May 3, 1966 A. SCHWARZBERGER 3,249,077

PATTERN TRACKING MEANS FOR LINE STITCHING MACHINES

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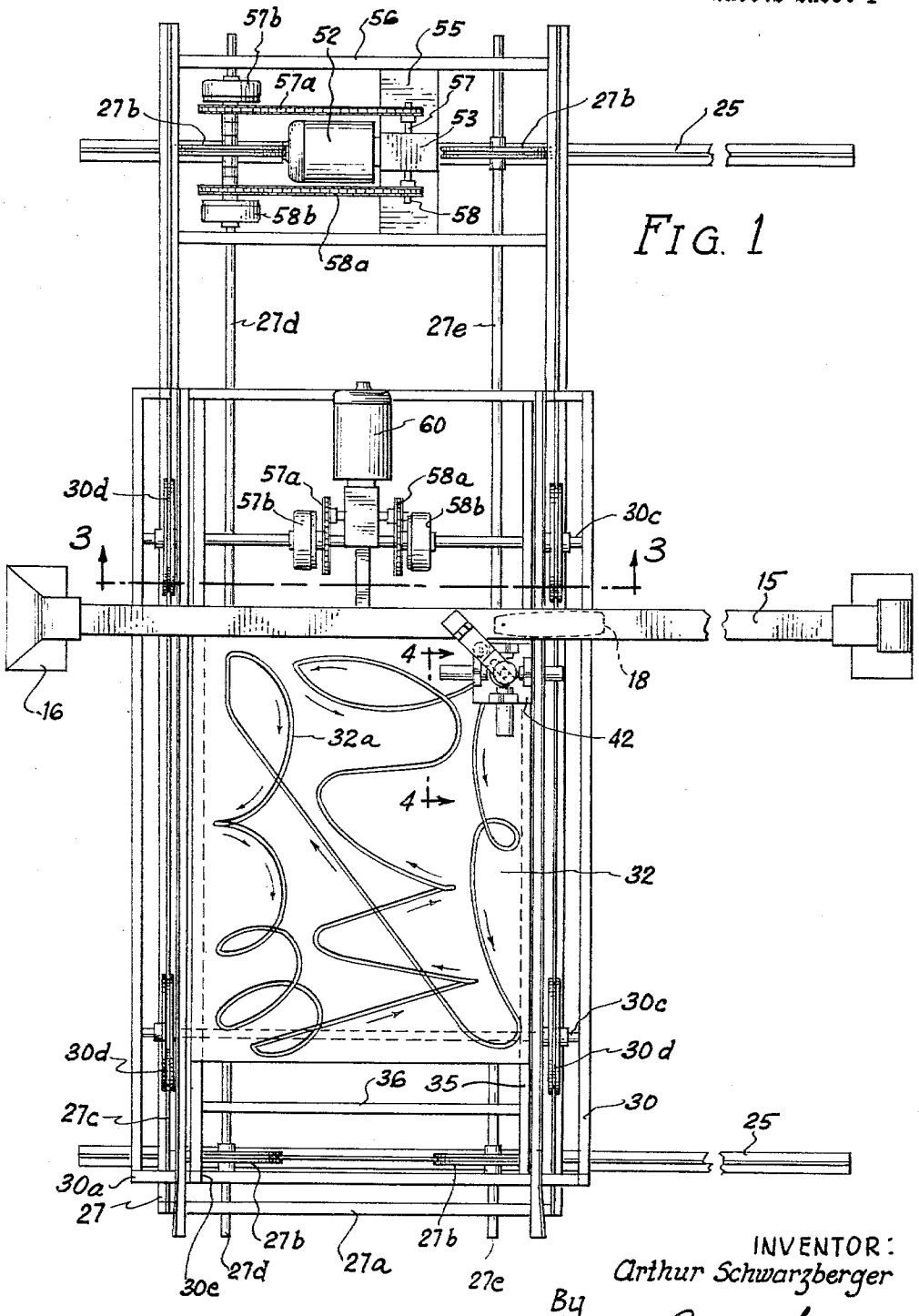


FIG. 1

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FIG. 2

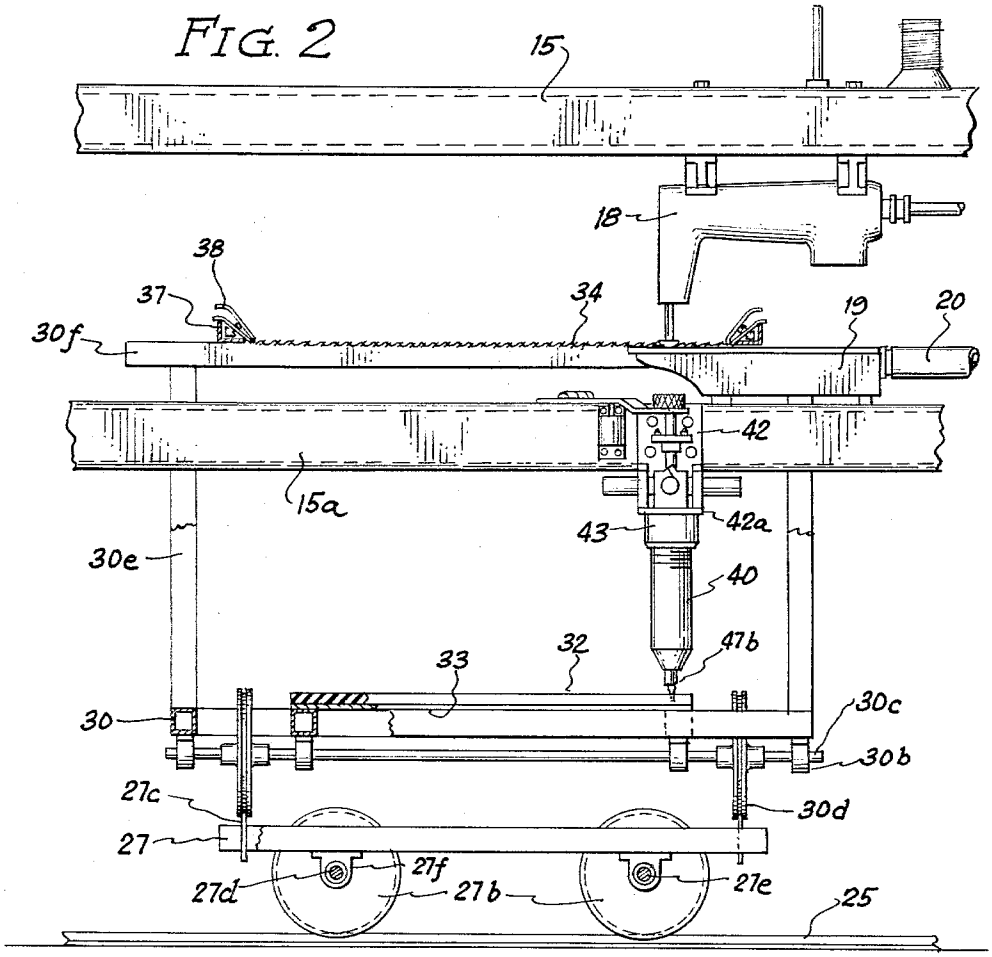
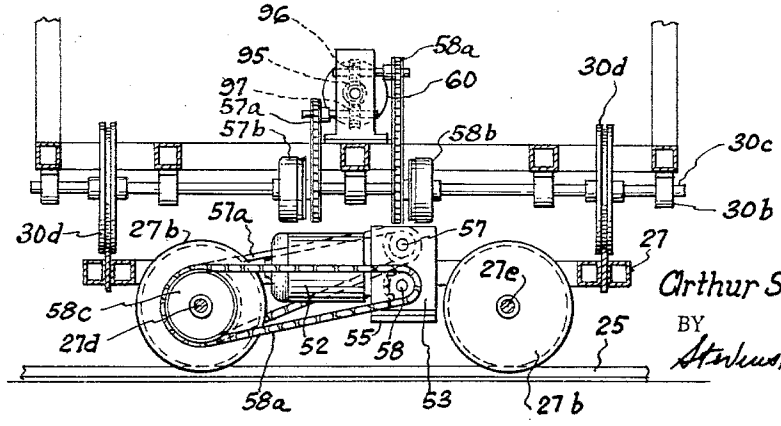


FIG. 3



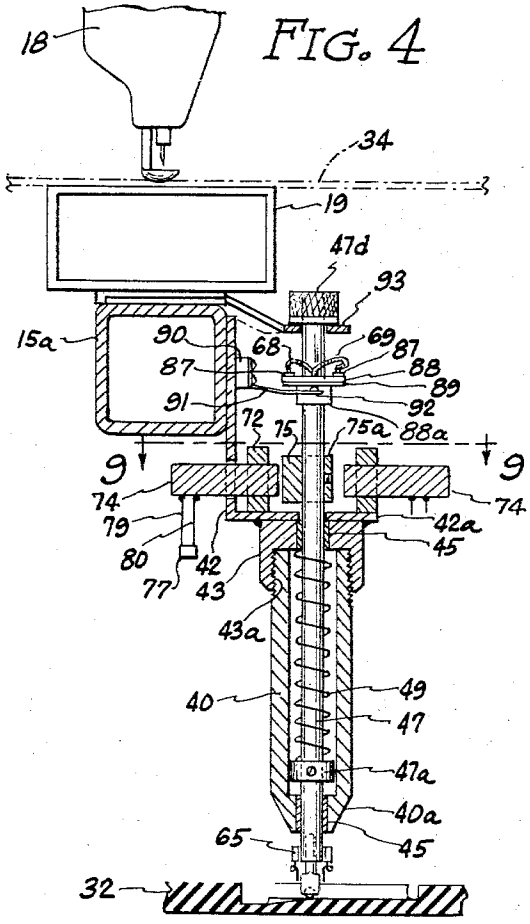
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PATTERN TRACKING MEANS FOR LINE STITCHING MACHINES

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FIG. 4



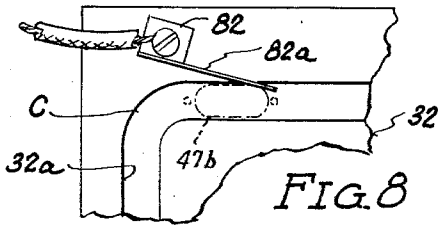


FIG. 8

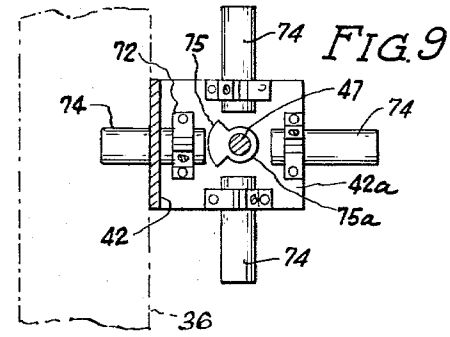
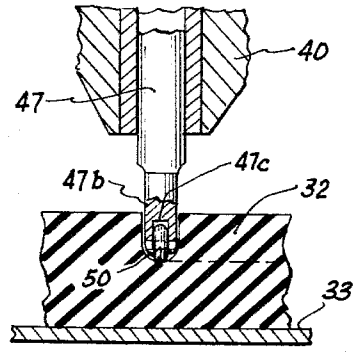


FIG. 9

FIG. 6



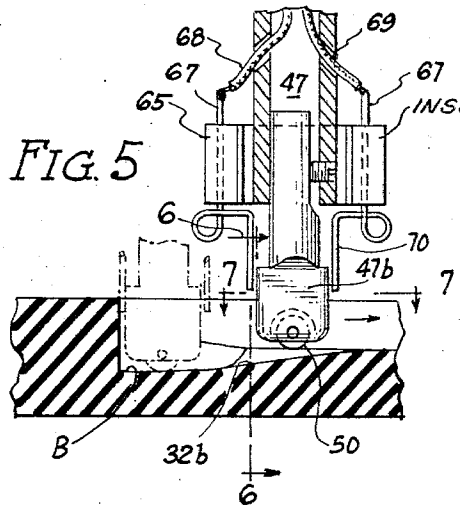


FIG. 5

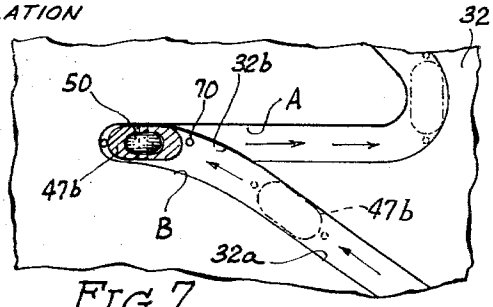


FIG. 7

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PATTERN TRACKING MEANS FOR LINE STITCHING MACHINES

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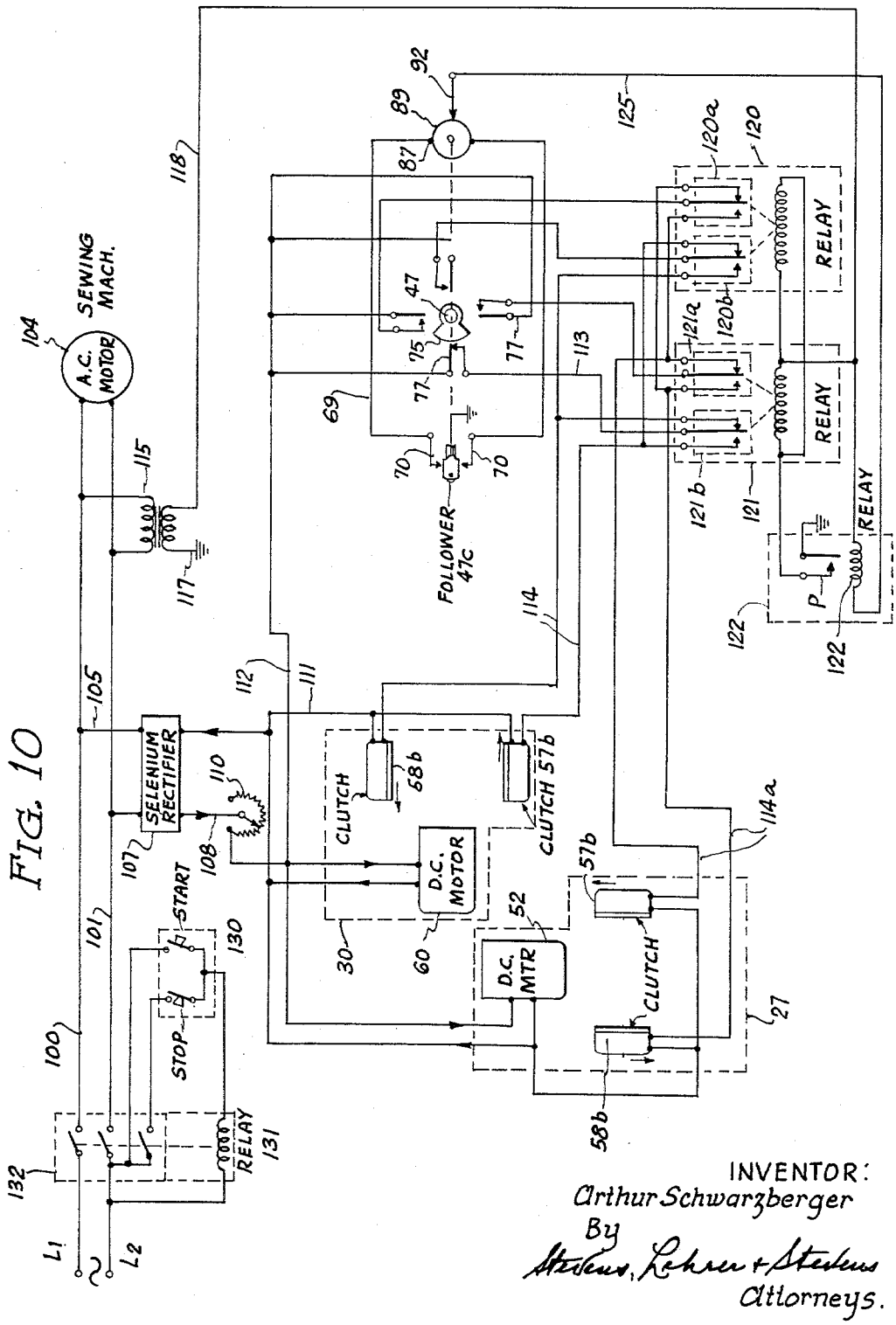


FIG. 10

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United States Patent Office

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PATTERN TRACKING MEANS FOR LINE STITCHING MACHINES

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Filed Jan. 9, 1963, Ser. No. 250,312
12 Claims. (Cl. 112—118)

My invention relates to machines which impose lines stitching in assembled layers of textile materials in conformity with a pattern, and more particularly to means for causing the material to move in conformity with the course of the pattern as the needle of the stitching facility is in action.

An object of the invention is to provide a follower and a complemental pattern having a single continuous devious course which the follower engages and to provide relative movement between the follower and the pattern for controlling the movements of a piece of material in relation to the stitching needle whereby line stitching by the operation of the needle in the material is formed in the material in accordance with the pattern course.

Another object of the invention is to provide a mechanism which produces accurate and rapid relative movements of the follower and the pattern course, which the follower engages, in any direction, the pattern course being a single, continuous one in the form of a single track or groove having straight portions, crossing portions and return bend portions.

Another object is to provide a pair of vertically assembled carriers which receive motion individually in directions at right-angles to each other, whereby to induce the upper carrier to move in various directions by combining its motion with that of the lower carrier.

A further object of the invention is to provide means for mounting a piece of material on the upper carrier for engagement with the stitching needle and for movement in accordance with the relative movements of the follower and the pattern track or groove, which the follower engages, such latter movements causing the upper carrier to move the material along the stationary stitching facility so as to impose line stitching in the material in accordance with the formation of the track or groove.

A further object is to provide a series of electrical controls which automatically reverse the travel of the material where ends or sharp bends occur in the pattern track.

A better understanding of the invention may be gained by reference to the accompanying drawings, in which:

FIG. 1 is a top plan view of the machine as viewed from the front;

FIG. 2 is an enlarged front elevation, partly in section;

FIGS. 3 and 4 are enlarged vertical sections on the lines 3—3 and 4—4 respectively, of FIG. 1;

FIG. 5 is an enlargement of the lower portion of FIG. 4, showing a fragment of the pattern track and certain electrical connections;

FIG. 6 is a front view of the tracking guide as seen from the section line 6—6 of FIG. 5;

FIG. 7 is a section on the line 7—7 of FIG. 5, showing a fragment of the pattern track with a return bend;

FIG. 8 is a plan view of a fragment of the pattern track, showing an electrical switching device;

FIG. 9 is a section on the line 9—9 of FIG. 4; and

FIG. 10 is a diagrammatic view of an electrical circuit employed in the machine.

Referring to the drawings, FIG. 1 shows that the general design of the machine is elongated from front to rear; and specific reference to FIGS. 1 and 2 shows that the machine is spanned crosswise by a massive bridge frame **15** formed with terminal floor standards **16**. The frame carries the head **18** of a sewing machine, while the base **19** of the latter is carried by a cross-bar **15***a* (only partly shown in FIG. 2) extending between the standards **16**.

The carriers first mentioned are mounted over a system of floor rails noted in FIGS. 1 and 2. Thus, a pair of rails **25** extend along the front and rear of the bridge frame **15**, respectively. These rails are secured to the floor of the space occupied by the machine, or to extensions of the standards **16**, and are designed to form a track for the travel of the lower carrier **27** from side to side between the floor standards **16**. The carrier is in the form of an open frame formed with cross-bars **27***a*; and the carrier has wheels **27***b* which ride on the rails **25**.

The side bars of the carrier **27** form a track for the upper carrier **30**, whose travel is crosswise of the track rails **25**, that is, between front and rear positions. The carrier **30** also has cross-bars **30***a* and pendent journals **30***b* (see FIG. 2) for the shafts **30***c* of wheels **30***d* which ride on rails **27***c* rising from the side rails of the carrier **27**.

Mounted as described, the upper carrier **30** may not only be moved forth and back, but also may be carried from side to side by the lower carrier as the latter rides on the track rails **25**. Also, when these movements are combined, any object on the carrier **30** may also travel in a diagonal or curved course. The quilting pattern **32** is secured on the upper carrier **30**, as indicated by numeral **33** in the lower part of FIG. 2; and the lower part of FIG. 1 shows the devious course of the pattern track configuration, which is a single, continuous groove **32***a* formed in or otherwise provided on the upper face of the pattern material. As shown in FIG. 4, the pattern is disposed well below the cross-bar **15***a*, while the piece **34** of material is positioned horizontally above the cross-bar **15***a*, parallel to the pattern, and is carried by the upper carrier **30** for movements between the head **18** and the base **19** of the sewing machine or stitching facility.

With the pattern mounted for travel horizontally in any direction when the carriers are moved singly or in combination, the principle of the present machine is to provide a stationary follower along which the pattern groove moves during the travel of the pattern in order to guide the latter and the textile material **34** according to the course of the pattern groove. This can also be accomplished with the pattern mounted on the floor and the follower mounted on the upper carrier, so as to provide a stationary pattern and a moving follower.

FIGS. 1 and 2 show that the upper carrier **30** has uprights **30***e* for supporting a horizontal frame composed of side bars **35** and cross-bars **36**. The bridge frame cross-bar **15***a* serves as the support for the follower housing **40**, the same appearing in elevation in FIG. 2 and in section in FIG. 4. As shown in FIG. 4, the follower housing **40** depends from the stationary cross-bar **15***a* and is interposed vertically between the material **34** and the pattern **32**. The top of the carrier **30** is not shown in FIG. 1, but indicated at **30***f* in FIG. 2. Such top carries an internal frame **37** in which the textile material **34** is stretched and secured by clamps **38**. As seen in FIG. 4, the cross-bar **15***a* receives a bracket **42** on one side, the bracket hav-

ing a base 42*a*; and the latter carries a headpiece 43 tapped at 43*a* from the bottom. The follower housing 40 is a massive vertical tube whose upper end is screwed into the headpiece 43, the lower end portion of the follower housing having a conical taper 40*a*. The headpiece and lower end portion of the follower housing have bushings 45 for the slidable passage of the follower 47 which is a tubular rod. On the latter is coiled a compression spring 49, the upper end of the spring abutting the headpiece and the lower end bearing against a collar 47*a* adjustable along the rod. FIG. 6 shows that the latter has a foot 47*b* recessed at 47*c* from the bottom to receive a roller 50, which is journalled in the recess 47*a* and extends below the foot 47*b*. FIG. 7 shows that the foot 47*b* is elongated horizontally to conform to the course of the single, continuous pattern groove 32*a*, full lines showing the foot when the groove has a longitudinal portion and dotted lines when the groove has diagonal or curved portions.

The movements of the carriers 27 and 30 are controlled independently. In other words, one power source causes the carrier 27 to travel from side to side on the rails 25, while another power source causes the carrier 30 to run between front and rear positions on the rails 27*c*. The first power source is an electric motor 52 seen in the upper part of FIG. 1 and the lower part of FIG. 3. The motor is joined to a gear box 53, which is supported by a platform 55 spanning hangers 56 of the carrier 27 (not shown in FIG. 3). The wheels 27*b* of this carrier are mounted on shafts 27*d* and 27*e* journaled in bottom bearings 27*f* of the carrier, as seen in FIG. 2; and FIGS. 1 and 3 show that shafts 57 and 58 emerge from the sides of the gear box 53 to pass chain drives 57*a* and 58*a* to magnetic clutches 57*b* and 58*b* mounted on the shaft 27*d*. The latter and the wheels carried by it are therefore driven, while the shaft 27*e* turns freely and the wheels 27*b* carried by it merely roll. The center part of FIG. 1 and the upper part of FIG. 3 show that the drives for the rear wheels 30*d* of the carrier 30 are similar to those employed for the left-hand wheels 27*b* of the carrier 27; and the motor for driving the wheels 30*d* is indicated at 60.

The configuration of the single, continuous pattern groove 32*a* is of course identical with the linear design desired to be stitched in the textile material 34 seen in the top part of FIGS. 2 and 4. In practice such design is symmetrical and ornamental, but the configuration of the continuous pattern groove in FIG. 1 is made intentionally with irregularities and sharp angles to demonstrate the versatility of the present follower mechanism under the most difficult tracking conditions. Ordinarily, the elongated form of the follower foot 47*b* causes it to be rotated when the pattern groove changes from one portion to another, as explained previously in connection with FIG. 7. However, when the groove moves in a linear direction A to a given point and continues with a sharp return bend B, as indicated by arrows in FIG. 7, means are provided for moving the pattern in reverse, as per lower arrows in FIG. 7, in order to continue the tracking of the follower in the groove.

While a master switch or button is provided for starting the motors which induce the travel of the carriers, the controls for reversing such travel under the conditions just described reside in the follower. Reference to FIGS. 4, 5 and 7 shows that the follower carries a block 65 of insulation material, in which are lodged a pair of vertical strips 67, one on each side of the follower. Insulated electrical conductors 68 and 69 rise from the upper ends of the strips, entering the follower 47 as shown in FIG. 5. The lower ends of the strips are fashioned into spring blades 70 which depend spacedly from opposite ends of the follower foot 47*b*.

FIG. 7 shows that the pattern groove portion A has advanced to a point where one end impinges on the left-hand blade 70 of the follower foot. This action causes the blade to contact the foot, as also indicated by dot-and-dash lines in the left-hand part of FIG. 5. This contact is in the circuit of the magnetic clutches which drive one of the carriers in the direction of the pattern groove portion A; and the contact is a switch which procures the alternation of the clutch action in reverse direction, so as to cause the portion B of the groove to receive and travel along the foot 47*b*. In order to avoid the backing movement of the groove portion A along the foot on the reversal mentioned, such portion has a decline 32*b* which extends into the portion B, as shown in the center of FIG. 5. Therefore, on the reverse travel of the pattern the weight of the follower will cause it to resist rising back into the groove portion A, and the portion B will therefore move along the foot in the reverse direction. It follows now that the other blade 70 will come into play for reversing purposes when the next return point in the groove meets the follower foot. The reversing action just described may also be procured by locating the switching contact in the reversing end of the groove, instead of on the follower.

It may be assumed that the travel of the pattern in the direction A of the groove 32*a* (FIG. 7) is an indication that the carrier 27 is traveling between left and right, as seen in FIG. 1. The control for this motion originates in the environment of the follower. FIGS. 4 and 9 show that the headpiece 43 carries clamping blocks 72 on four sides for a set of fixed casings 74; and the rod 47 carries a collar 75*a* between the inner ends of the casings 74, the collar being extended with a sector-shaped iron shoe 75. The casings each incorporate a conventional magnetic proximity switch 77 (see FIG. 10) which closes contact between conductors 79 and 80 (also see FIG. 4) to operate the carrier 27 in the direction A when an iron object—the shoe 75—comes opposite the casing 74 as shown in FIG. 9. Since the follower turns from the influence of the pattern groove and in its direction, a movement of the pattern in a direction transverse to the track portion A would cause the follower rod 47 and its associated shoe 75 to turn into a position opposite an adjacent casing. This affects the circuit in a manner to operate the carrier 30 transversely of the previous direction. It follows now, in accordance with the circuit illustrated in FIG. 10, that the rotation of the follower to locate the shoe 75 opposite the remaining casings 74 will procure carrier movements in directions reversed to those previously obtained.

The end of pattern travel occurs at a given point, and the same may be a corner C of the groove 32*a*, depicted in FIG. 8. Here a switch 82 is located adjacent to the groove to break the circuit of the motors 52 and 60 and sewing machine 18 by pressure of the follower 40 on a switch arm 82*a*. The machine therefore stops, and the quilted textile unit may be removed and replaced by a new textile assembly for a repetition of the operation.

At the outset the closing of the master switch starts the carrier motors and the sewing machine motor. While these motors are in constant operation, the pattern groove controls the movements of the carriers as mentioned. Near the upper end of the follower rod 47, FIG. 4 shows that the conductors 68 and 69 emerge to connect with binding posts 87 carried by a plate 88 and hub 88*a* of insulation material; and the plate has a metal ring 89 underneath. The frame bar 15*a* has an insulation block 90 from which a spring bracket 91 extends to apply a brush 92 to the ring 89 from underneath. The bracket 91 is thus an electrical take-off from the switch blades 70 which allows for the turning of the follower rod 47; and the brush 92 is continued as a conductor 125 as shown at the right in the circuit diagram of FIG. 10. Above the take-off zone the rod passes through a bracket 93 from the frame bar to receive a terminal knob 47*d*. While the rod and its foot portion bear on the pattern groove by the pressure of the spring 49, the knob 47*d* may be used to raise the foot out of the groove when the pattern is to be released or changed.

It is now apparent that the reversing blades or switch actuators 70 act as controls through the bracket 93; and

that the magnetic blades 77 act through the conductors 68 and 69 to control the traveling directors of the carriers. As has been mentioned, the motors 52 and 60 are in constant operation after the starting switch has been turned on. The controls just mentioned are therefore directed to the magnetic clutches 57*b* and 58*b* carried by the wheel shafts 27*d* and 30*c*. The gear boxes 53 shown in the upper and lower center of FIG. 3 indicate that the shafts of the motors 52 and 60 carry worms 95; and the shafts 57 and 58 in each gear box carry gears 96 and 97 in mesh with the worm 95. The chain drives 57*a* and 58*a* therefore operate constantly in opposite directions to rotate drums 57*c* and 58*c* inside the magnetic clutches freely on the shafts 27*d* and 30*c*. Now, the wiring of the aforesaid controls to the magnetic clutches serves to engage them for driving movement in one or the other direction, according to the course of the pattern groove, to rotate the carrier wheels accordingly.

As inferred from FIG. 9, the directional carrier controls are independent of each other, according to the casing 74 toward which the shoe 75 is directed. Since the turns of the pattern groove may be gradual in places, the shoe may often turn part-way from one casing toward another. While this may not affect the approached casing at the outset, such casing will become affected on the continued approach of the shoe, causing the companion carrier to move together with the initial one. The combined movement of the carriers will thus train the textile material in conformity with the devious portions, such as turns, curves and the like formed in the single continuous groove in the pattern.

The wiring of the machine is preferably with a power voltage—110—for the motors and magnetic clutches; and with a low voltage—6—for the carrier controls to make them economical to purchase and safe. Thus, the circuit diagram shows the A.C. power line conductors 100 and 101 leading to the motor 104 of the sewing machine. A branch 105 of the conductor 100 leads through a selenium rectifier 107 to one of the terminal of the motors 52 and 60. A companion branch 108 of the conductor 101 leads through the rectifier and a rheostat 110 to the other terminal of the said motors. Extensions 111 of the branch 105 go to one of the terminals of the magnetic clutches 57*b* and 58*b*. The rectifier is employed to gain the use of D.C. motors for the carrier movements. Such motors permit the use of the rheostat for changing the traveling speed of the carriers as desired. Thus, the stitches of the sewing machine in the textile material may be made longer by increasing the carrier speed and vice-versa.

The step-down of the A.C. current from the line 100–101 is procured by a transformer 115. The output of the transformer has one terminal grounded at 117 and the other extending as a conductor 118 to a series of relays 120, 121, and a ratchet relay 122 which control the magnetic proximity blades 77. One conductor 125 from the ratchet relay 122 goes to the brush 92 which bears on the ring 89. In the right-central part of the diagram the conductors 85 are shown, these leading from the blades 70 alongside the follower foot 47*b* to the ring 89. A branch 112 of the conductor 108 leads to one terminal of each of the proximity blades 77. From the opposite terminal thereof a conductor 113 leads to the center terminal of each relay 120 and 121. From relay units 120*a* and 121*a* conductors 114 lead to clutches 57*b* and 58*b* of carrier 27; and from relay units 120*b* and 121*b* conductors 114*a* lead to clutches 57*b* and 58*b* of carrier 30. Therefore, when a reversing contact is made at 70, ratchet relay 122 alternates the contacting of the points in the aforesaid relay units. This action results in the alternation of the current flow from proximity blades 77 through their respective relay units, so that current which was flowing through unit 120*a* to clutch 58*b* of carrier 27 now flows through unit 120*a* to clutch 57*b* of carrier 30. The same action takes place in the other relay units—121*a*, 121*b* and 120*b*—in relation to their respective clutches.

The upper left-hand corner of FIG. 10 shows the master switch at 130, the same being in circuit with a relay 131 to affect a series of across-the-line switches 132 for the control of the line current.

I claim:

1. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, means mounting a piece of material on the frame for movements in a horizontal plane relative thereto, a sewing machine carried by the frame in cooperative relation with the piece of material, a pattern positioned below the piece of material parallel thereto and having an upper surface provided with a continuous groove arranged in prescribed directions and having sharp return bend portions, a follower disposed between the material and the upper surface of the pattern and positioned in engagement with the groove, means producing relative movement between the follower and the pattern to effect movements of the material and orient the stitching by the sewing machine in the material in conformity with the course of the groove and means automatically reversing the relative movements of the follower and the pattern at the return bend portions.

2. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, means mounting a piece of material on the frame for movements in a horizontal plane relative thereto, a sewing machine carried by the frame in cooperative relation with the piece of material, a pattern positioned below the piece of material parallel thereto and having an upper surface provided with a single, continuous groove arranged in prescribed directions and having sharp return bend portions, means mounting the pattern for movements in a horizontal plane, a stationary follower carried by the frame and interposed vertically between the piece of material and the pattern and disposed in engaging relation with the groove, the pattern traveling along the follower which guides the movements of the pattern in directions orienting the stitching by the sewing machine in the material in conformity with the course of the groove and means automatically reversing the movements of the pattern at the return bend portions.

3. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, means mounting a piece of material on the frame for movements in a horizontal plane relative thereto, a sewing machine carried by the frame in cooperative relation with the piece of material, a pattern positioned below the piece of material parallel thereto and having an upper surface provided with a single continuous groove arranged in prescribed directions and having sharp return bend portions, means mounting the pattern for movements in a horizontal plane, a stationary follower carried by the frame and interposed vertically between the piece of material and the pattern and disposed in engaging relation with the groove, the pattern traveling along the follower which guides the movements of the pattern in directions orienting the stitching by the sewing machine in the material in conformity with the course of the groove, means automatically reversing the movements of the pattern at the return bend portions in the groove, each bend portion having an entering portion and a returning portion, and means at each bend portion leading the follower into the returning portion when said reversing occurs.

4. The structure of claim 3, wherein said last means comprises a decline formation of the entering portion of the groove at each bend portion leading into the returning portion at the bend portion.

5. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, a lower carrier mounted for rectilinear reciprocatory movements relative to the frame, means for moving said lower

carrier, an upper carrier, means mounting the upper carrier on the lower carrier for rectilinear reciprocatory movements of the upper carrier in a direction transverse to the rectilinear reciprocatory path of movement of the lower carrier, means for moving said upper carrier, means attaching a piece of material to the upper carrier and disposing the material in a horizontal plane, a sewing machine carried by the frame in cooperative relation with the material, a pattern mounted on the upper carrier below the material and parallel thereto and having an upper surface provided with a single continuous groove arranged in connecting portions adapted to correspond to the desired line stitching to be imposed by the sewing machine in the material, a follower positioned vertically between the material and the pattern and operatively engaged in tracking relation with the groove effective to orient the stitching in conformity with the portions of the groove, and control means, responsive to the engagement of portions of the groove with the follower, controlling the means for moving the lower carrier and the means for moving the upper carrier so that one carrier is moved when a portion of the groove extends substantially in one direction and the other carrier is moved when another portion of the groove extends transversely of the direction of said first mentioned portion.

6. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, a lower carrier mounted for rectilinear reciprocatory movements relative to the frame, means for moving said lower carrier, an upper carrier, means mounting the upper carrier on the lower carrier for rectilinear reciprocatory movements of the upper carrier in a direction transverse to the rectilinear reciprocatory path of movement of the lower carrier, means for moving said upper carrier, means attaching a piece of material to the upper carrier and disposing the material in a horizontal plane, a sewing machine carried by the frame in cooperative relation with the material, a pattern mounted on the upper carrier below the material and parallel thereto and having an upper surface provided with a single continuous groove arranged in connecting portions adapted to correspond to the desired line stitching to be imposed by the sewing machine in the material, a follower positioned vertically between the material and the pattern and operatively engaged in tracking relation with the groove effective to orient the stitching in conformity with the portions of the groove and control means, responsive to the engagement of portions of the groove with the follower, controlling the means for moving the lower carrier and the means for moving the upper carrier so that one carrier is moved parallel to a portion of the groove extending in a direction along the longitudinal axis of the pattern and the other carrier is moved parallel to a portion of the groove extending transversely of the longitudinal axis of the pattern and in communication with the portion extending longitudinally of the pattern.

7. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, a lower carrier mounted for rectilinear reciprocatory movements relative to the frame, means for moving said lower carrier, an upper carrier, means mounting the upper carrier on the lower carrier for rectilinear reciprocatory movements of the upper carrier in a direction transverse to the rectilinear reciprocatory path of movement of the lower carrier, means for moving said upper carrier, means attaching a piece of material to the upper carrier and disposing the material in a horizontal plane, a sewing machine carried by the frame in cooperative relation with the material, a pattern mounted on the upper carrier below the material and parallel thereto and having an upper surface provided with a single continuous groove arranged in connecting portions adapted to correspond to the desired line stitching to be imposed by the sewing machine in the material, a follower positioned vertically between the material and the pattern and operatively engaged in tracking relation with the groove effective to orient the stitching in conformity with the portions of the groove, and control means, responsive to the engagement of portions of the groove with the follower, selectively controlling the means for moving the lower carrier and the means for moving the upper carrier so that one carrier is moved when a portion of the groove extends substantially in one direction and the other carrier is moved when a portion of the groove extends in a direction substantially transversely of the stated one direction and both carriers are moved in unison when a portion of the groove varies from either direction.

8. A machine for imposing line stitching in a piece of material comprising a stationary upstanding frame, a lower carrier mounted for rectilinear reciprocatory movements relative to the frame, means for moving said lower carrier, an upper carrier, means mounting the upper carrier on the lower carrier for rectilinear reciprocatory movements of the upper carrier in a direction transverse to the rectilinear reciprocatory path of movement of the lower carrier, means for moving said upper carrier, means attaching a piece of material to the upper carrier and disposing the material in a horizontal plane, a sewing machine carried by the frame in cooperative relation with the material, a pattern mounted on the upper carrier below the material and parallel thereto and having an upper surface provided with a single continuous groove arranged in connecting portions adapted to correspond to the desired line stitching to be imposed by the sewing machine in the material, a follower positioned vertically between the material and the pattern and operatively engaged in tracking relation with the groove effective to orient the stitching in conformity with the portions of the groove, said follower depending from the frame and mounted for rotative movement as the portions of the groove extend in different directions relative to the longitudinal axis of the pattern, and control means, responsive to selective positions of rotation of the follower, for selectively actuating the means for moving the upper carrier and the means for moving the lower carrier so that the carriers move in selective directions corresponding to said selective portions of the groove.

9. The structure of claim 8, wherein said control means includes an electrical circuit, magnetic proximity switches in said circuit and a ferrous shoe carried by the follower, said switches being in the path of the shoe.

10. The structure of claim 8, wherein said means for moving the upper carrier and the means for moving the lower carrier each includes an electrical circuit, electrical motors in said circuit, magnetic clutches operatively connected to the motors, means connecting said clutches to the carriers and said control means includes switches in said circuit selectively controlling the magnetic clutches.

11. The structure of claim 8, wherein said means for moving the upper carrier and means for moving the lower carrier includes a constantly operating electrical motor for each carrier, a first drive means for each carrier moving the carrier in one reciprocatory direction, a second drive means for each carrier for moving the carrier in the opposite direction, magnetic clutches associated with the motors and connected to the first and second drive means for each carrier for selectively actuating the drive means, the control means controlling the operation of the clutches automatically at portions of the groove, defining return bends, to actuate the clutches selectively for operating the second drive means for a carrier so as to move a carrier in the opposite direction.

12. The structure of claim 8, wherein said groove has return bend portions and said means for moving the upper carrier and said means for moving the lower carrier comprises a motor for each carrier and including a drive worm, gears meshing with the drive worm from opposite

sides to receive rotary movement in opposite directions, magnetic clutches receiving drives from said gears and engageable with one drive to transmit traveling motion to each carrier in a given direction, an electric circuit in which the motors and the clutches are connected and said control means including switch means automatically operative at the return bend portions to change the clutch engagement to the other drive for transmitting motion to the carriers in opposite directions.

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