movement of the trolley 66 endwise of the machine 77. The abutments 174 are adjustable to provide for cuffs of varying lengths. For holding the wheel 128 against the pattern surface while the trolley is moving laterally, there is provided a plunger 180, FIGS. 3 and 4, mounted on the upstanding arm 58 of the slide element 59 for endwise movement. The plunger 180 is biased inwardly toward the trolley 66 by a compression spring 181 acting between the arm 58 and an abutment 182 on the inner end of the plunger. The plunger 180 is adapted to be engaged by the end of a rod 183 mounted in the trolley 66 for endwise adjustment to provide cuffs of varying widths. This rod 183 is adjusted to engage the plunger 180 so that the final endwise movement of the trolley 66 will move the plunger 180 against the action of the spring 181, thus resiliently biasing the wheel 128 against the pattern surface. At the corners, both the plunger 180 and the rod 171 are operative to hold the wheel 128 against the pattern surface.

With reference to FIGS. 14 and 15, the rough contour seam S2 runs to the unstitched edge of the cuff at both the beginning and at the end of the seam, i.e., from the point P1 to the point P2, whereas the finish contour seam S3 must begin and end exactly on the seam S1, as indicated at the points P3 and P4 which are the beginning and ending respectively of the seam S. The trolley 66 with the work carrying plate 68 must therefore be shifted at the completion of the rough sewing operation from the position where it stopped, which is with the point P2 at the point of stitch formation, to the position for the beginning of the finish contour sewing operation, which is with the point P3 at the point of stitch formation. In the same manner, at the completion of the finish contour sewing operation, the trolley 66 must be moved so that the point P1 rather than the point P4 is the point of stitch formation.

To accomplish this shifting of the trolley 66, there is provided a right trolley shifting mechanism 184, FIG. 6, that is operative at the completion of the rough sewing operation, and a left trolley shifting mechanism 185 that is operative at the completion of the finish sewing operation.

The right trolley shifting mechanism 184, FIGS. 5 and 6, comprises a solenoid 186 mounted upon a bracket 187 carried by the vertical mounting plate 49. The armature of the solenoid 186 is pivotally connected to an intermediate point on a lever 188 that is pivotally mounted on a vertical axis at the one end of a bracket 189 carried by the plate 49. The other end of the lever 188 is pivotally connected to the rear end of a slide bar 190 which is guided and supported by a pair of rollers including an underlying horizontal axis roller 191 and a laterally disposed vertical axis roller 192 that are carried by the arm 168 of the bracket 169. A spring wire 193 is disposed at the joint between the lever 188 and the slide bar 190 for biasing them angularly thereby to hold the slide bar 190 against the roller 192. The slide bar 190 is biased in the return direction by a coil tension spring 194. The slide bar 190 is formed with a cam face 195 that is adapted to engage a roller 196 on the drive shaft 127 of the trolley 66 and thus to force the trolley 66 away from the expansible pattern 133 for removing the wheel 128 from engagement with the rubber surface 134 thereof to permit shifting of the trolley 66 relatively to the pattern 133. Mounted on the slide bar 190 immediately behind the cam face 195, is an arm 197 that is adapted to engage the roller 196 and thus move the trolley 66 forwardly to place the point P3 laterally opposite the point of stitch formation. When the pattern 133 collapses upon de-energizing the solenoid 162, the trolley 66 is moved by the springs 172 inwardly to place the wheel 128 against the fixed pattern 131 to place the point P3 at the point of stitch formation. Thus, when the solenoid 186 is energized, the slide bar 190 is moved forwardly, the cam face 195 acting first to engage the roller 196 and force the wheel 128 away from the pattern 133 and the arm 197 then engaging the roller 196 to move the trolley forwardly, and when the pattern 133 is collapsed, the trolley 66 moves inwardly. The stroke of the armature of the solenoid 186 is limited and thus determines the stop position of the slide bar 190, adjustment of which is obtained by adjusting the solenoid 186 on the bracket 187.

The left trolley shifting mechanism 185, comprises a solenoid 198 mounting upon a bracket 199 carried at the rear of the vertical mounting plate 49. The armature of the solenoid 198 is connected to one end of a link 200 that extends through an aperture in the plate 49 and has the other end connected to an intermediate point on a bar 201. One end of the bar 201 is pivotally connected to a link 202 that is in turn pivotally connected to an intermediate point on a lever 203 that is pivotally mounted at one end on a vertical axis stud 204 mounted on a bracket 205 carried by the mounting plate 49. A roller 206 is mounted upon the free end of the lever 203 and is adapted to engage against the roller 196 on the drive shaft 127 of the trolley 66, as seen in FIG. 6A. The end of the bar 201 opposite from the end connected to the link 202 is pivotally connected to an arm 207 of a piece 208 that also includes integral with the arm 207, a bar 209 and an arm 210 on the end thereof opposite from the arm 207. The piece 208 is pivotally mounted in a vertical axis stud 211 mounted on the bracket 204 for swinging movement about the end of the arm 210. The free end of the arm 210 is connected to one end of a bar 212 which at its other end is connected to an anchor link 213 pivotally mounted on a vertical axis stud 214 mounted on the bracket 205. A spring 215 biases the left trolley shifting mechanism 185 to the return position against a stop 216.

When the trolley 66 approaches the end of the right start sewing operation, the wheel 128 is on the pattern 131, as seen in FIG. 6A, and comes to rest with the point P4 at the point of stitch formation. The trolley is then shifted by the left trolley shifting mechanism 185 to place the point P2 at the point of stitch formation to begin the succeeding left start sewing operation. In operation of the left trolley shifting mechanism 185, when the solenoid 198 is energized, the link 200 is drawn rearwardly to swing the lever 203 until the roller 206 engages the roller 196 and to swing the piece 208 until the bar 212 engages the roller 196. With the wheel 128 in engagement with the fixed pattern 131, there is resistance to further movement of the lever 203, which through the link 202, anchors the one end of the bar 201. The solenoid 198 then acts through the link 200 to pivot the bar 201 and the piece 208, which swings the arm 210 about the stud 211 to move the bar 212 outwardly of the pattern 131 thereby forcing the wheel 128 away from the pattern. As soon as the wheel 128 is off the pattern 131, the trolley can be moved relatively thereto so that further action of the solenoid 198 through the lever 203 moves the trolley to place the point P2 laterally opposite the point of stitch formation. When the pattern 133 is expanded, the trolley is forced laterally to move the point P2 to the point of stitch formation.

To facilitate loading the cuffs, there is provided at the left start sewing position an edge guide 217, FIG. 3, for the side of the work and an edge guide 218 for the front edge of the work. The guide 218 is mounted on the table for sliding movement and is biased by a spring 219 toward the work supporting plate 68. On the front edge of the guide 218, there are a pair of spacers 220 which engage against the edge of the plate 68. The guide 218 is set so that when the plate 68 is in the left start position, spring 219 is stressed, thus insuring that the guide is in proper position relatively to the plate. At the right start position, there is provided an edge guide 221 which, like the guide 218, is mounted for sliding movement and is biased toward the plate 68 by a spring 222 and has spacers 223 that engage against the edge of the plate 68. The guide 221 yields for completion of the left start sewing operation and follows the plate 68 as it is shifted to the left start position.

On the table top 1, there are provided a plurality of anti-friction balls 224 to facilitate movement of the work supporting plate 68 over the same.

The various elements of the machine are controlled as is hereinafter fully described with reference to FIG. 16 by electrical components that are mounted in a box 225, FIG. 1, mounted on the legs 3 of the support, and by a plurality of switches mounted on the machine. For clarity, the electrical wiring of the machine has not been shown in the drawings but will be obvious from FIG. 16. The switches, in addition to the switches 23, 165 and 166 referred to above, include a pair of push button switches 226 and 227 mounted upon the opposite sides of the table top 1. The switch 226 is the left start switch for initiating the left start or rough contour sewing

operation and the switch 227 is the right start switch for initiating the right start or finish contour sewing operation. Adjacent to the right start switch 227 is an emergency switch 228. A right limit switch 229 and a right auxiliary limit switch 230 are mounted on a platform 231 carried by posts 232 that are mounted on the top of the mounting plate 49 and are disposed in position to be engaged by a tripping arm 233, FIG. 4, on the trolley 66. A left limit switch 234 is mounted upon the end of an arm 235 pivoted for swinging movement about a vertical axis on a bracket 236 on the edge of the table top 1. A spring 237 biases the arm 235 toward the trolley 66 to a stop position determined by a stop arm 238. A left auxiliary limit switch 239 is carried by a platform 240, FIG. 4, that is mounted on a post 241 secured to the mounting plate 49.

Circuit

With reference to the schematic-circuit diagram, FIG. 16, power is supplied to the motor 28 of the transmitter 26 from a 220 volt source by the lines 242 through an on-off switch 243 and the leads 244. Power is supplied to the remainder of the machine from a 110 volt source by the lines 245 through an on-off switch 246 and leads 247 and 248 which are hereinafter referred to as the common 247 and the ground 248.

Cycling of the machine from the left start position and from the right start position is controlled respectively by a left start relay 249 and a right start relay 250. The left start relay 249 includes a pair of normally closed contacts 251 and three pairs of normally open contacts 252, 253 and 254, and a coil 255 which, when energized, opens the contacts 251 and closes the contacts 252, 253 and 254. The right start relay 250 includes two pairs of normally closed contacts 256 and 257 and two pairs of normally open contacts 258 and 259, and a coil 260 which, when energized, opens the contacts 256 and 257 and closes the contacts 258 and 259. These contacts are hereinafter referred to as follows: 251 and 257 are brake contacts, 253 and 259 are clutch contacts, 254 and 259 are holding contacts, 252 are gear shift contacts, and 256 are interlock contacts.

The brake contacts 251 are connected at one side to the common 247 and at the other side by a lead 261 to one side of the brake contacts 257, the other side of which is connected to a lead 262. With the brake contacts 251 and 257 connected in series, power is delivered from the common 247 to the lead 262 only when both of the contacts 251 and 257 are closed and it is off the lead 262 when either of the contacts 251 or 257 are open.

The lead 262 is connected first to the brake coil 31 of the double acting solenoid 29 of the transmitter 26, the other side of which coil 31 is connected to the ground 248. Thus, the brake is applied to stop the operation of the sewing machine whenever both of the brake contacts 251 and 257 are closed and the brake is released whenever either of these contacts are open.

The lead 262 is also connected to one side of the coil 263 of the needle positioner relay 264, the other side of which is connected to the ground 248. The relay 264 includes a pair of normally open contacts 265 which are closed when the coil 263 is energized. The contacts 265 are connected by leads 266 with the needle positioner 35 which is also connected to the power leads 247 and 248. When the contacts 265 are closed, the needle positioner 35 is actuated and it is thus actuated simultaneously with the actuation of the brake of the transmitter.

The lead 262 is further connected to the solenoid 82 of the relief valve 80 of the vacuum mechanism of the work holder, the opposite side of which is connected to the ground 248. Thus, when the brake solenoid 31 is energized and the sewing operation is stopped, the solenoid 82 is energized to open the valve 80 thereby relieving the vacuum that holds down the rubber flap 70 of the work holder.

The clutch coil 32 of the double acting transmitter solenoid 29 is adapted to be energized alternatively by parallel circuits, the coil 32 being connected at one side to the ground 248 and at the other side to a lead 267 having parallel branches that are connected to one side of the clutch contacts 253 and 258 of the start relays 249 and 250. The other side of the clutch contacts 253 of the left start relay 249 is connected by a lead 268 to one side of one switch 269 of the emergency switch 228 and also to one side of the holding contacts 254. The other side of the emergency switch 269 is connected by a lead 270 with one side of the normally closed right limit switch 229, the other side of which is connected to the common 247. The lead 270 is also connected to one side of the interlock contacts 256 of the right start relay 250, the other side of which is connected by a lead 271 with one side of the normally open left start switch 226 which, in turn, has the other side thereof connected by a lead 272 to one side of the coil 255 of the left start relay 249 which is connected at its other side to the ground 248. Thus, when the left start switch 226 is closed, power from the common 247 is delivered to the coil 255 through the right limit switch 229, lead 270, interlock contacts 256, lead 271, left start switch 226 and lead 272. Upon energization of the coil 255, contacts 251 are opened to remove power from the lead 262, thus de-energizing the brake coil 31, vacuum relief solenoid 82, and needle positioner relay coil 263, and contacts 252, 253 and 254 are closed. Power from the common 247 is then supplied to the coil 255 through the right limit switch 229, lead 270, emergency switch 269, lead 268 and holding contacts 254. The left start switch 226 can now be released and the machine will continue to run until the right limit switch 229 is opened by the tripping arm 233 on the trolley 66 at the end of the left start or rough sewing operation. During this time, the clutch coil 32 of the transmitter is energized from the common 247 through the right limit switch 229, lead 270, emergency switch 269, clutch contacts 253 and lead 267. The interlock contacts 256, which are connected in series with the left start switch 226, insure that the left start sewing operation cannot inadvertently be initiated while the machine is performing a right start sewing operation.

The lead 267 is also connected to one side of the coil 273 of the presser lifter relay 274, the other side of which is connected to the ground 248. In order to obtain a time delay to insure that the sewing machine has completely stopped and the needle has been raised by the needle positioner before the presser lifter mechanism is actuated to raise the presser foot 16, the lead 267 is connected through a rectifier 275 and resistance 276 to the coil 273 and through a resistance 277 to one side of a condenser 278, the other side of which is connected to the ground 248. To actuate the presser lifter mechanism, the relay 274 includes a pair of normally closed contacts 279 that are closed when the coil 273 is de-energized. The contacts 279 are connected at one side to the common 247 and at the other side by a lead 280 to one side of a coil 281 of the presser lifter solenoid 20, the other side of which is connected to the ground 248. When the coil 281 is thus energized, the presser foot of the sewing machine is raised. Due to the energy stored in the condenser 278, the coil 273 is not immediately de-energized when power is removed from the lead 267, thus providing the aforementioned delay in closing the contacts 279.

Closing of the gear shift contacts 252 actuates the gear shift mechanism to effect a forward drive of the traverse mechanism, i.e., drive of the traverse mechanism from its left start position to its right start position, or in other words, through the rough sewing operation. To actuate the gear shift mechanism, the contacts 252 are connected at one side to the common 247 and at the other side by a lead 282 with one side of a coil 283 of a gear shift relay 284, the other side of which coil 283 is connected to the ground 248. The relay 284 includes two pairs of

normally open contacts 285 and 286 which are closed when the coil 283 is energized. One side of the contacts 285 are connected by a lead 287 to one side of the coil 288 of the gear shift solenoid 289, the other side of which is connected to the ground 248. The one side of the contacts 286 is connected to the lead 282 while the other side is connected by a lead 290 to the side of the contacts 285 opposite from the lead 287. Thus, when the gear shift contacts 252 of the relay 249 are closed, power from the common 247 is directed to the coil 283 of the gear shift relay 284 through the contacts 252 and lead 282. Upon energization of the coil 283, the contacts 285 and 286 are closed and power is then directed to the coil 288 of the gear shift solenoid 105 through the contacts 252, lead 282, contacts 286, lead 290, contacts 285 and lead 287.

Since stopping of the sewing machine is not instantaneous, there is a certain amount of coasting after the brake contacts 251 have been closed. Opening of the gear shift contacts 252 occurs simultaneously in the relay 249 with the closing of the brake contacts 251 so that the gears would be shifted immediately and the coasting will drive the traverse mechanism in reverse position at which it stops at the end of the left start sewing operation. To avoid this, there is provided a holding circuit for the gear shift relay. To establish the holding circuit, the lead 290, which is connected to the one side of the contacts 285 and 286 is also connected to one side of a pair of normally closed contacts 291 on the right start switch 227 which also includes a pair of normally open starting contacts 292. The other side of the contacts 291 is connected by a lead 293 to a normally closed contact 294 on the left limit switch 234 which also includes a normally open contact 295 and a common contact 296 that is connected to the common 247. Since, upon approaching the right start position, the contact 294 is closed, power is supplied from the common 247 to the coil 283 of the gear shift relay 284 through the contact 294, lead 293, contacts 291, lead 290 and contacts 286. Power is supplied simultaneously to the coil 288 of the gear shift solenoid 105 from the lead 290 through the contacts 285 and lead 287. The gear shift solenoid 105 will thus remain energized until the right start switch 227 is actuated.

To start the machine from the right start position, or in other words, to initiate the finish sewing operation, the right start switch 227 is depressed to open the contacts 291, thus de-energizing the gear shift mechanism to shift the gears to reverse feed, and to close the start contacts 292. The one side of the contacts 296 is connected to the lead 293 and is thus connected to the common 247 through the normally closed contact 294 of the left limit switch 235. The other side of the contacts 292 is connected by a lead 297 to one side of the coil 260 of the right start relay 250, the other side of which is connected to the ground 248. The coil 260 is thus energized from the common 248, through the contact 294, lead 293, contacts 292, and lead 297, and acts to open the interlock contacts 256 and brake contacts 257 of the right start relay 250 and to close the clutch contacts 258 and holding contacts 259. Upon closing of the holding contacts 259, a holding circuit is established for the coil 260, which circuit comprises a second switch 298 of the emergency switch 228 connected at one side to the lead 293 and at the other side by a lead 299 to one side of the holding contacts 259 which are connected at the other side to the lead 297 and thus to the coil 260. When the holding contacts 258 are closed, the coil 260 is energized through the contact 294 of the left limit switch 234, lead 293, emergency switch 298, lead 299, and holding contacts 259. The right start switch 227 can now be released and the machine will continue to run until the contact 294 of the left limit switch 234 is opened at the end of the finish sewing operation. During this time, the clutch coil 32 of the transmitter solenoid 26 is energized from the common 247, through the contact 294, lead 293, emergency switch 298, lead 299, clutch contacts 258 and lead 267.

The pattern enlarging solenoid 162 includes a coil 300 which, when energized, actuates the pattern enlarging mechanism to provide the large pattern for the rough sewing operation, which is the left start operation. Thus, the coil 300 is designed to be energized continuously during the rough sewing operation. To energize the coil 300, there is provided a normally closed pair of contacts 301 associated with the presser lifter mechanism which are closed when the presser foot of the sewing machine is down. The contacts 301 are connected at one side to the common 247 and at the other side to a lead 302. A parallel source of power is provided for the lead 302 through the normally closed auxiliary right limit switch 230 which is connected at one side to the common 247 and at the other side to the lead 302. The lead 302 is connected to one side of the normally open auxiliary left limit switch 239 which is connected at its other side by the lead 303 to one side of a coil 304 of a first pattern enlarging relay 305, the other side of which coil 304 is connected to the ground 248. The relay 305 has two pairs of normally open contacts 306 and 307. The contacts 306 constitute holding contacts for the coil 304 and are connected at one side to the lead 302 and at the other side to the lead 303 and thus to the one side of the coil 304. The contacts 307 are connected at one side to the common 247 and at the other side by a lead 308 through a delay circuit to a coil 309 of a second pattern enlarging relay 310, the delay circuit comprising a rectifier 311 and resistance 312 connected in series between the lead 308 and a lead 313 that is connected to the coil 309 and to a condenser 314 that are connected at their opposite sides to the ground 248. The relay 310 includes a pair of normally open contacts 315 that are connected at one side to the lead 308 and at the other side by a lead 316 to one side of the coil 300 of the pattern enlarging solenoid which is connected at its other side to the ground 248.

The left trolley shaft solenoid 198 includes a coil 317 that is connected to the ground 248 and to a lead 318 that is also connected to one side of a pair of normally open contacts 319 of a left trolley shift relay 320, the other side of which contacts 319 is connected to the lead 302. The relay 320 includes a coil 321 which, when energized, closes the contacts 319. The coil 321 is connected at one side to the ground 248 and at the other side to a lead 322 that is also connected to one side of a pair of normally closed contacts 323 in the switch 165 which is associated with the pattern enlarging solenoid 162 and adapted to be opened when the solenoid 162 is actuated by energization of the coil 300. The other side of the contacts 323 is connected by a lead 324 to one side of a pair of normally open contacts 325 which, like the contacts 301, are associated with the presser lifter mechanism. The contacts 325 are designed to be closed when the presser lifter solenoid 20 is actuated by energization of the coil 281. The other side of the contacts 325 is connected by a lead 326 to the normally open contact 295 of the left limit switch 234.

The right trolley shift solenoid 186 includes a coil 327 that is connected at one side to the ground 248 and at the other side by the lead 328 to one side of a pair of normally closed contacts 329 of the switch 166 which, like the switch 165, is associated with the pattern enlarging solenoid 162 and is adapted to be closed when the solenoid 162 is actuated by energization of the coil 300. The other side of the contacts 329 are connected to the lead 267 so that the coil 327 will be energized whenever the brake coil 31 is energized and the contacts 329 are closed.

Operation

Connected in this manner, when the traverse mechanism approaches the end of the right start or finish sew-

ing operation, it initially engages the left limit switch 234 to open the contact 294 and close the contact 295. Opening the contact 294 de-energizes the coil 260 of the right start relay 250 which opens the clutch contacts 258 to stop the sewing machine drive and closes the brake contacts 257 to apply the brake and thus bring the sewing machine to a stop. Simultaneously with applying the brake, the needle positioner is actuated. Simultaneously with de-energizing the clutch coil 32, power is removed from the presser lifter relay so that after a time delay determined by the condenser 278, the coil 277 is de-energized to close the contacts 279, and energize the coil 281 to raise the clamp. Since the contact 295 of the left limit switch 234 is now closed, as soon as the presser lifter is actuated to raise the presser and thus close the contacts 325, power is delivered from the common 248 to the coil 321 of the left trolley shift relay 320 through the contact 295, lead 326, contacts 325, lead 324, contacts 323, and lead 322. The contacts 319 of the left pattern shift relay 320 are thus closed and power is delivered to the coil 317 of the left pattern shift solenoid 198 from the common 248 through the right auxiliary limit switch 230 (the contacts 301 now being open with the clamp raised), lead 302, contacts 319, and lead 318. The left pattern shift mechanism is thus actuated to move the trolley from the position at which it stopped at the completion of the right start sewing operation into the starting position for the left start sewing operation.

The final motion of the traversing mechanism as it is moved by the left pattern shift mechanism closes the left auxiliary limit switch 239, thus supplying power to the coil 304 of the first pattern enlarging relay 305 from the common 247, through the right auxiliary limit switch 230, lead 302, left auxiliary limit switch 239 and lead 303. Upon energization of the coil 304, the contacts 307 are closed, which establishes the circuit for the coil 309 of the second pattern enlarging relay 310 from the common 247 through the contacts 309, lead 308, rectifier 311, resistance 312, and lead 313 which, in order to obtain a time delay in the energization of the coil 309, is connected by parallel branches to the condenser 314 and coil 309. Upon energization of the coil 309, the contacts 315 are closed and power is delivered to the coil 300 of the pattern enlarging solenoid 162, thus actuating the pattern enlarging mechanism.

The holding contacts 306 of the first pattern enlarging relay 305 are closed simultaneously with the closing of the contacts 307 upon energization of the coil 304, thus establishing the holding circuit for the coil 304 from the common 247 through the right auxiliary limit switch 230, lead 302, contacts 306 and lead 303. The coil 300 of the pattern enlarging solenoid 162 is thus energized independently of the left auxiliary limit switch.

When the pattern enlarging mechanism is actuated by energization of the coil 300, the contacts 323 are opened, thus breaking the circuit of the coil 321 of the left trolley shift relay 320, which opens the contacts 319 and in turn breaks the circuit of the coil 317 of the left pattern shift solenoid 198 and collapses the left pattern shift mechanism. At the same time, the contacts 329 are opened to deenergize the coil 327 of the right trolley shift solenoid 186, which was energized from the line 262 when the brake contacts 257 were closed. In the right start sewing operation, the actuation of the right trolley shift mechanism constitutes an idle stroke.

The machine is now in starting condition for the left start sewing operation. As noted above, this operation is initiated by closing the left start switch 226 which, through the right limit switch 229 and the interlock contacts 256 of the right start relay 250, energizes the coil 255 of the left start relay 249 and thereby opens the brake contacts 251 and closes the gear shift contacts 252, clutch contacts 253, and holding contacts 254. Opening the brake contacts de-energizes the brake coil 31 of the transmitter solenoid thus releasing the brake and de-energizes the coil 263 of the needle positioner relay to release the needle positioner. Closing of the clutch contacts 253 energizes the clutch coil 32 of the transmitter solenoid through the right limit switch 229 and the emergency switch 269 and thereby engages the sewing machine drive, and de-energizes the coil 273 of the presser lifter relay 274 and thus de-energizes the coil 281 of the presser lifter solenoid 20 to lower the presser foot of the machine. Lowering the presser foot of the machine, closes the contacts 301 which establishes the power source to the lead 302 parallel to the auxiliary right limit switch 230 and opens the contacts 325. Closing of the gear shift contacts 252 energizes the coil 283 of the gear shift relay 284, which not only energizes the coil 288 of the gear shift solenoid 105, but also establishes the holding circuit for the coil 283 through the contacts 291 of the right start switch 227 and the contact 294 of the left limit switch 234. Closing of the holding contacts 254 establishes the holding circuit for the coil 255 through the right limit switch 229 and the emergency switch 269.

The sewing machine thus runs through the left start sewing operation. The initial motion of the traverse mechanism in this operation opens the left auxiliary limit switch 239, but the pattern shift solenoid 162 remains energized by virtue of the holding circuit through the holding contacts 306 of the first pattern shift relay 305, which in turn receives power alternatively by parallel circuits through the right auxiliary limit switch 230 and the contacts 301 associated with the clamp lifter mechanism. The motion of the traverse mechanism then releases the left limit switch 234 which opens the contact 295 and closes the contact 294. Since the left trolley shift mechanism 185 had previously been released by opening of the contacts 323 associated with the trolley shift mechanism, opening the contact 295 only resets it for the succeeding right start operation. Closing of the contact 294 resets it relatively to its function in the succeeding right start operation and also establishes the parallel holding circuit for the gear shift mechanism through the contacts 291 of the right start switch 227.

At the end of the left start sewing operation, the trolley mechanism engages and opens the right limit switch 229 and the right auxiliary limit switch 230. Opening the right auxiliary limit switch 230 has no immediate effect since the contacts 301 associated with the presser lifter mechanism remain closed and supply power to the lead 302 to hold the pattern shift mechanism in operation. Opening the right limit switch 229 breaks the holding circuit of the coil 255 of the left start relay 249, thus de-energizing the coil 255 to open the contacts 252, 253 and 254 and to close the contacts 251. Upon opening the holding contacts 254, the coil 255 is taken out of the circuit so that it can be energized only by closing the left start switch 226. Closing the brake contacts 252 of the left start relay 249 directs power through the brake contact 256 of the right start relay 250 to the lead 262 which directs it to the brake coil 31 of the transmitter solenoid to apply the brake to the coil 263 of the needle positioner relay 264 to actuate the needle positioner. Opening the clutch contacts 253 de-energizes the clutch coil 32 of the transmitter solenoid to stop the sewing machine drive, and through a time delay, de-energizes the coil 273 of the presser lifter relay 274. Since the coil 300 of the pattern enlarging solenoid 162 is still energized, the contacts 329 are open and the coil 327 of the right trolley shift solenoid 186 is not energized immediately. Opening the gear shift contacts 252 has no immediate effect since the contact 294 of the left limit switch 234 and the contacts 291 of the right start switch 227 provide an alternate source of power for the gear shift relay 284 and the gear shift solenoid 289.

When the presser lifter mechanism of the sewing machine is actuated to raise the presser foot, the contacts 326 are closed and the contacts 301 are opened. Closing the contact 326 has no effect in this position of the traverse

mechanism since the contact 295 of the left limit switch 234 and the contacts 323 associated with the pattern enlarging solenoid 162 with which it is in series are open. Opening the contacts 301, with the right auxiliary limit 230 already open, removes the source of power for the lead 302, thus deenergizing the coil 304 of the first pattern enlarging relay 305 which de-energizes the coil 309 of the second pattern enlarging relay 310 which in turn de-energizes the coil 300 of the pattern enlarging solenoid 162 to provide the reduced pattern for the right start operation, and also breaks the holding circuit for the coil 304 so that it can be energized only by closing the left auxiliary limit switch 239. As the pattern enlarging solenoid 162 is de-energized, the contacts 323 and 329 are closed. Since the contact 295 of the left limit switch 234 is open, closing the contact 323 has no effect. Closing the contact 329 energizes the coil 327 of the right trolley shift solenoid 186, to move the traverse mechanism from the stopping position at the end of the left start sewing operation to the starting position for the beginning of the right start sewing operation. This movement of this traverse mechanism permits the right limit switch 229 and the right auxiliary limit switch 230 to close which resets them for the succeeding left start operation.

The machine is now in starting condition for the right start sewing operation which is initiated by actuation of the right start switch 227. When the contacts 291 of the right start switch 227 are opened, the coil 283 of the gear shift relay 284 is de-energized which shifts the gears to reverse drive and also breaks the holding circuit for the coil 283 so that it can be energized again only by closing the gear shift contacts 252 of the left start relay 249. When the contacts 292 of the right start switch 227 are closed, the coil 260 of the right start relay 250 is energized through the contact 294 of the left limit switch 234 and the contacts 292. Upon energization of the coil 260, the contacts 256 and 257 are opened and the contacts 258 and 259 are closed. Opening the interlock contacts 256 prevents inadvertent initiation of the left start sewing operation while the machine is performing a right start sewing operation. Opening the brake contacts 257 releases the brake of the transmitter, de-energizes the needle positioner, and de-energizes the right trolley shift mechanism. Closing the clutch contacts 258 energizes the clutch coil 32 of the transmitter solenoid through the contact 294 of the left limit switch 234 and the emergency switch 269 and lowers the presser foot. Upon lowering the presser foot, the contacts 325 are opened and thus reset for actuation of the left trolley shift mechanism when the work clamp is raised at the end of this the right start sewing operation, and the contacts 301 are closed which applies power to the lead 302 but which has no effect since the elements actuated by this lead are all disconnected in that the left auxiliary limit switch 239 and contacts 306 and 319 are open. Closing the holding contacts 258 establishes the holding circuit for the coil 260 through the contact 294 of the left limit switch 234 and the emergency switch 269. The right start switch 227 can now be released and the machine will continue to cycle through the right start sewing operation.

As outlined above, upon completion of the right start sewing operation, the left limit switch 234 is first engaged to de-energize the coil 260 of the right start relay 250, thus simultaneously de-energizing the clutch coil 32 of the transmitter solenoid and, after a time delay, de-energizing the coil 273 of the presser lifter 274, and energizing the brake coil 31 and the needle positioner coil 263. Upon raising the presser foot, the contacts 325 are closed to energize the coil 321 of the left trolley shift relay 320 which actuates the left trolley shift mechanism and thus moves the trolley 66 to its left start position. This movement closes the left auxiliary limit switch 239 which energizes the coil 304 of the first pattern enlarging relay 305 which, after a time delay, actuates the pattern enlarging solenoid 162 through the second pattern enlarging relay 310. Actuation of the pattern enlarging solenoid 162 opens the contacts 323 and 329 and thus de-energizes the left and the right trolley shift solenoids 198 and 186. The machine is now reset for the succeeding left start sewing operation.

Having thus described the nature of the invention, what we claim herein is:

1. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, and a traverse mechanism for carrying work relatively to the point of stitch formation, said traverse mechanism comprising a frame mounted upon said support, a trolley support freely mounted on said frame for linear movement, a trolley freely mounted on said trolley support for linear movement in a direction normal to the direction of movement of said trolley support, pattern means carried by said frame and having a peripheral pattern surface conforming to the desired seam configuration, a wheel journaled in said trolley and adapted to engage the peripheral pattern surface, spring means acting between said frame and said trolley support for biasing the trolley support in the direction of movement thereof and spring means acting between said trolley support and said trolley for biasing said trolley in the direction of movement thereof to hold said wheel in resilient engagement with the peripheral pattern surface, and means for imparting rotation to said wheel for moving said trolley relatively to the point of stitch formation in a path defined by said peripheral pattern surface.

2. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, and a traverse mechanism for carrying work relatively to the point of stitch formation comprising a frame mounted upon said support, a trolley support freely mounted on said frame for linear movement, a trolley freely mounted on said support for linear movement in a direction normal to the direction of linear movement of said trolley support, pattern means carried by said frame and having a peripheral pattern surface conforming to the desired seam configuration, a wheel journaled in said trolley and adapted to engage the peripheral pattern surface, spring means acting between the frame and the trolley support and operative adjacent to each end of the linear movement of the trolley support for biasing the trolley support toward the opposite end, spring means acting between said trolley and said trolley support for biasing said trolley in one direction of linear movement, and drive means for imparting rotation to said wheel for rolling the same about the pattern surface and thereby moving said trolley relatively to the point of stitch formation in a path defined by said peripheral pattern surface.

3. The combination in accordance with claim 2, in which said drive means comprises a flexible and extensible drive shaft to provide for planar movement of said trolley about the seam pattern defined by said pattern means.

4. In a sewing machine for automatically sewing a cuff contour seam on three sides of a cuff comprising a line of stitching extending continuously along one side of the cuff, along the free edge and along the other side edge, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, and a traverse mechanism for carrying the cuff relatively to the point of stitch formation comprising a frame mounted on said support, a trolley support freely mounted on said frame for linear movement, a cuff supporting trolley freely mounted on said trolley support for linear movement in a direction normal to the direction of linear movement of said trolley support, pattern means carried by said frame and having a peripheral pattern surface conforming to the desired cuff contour seam, a wheel journaled in said support and adapted to engage the

peripheral pattern surface, a rod mounted in said frame for endwise sliding movement on an axis parallel to the direction of linear motion of said trolley support, oppositely acting springs between said rod and said frame for resiliently centering said rod and for resisting endwise displacement of said rod in each direction, a pair of abutments on said rod and adapted to be engaged by said trolley support adjacent the opposite ends of the linear movement of the trolley support for biasing the wheel against the pattern surface during stitching of the side edges of the cuff, spring means acting between the trolley support and the trolley for biasing said trolley linearly to hold said wheel against the pattern surface during stitching of the free edge of the cuff, and drive means for imparting rotation to said wheel for rolling the same about the pattern surface and thereby moving said trolley relatively to the point of stitch formation in a path defined by said pattern surface.

5. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, a traverse mechanism including an arm having a work-supporting portion movable in a predetermined stitch pattern relatively to the point of stitch formation, a work-supporting portion having a periphery corresponding to the configuration of the stitch pattern and spaced inwardly from the free edge of the work to define a margin in which the stitching is made, and means for clamping work on the work-supporting portion of said arm comprising a flap of flexible air-impervious material conforming to the configuration of the work-supporting portion of said arm, said flap being secured to said arm along one edge and adapted to overlie the work-supporting portion of said arm, said arm having a hollow interior and a plurality of apertures communicating with the hollow interior and opening on the surface adjacent to said flap about the periphery of the work-supporting portion thereof, and a source of vacuum connected to the hollow interior of said arm.

6. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, a presser mechanism, and a presser lifter mechanism; drive means for said sewing machine, a work carrying traverse mechanism, means mounting said traverse mechanism on said support for movement in a plane parallel to the plane of said bed plate, means operatively connecting said traverse mechanism to said sewing machine drive means for simultaneously imparting actuation to said traverse mechanism upon actuation of said sewing machine, pattern means for controlling the movement of said traverse mechanism relatively to the point of stitch formation to define a seam of predetermined configuration, operator controlled means for initiating operation of said sewing machine drive means, means automatically actuated by said traverse mechanism as the end of the seam for stopping operation of said drive means, and means including a time delay mechanism for actuating said presser lifter mechanism to raise said presser mechanism upon stopping said sewing machine drive and to lower said presser mechanism simultaneously with initiation of actuation of said sewing machine drive.

7. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, drive means for said sewing machine, a work carrying traverse mechanism, means mounting said traverse mechanism on said support for movement in a plane parallel to the plane of said bed plate, pattern means for controlling the movement of said traverse mechanism relatively to the point of stitch formation and defining a discontinuous seam of predetermined configuration, reversible means operatively connecting said traverse mechanism to said sewing machine drive means for simultaneously imparting actuation to said traverse mechanism upon actuation of said sewing machine, operator controlled means for initiating operation of said sewing machine drive means, means automatically actuated by said traverse mechanism at the ends of the seam for stopping actuation of said drive means, and means for effecting reversal of said reversible means upon alternate initiations of said sewing machine drive means whereby said traverse mechanism will be driven in opposite directions from one end of the seam to the other end upon alternate cycles.

8. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, drive means for said sewing machine, a traverse mechanism including a work carrying trolley and means mounting said trolley upon said support for movement in a plane parallel to the plane of said bed plate, pattern means having a peripheral pattern surface defining a discontinuous seam of predetermined configuration, a wheel carried by said trolley, means biasing said trolley to hold said wheel in engagement with said pattern surface, reversible means operatively connecting said wheel to said sewing machine drive means for simultaneously imparting rotation to said wheel upon actuation of said sewing machine, operator controlled means for initiating operation of said sewing machine drive means, means automatically actuated by said traverse mechanism at the ends of the seam for stopping actuation of said drive means, and means for effecting reversal of said reversible means upon alternate initiations of said sewing machine drive whereby said trolley will be driven in opposite directions from one end of the seam to the other end upon alternate cycles.

9. In combination in accordance with claim 8, in which said reversible means comprises a gear driven by said sewing machine drive means, a pair of gears, a shaft carrying said gears and mounted for movement relatively to said gear to place said gears alternately in mesh with said first mentioned gear, and a flexible and extensible drive means from said shaft to said wheel.

10. In combination in accordance with claim 8, in which said pattern means is adjustable for varying the seam defined by the peripheral pattern surface thereof, and means for varying the pattern means upon completion of a seam to provide a different peripheral pattern surface for the succeeding initiation of the sewing machine drive means.

11. In combination in accordance with claim 10, in which said adjustable pattern means comprises a fixed pattern surface and an expansible pattern surface adapted to be enlarged beyond the fixed pattern surface and contracted within the same.

12. In combination in accordance with claim 11, in which said expansible pattern surface comprises a wedge-shaped central portion and a pair of beveled side portions slidably mounted on opposite sides thereof.

13. In combination in accordance with claim 8, in which there are provided trolley shifting mechanisms at the opposite sides of the pattern means, and means for actuating said trolley shifting mechanisms upon completion of a seam to shift said trolley from the stopping point at the end of the seam to the beginning point of the succeeding seam.

14. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, and a traverse mechanism for carrying work relatively to the point of stitch formation comprising a frame mounted upon said support, a trolley support freely mounted on said frame for linear movement, a trolley freely mounted on said support for linear movement in a direction normal to the direction of linear movement of said trolley support, pattern means carried by said frame and having a peripheral pattern surface conforming to the desired seam configuration, a wheel journaled in said trolley and adapted to engage the peripheral pattern surface, spring means acting between the frame and the trolley support and operative adjacent to each end

of the linear movement of the trolley support for biasing the trolley support toward the opposite end and comprising a rod mounted in said frame for endwise sliding movement on an axis parallel to the direction of linear motion of said trolley support, oppositely acting springs between said rod and said frame for resiliently centering said rod and for resisting endwise displacement of said rod in each direction, and abutments on said rod and adapted to be engaged by said trolley support, spring means acting between said trolley and said trolley support for biasing said trolley in one direction of linear movement, and drive means for imparting rotation to said wheel for rolling the same about the pattern surface and thereby moving said trolley relatively to the point of stitch formation in a path defined by said peripheral pattern surface.

15. The combination in accordance with claim 14, in which said abutments are adjustably secured to said rod.

16. In combination, a support, a sewing machine mounted upon said support and having a bed plate and stitching mechanism defining a point of stitch formation on said bed plate, and a traverse mechanism for carrying work relatively to the point of stitch formation comprising a frame mounted upon said support, a trolley support freely mounted on said frame for linear movement, a trolley freely mounted on said support for linear movement in a direction normal to the direction of linear movement of said trolley support, pattern means carried by said frame and having a peripheral pattern surface conforming to the desired seam configuration, a wheel journaled in said trolley and adapted to engage the peripheral

pattern surface, spring means acting between the frame and the trolley support and operative adjacent to each end of the linear movement of the trolley support for biasing the trolley support toward the opposite end, spring means acting between said trolley and said trolley support for biasing said trolley in one direction of linear movement and comprising a plunger carried by said trolley support, a spring for resiliently resisting endwise displacement of said plunger, and a rod carried by said trolley and adapted to engage said plunger, and drive means for imparting rotation to said wheel for rolling the same about the pattern surface and thereby moving said trolley relatively to the point of stitch formation in a path defined by said peripheral pattern surface.

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