Jan. 8, 1963 R. V. MILLIGAN ETAL 3,072,081

EDGE GUIDE AUTOMATIC SEWING

Filed April 5, 1960 6 Sheets-Sheet 1

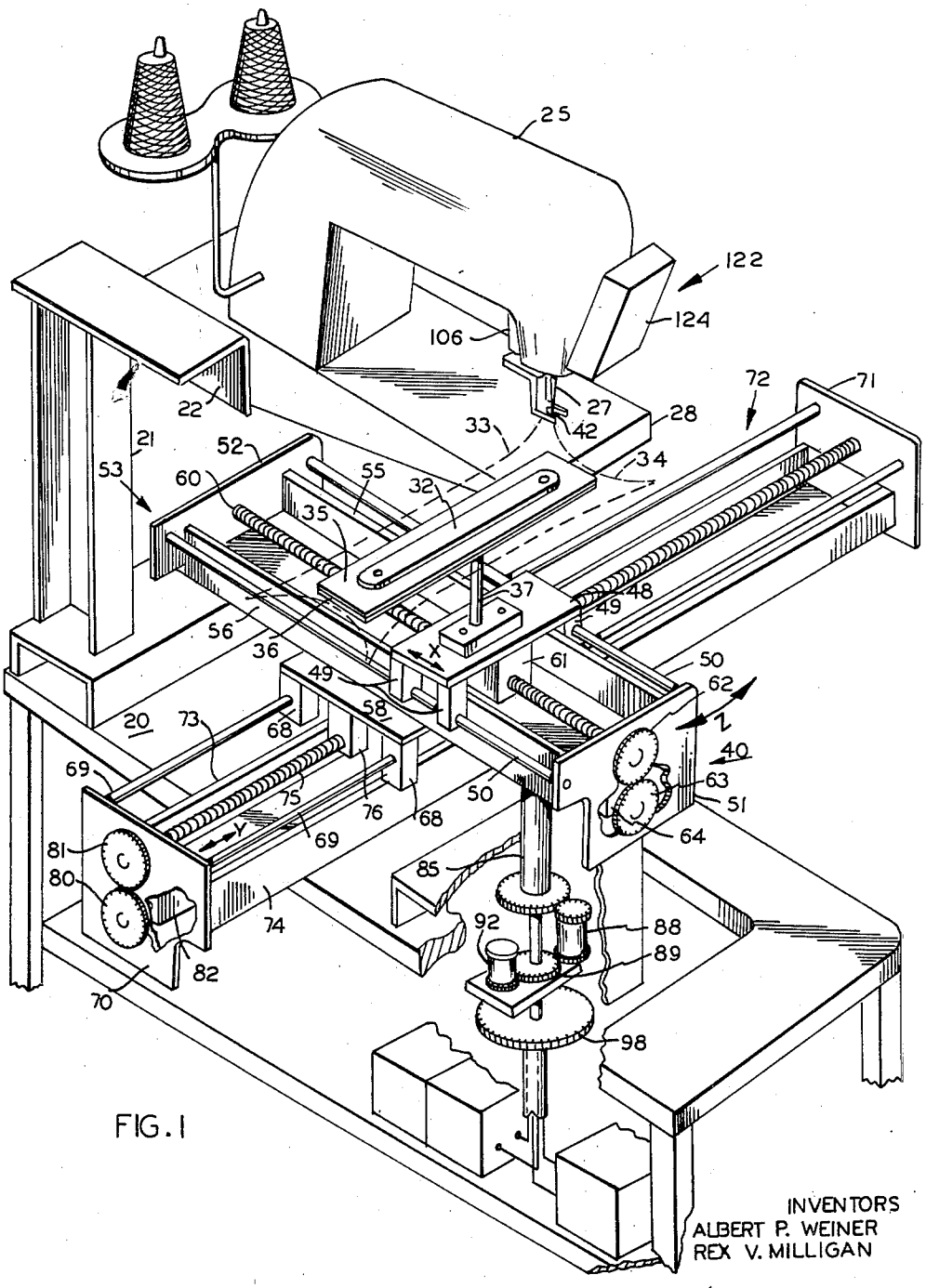

FIG. 1

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN

BY H. Edward Foerch Jr.
ATTORNEY

Jan. 8, 1963 R. V. MILLIGAN ETAL 3,072,081

EDGE GUIDE AUTOMATIC SEWING

Filed April 5, 1960 6 Sheets-Sheet 2

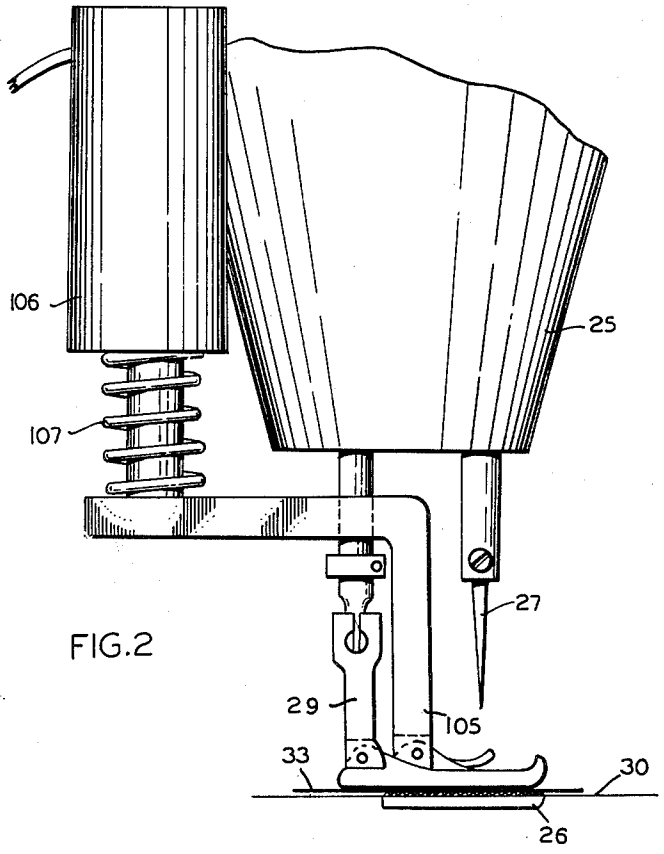

FIG.2

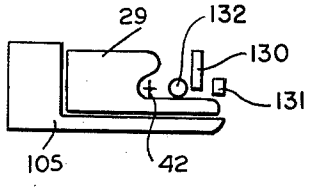

FIG.3

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN

BY H. Edward Tauch, Jr.
ATTORNEY

Jan. 8, 1963 R. V. MILLIGAN ETAL 3,072,081
EDGE GUIDE AUTOMATIC SEWING
Filed April 5, 1960 6 Sheets-Sheet 3

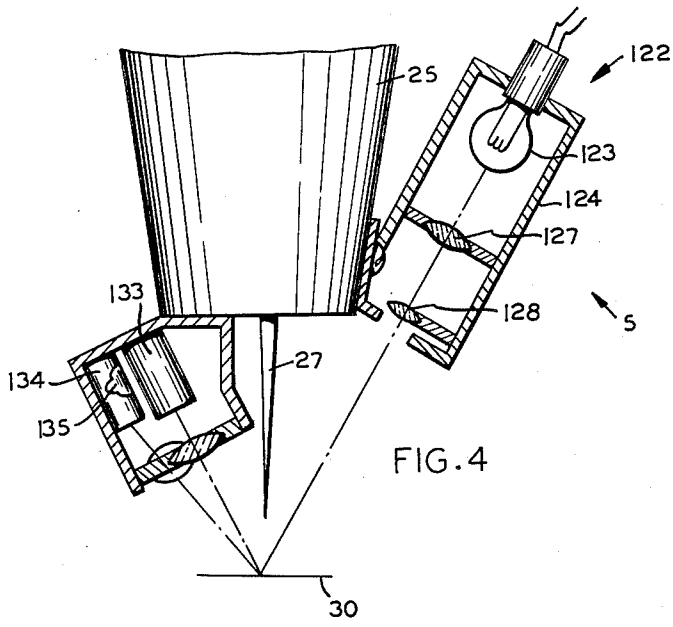

FIG. 4

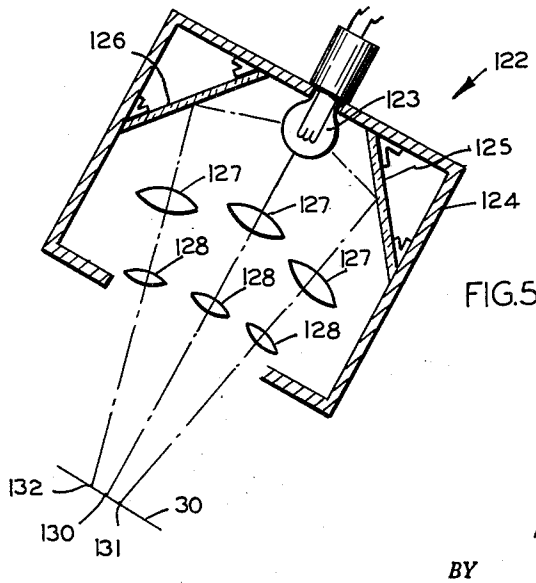

FIG. 5

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN
BY
H. Edward Foerch, Jr.
ATTORNEY

Jan. 8, 1963 R. V. MILLIGAN ETAL 3,072,081

EDGE GUIDE AUTOMATIC SEWING

Filed April 5, 1960 6 Sheets-Sheet 4

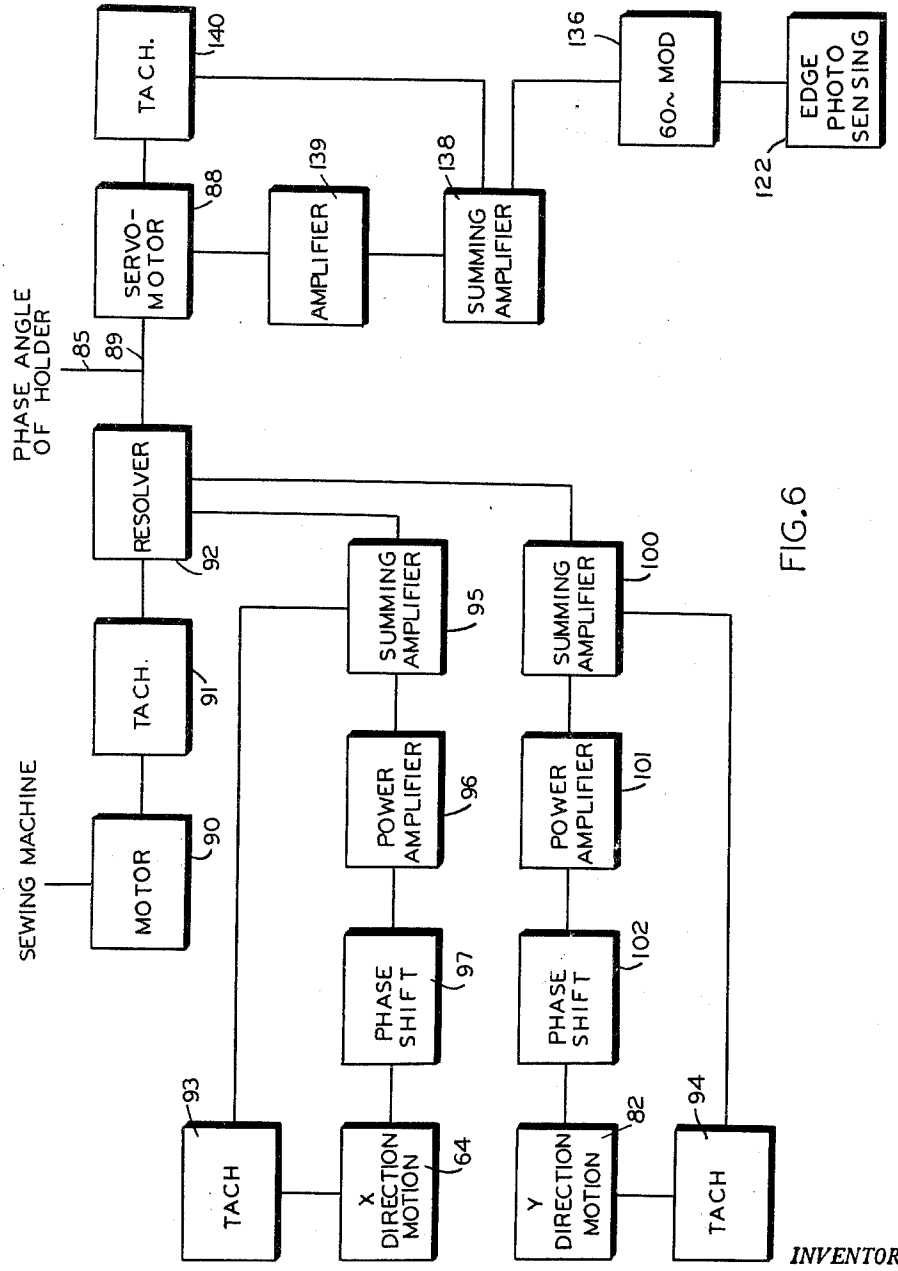

FIG. 6

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN

BY
H. Edward Farrell Jr.
ATTORNEY

Jan. 8, 1963 R. V. MILLIGAN ETAL 3,072,081

EDGE GUIDE AUTOMATIC SEWING

Filed April 5, 1960 6 Sheets-Sheet 5

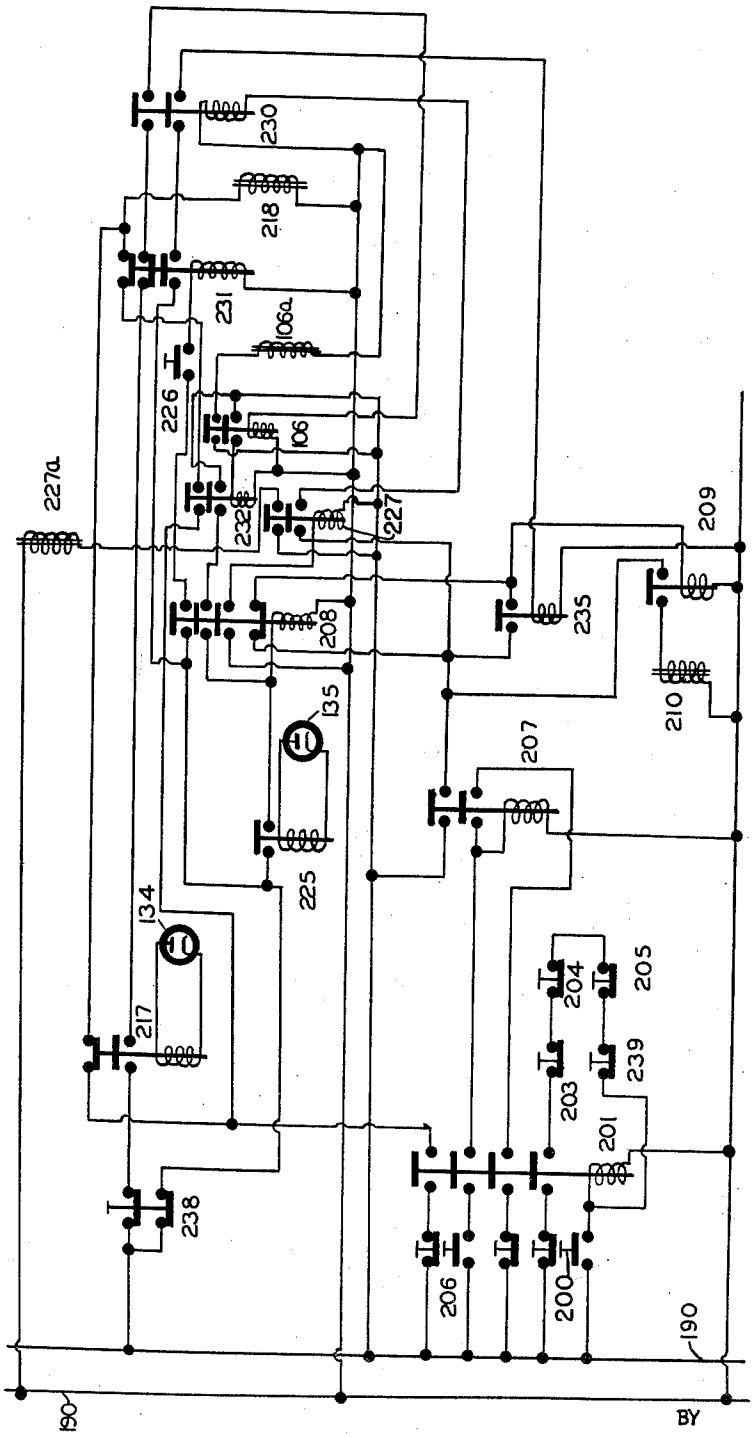

FIG. 7

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN

BY

ATTORNEY

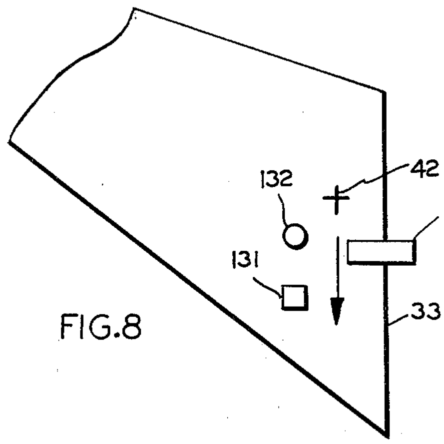

FIG.8

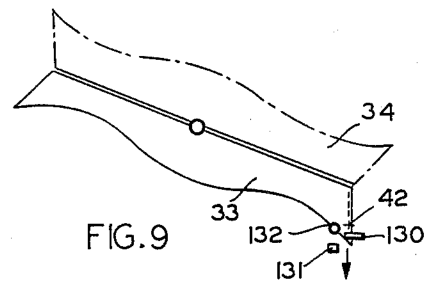

FIG.9

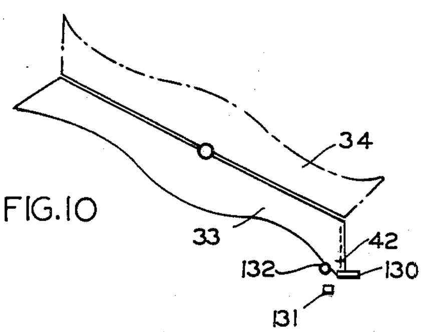

FIG.10

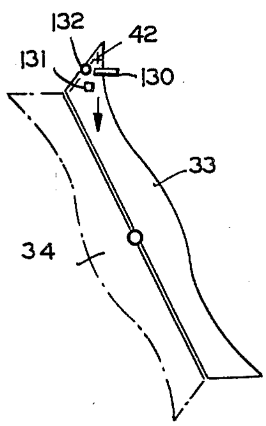

FIG.11

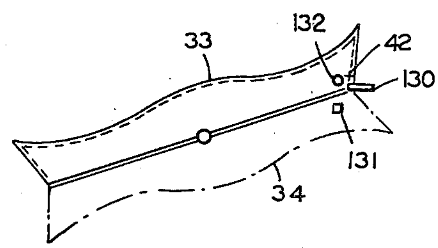

FIG.12

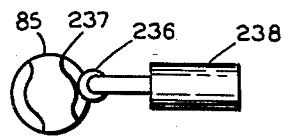

FIG.13

INVENTORS
ALBERT P. WEINER
REX V. MILLIGAN
BY H. Edward Fouch, Jr.
ATTORNEY

United States Patent Office

3,072,081

Patented Jan. 8, 1963

3,072,081

EDGE GUIDE AUTOMATIC SEWING

Rex V. Milligan, Albany, and Albert P. Weiner, Syracuse, N.Y., assignors to Cluett, Peabody & Co., Inc., Troy, N.Y., a corporation of New York

Filed Apr. 5, 1960, Ser. No. 20,127
2 Claims. (Cl. 112—2)

This invention relates generally to a device for guiding cloth through a sewing machine. More particularly, this invention relates to a device for guiding irregularly shaped cloth through a sewing machine in which a holding device moves the cloth in the direction and at the velocity of movement caused by the feed dogs, and in which the holding means rotates the cloth responsive to direction changes of the cloth edge to place a line of stitches at a predetermined distance from the edge of the cloth.

A garment often includes components, such as collar and cuffs which are formed by joining more than one ply of cloth. In forming the collar of a man's shirt, for example, the assembled number of plies are joined before attachment to the body of the shirt by lines of stitches placed at a uniform distance from the edge of the assembled piece.

The conventional manner of feeding cloth to a sewing machine is to manually position the cloth before serrated feed dogs of the sewing machine. These feed dogs are synchronized with the needle and move the cloth in only one direction with uniform increments between each stitch to produce a straight line of uniform stitches. If a curved stitch line is desired, the cloth must be manually rotated between the intermittent movement of the feed dogs to provide a new direction of advance for the feed dogs. Rotation of the cloth must occur about a point of sewing on the cloth to maintain a uniform stitch since only the center of rotation will not move linearly during rotation. Normally this is accomplished by rotating the cloth about the needle when the needle is extended through the cloth forming a stitch.

The automatic mechanical guiding of cloth pieces to the feed dogs of a sewing machine is difficult because of the flexibility and lack of self-support of the pieces of cloth, and also because of the irregularity of the shape and the non-uniformity of the cloth pieces. Guiding devices have been suggested which hold the edges of the cloth and which use cams or other mechanical following devices for producing the movement of the cloth piece along orthogonal directions with the conventional feed dogs removed to permit stitches to be formed in all directions. However, these devices have not gained acceptance because of inaccurate results caused by inherent inaccuracies of the mechanical systems and caused by the humidity sensitivity and the flexibility of the woven goods.

On the other hand, the guiding device of the present invention guides cloth pieces through a sewing machine so that a line of uniform stitches is formed at a predetermined distance from the edge of the cloth piece regardless of the shape of the cloth piece. The cloth guiding device of the present invention comprises a clamp for holding a component of a garment such as a collar of a man's shirt, in a horizontal plane with the ends of the cloth extending beyond the clamp. The holding clamp positions the garment component in the feed dogs of a conventional sewing machine. The holding clamp is mounted on guide means providing rotational movement of the holding clamp about the point of sewing on the cloth, and providing linear movement in the horizontla plane in the same direction and at the average velocity of the movement caused by the feed dogs of the sewing machine.

To provide rotational motion of the holding clamp and cloth component for sewing a curved stitch line, the guide means includes a first edge sensing means which produces a signal proportional to any deviation of the edge of the cloth component from a reference point as the cloth enters the feed dogs of the sewing machine. This signal which is positive or negative depending upon the direction of deviation actuates motive means producing corrective rotation about an axis, called herein the Z axis, extending through the point of sewing on the cloth to return the edge of the cloth component to the reference point. As the edge of the cloth component is maintained at a reference point as the cloth enters the feed dogs, a line of stitches is provided at a substantially equal distance from the edge of the cloth.

To provide linear movement of the holding clamp and cloth component in the direction and at the average velocity of the incremental movement caused by the feed dogs, sensing means including a tachometer and a trigonometric resolver measure the velocity of the sewing machine and resolves the velocity signal into two velocity components. One velocity component is a function of the sine of the angle of rotation of the holding clamp. This component is supplied to a first motor for producing motion of the holding clamp in either direction along a first axis, called herein the X axis, proportional to the magnitude of this first velocity component and in a direction determined by the sine thereof. The other velocity component is a function of the cosine of the angle of rotation of the holding clamp. This second velocity component is supplied to a second motor for producing motion of the holding clamp in either direction along a second axis, called herein the Y axis, proportional to the magnitude of this second component and in a direction determined by the cosine thereof. The first and second axes are perpendicular, are in the horizontal plane of the cloth and rotate with the cloth.

The resultant linear motion of the holding clamp is determined by the combined movement produced by the first and second motors along the X and Y axes. As these motions are functions of the sine and cosine of the angle of rotation, the resultant motion is determined by the speed of the sewing machine regardless of the angle of rotation of the holding clamp, and is adjusted through the drive mechanism to equal the average velocity of motion caused by the feed dogs. In addition, the windings of the trigometric resolver and of the first and second motors are aligned with respect to the direction of motion caused by the feed dogs to cause the resultant motion of the holding clamp to be in the same direction as the movement caused by the feed dogs.

Because the cloth is being moved linearly at a velocity determined by the speed of the sewing machine, the rotational velocity may be insufficient during angular direction changes of the cloth edge to maintain the edge at the reference point as the cloth enters the feed dogs. For this reason, the guide means includes a second edge sensing means responsive to angular direction changes of the cloth edge. This second sensing means deactuates the first edge sensing means, stops the incremental movement caused by the feed dogs with the point of sewing at the apex of the angular direction of the line of stitches corresponding to the angular direction change of said edge, extends the needle of the sewing machine through the cloth at the apex, reactuates the first edge sensing means to align the cloth with the edge of the changed direction at the reference point and then reactuates the sewing machine. In this manner, the guide means guides the cloth through the feed dogs to produce a line of stitches at a constant distance from the edge of the cloth. Also, a stitch is formed at the apex of angular direction changes of the line of stitches.

It is therefore an object of the present invention to pro-

vide a device for guiding a cloth piece through a sewing machine to form a line of uniform stitches at a predetermined distance from the edge of the cloth piece.

Another object of the present invention is to provide a device for guiding a cloth piece to a sewing machine to form angular direction changes of a line of stitches.

Another object of the present invention is to provide a device for guiding a cloth piece to a sewing machine to form a stitch at the apex of angular direction changes of a line of stitches.

Other objects and advantages of the present invention will be apparent from the following description and drawings in which:

FIG. 1 is an isometric view of the guiding device of the present invention;

FIG. 2 is a side view of a portion of the sewing machine shown in FIG. 1 showing the pressure foot;

FIG. 3 is a bottom view of the pressure foot shown in FIG. 2.

FIG. 4 is an end view of a portion of the sewing machine shown in FIG. 1 showing the light source and photoelectric cells;

FIG. 5 is a sectional view of the light source shown in FIG. 4;

FIG. 6 is a block electrical diagram illustrating the edge sensing and motion control of the guiding device shown in FIG. 1;

FIG. 7 is a circuit diagram for the angular direction control;

FIG. 8 illustrates the positioning of the light spots of the edge sensing means on the cloth;

FIGS. 9–11 illustrate the guiding device turning an angle;

FIG. 12 illustrates the guiding device guiding a second cloth piece through the sewing machine; and

FIG. 13 illustrates the interlock for deactuating the sensing means between collars.

Referring first to FIG. 1, a table 20 having a bracket 21 and cross member 22 is illustrated supporting a conventional sewing machine 25. The sewing machine 25 includes a sewing table 28 having a throat plate 30 beneath the cloth piece 33, as seen in FIG. 2. The throat plate 30 contains conventional serrated feed dogs 26 synchronized with the sewing needle 27. A pressure foot 29 holds the cloth piece against the feed dogs 26 during intermittent backward motion of the feed dogs 26 to move the cloth incrementally and thereby to provide a line of uniform stitches in the cloth piece 33.

Two collars 33 and 34 are illustrated back to back and supported by a holding means or clamp 32 for supporting the collars 33 and 34 in a horizontal plane. The clamp 32 is illustrated for convenience by upper clamping plate 35 and lower clamping plate 36. The collars 33 and 34 extend beyond the clamp 32 sufficiently to permit the feed dogs to engage the cloth and to permit sewing around the edge of the collars 33 and 34. The clamp 32 is supported by a pedestal 37 which permits all edges of the collar to enter the sewing machine without interference between the clamp 32 and the sewing machine table 28.

The collars 33 and 34 are guided through the sewing machine 25 by guide means 40 which moves the cloth so that a point of sewing 42 on the cloth moves in the same direction and at the same average velocity provided by the feed dogs 26 of the sewing machine 25. In addition, the guide means 40 rotates the collars 33, 34 about a vertical axis coincident with the point of sewing 42. Such rotative motion does not increase or decrease the average velocity of the cloth at the point of sewing 42. Therefore, the length of each stitch will be the same although a curved stitch line is being sewn.

The guide means 40 supports the pedestal 37 and includes a first carriage 48 having guide members 49 which run on the guide bars 50. The guide bars 50 extend between the end members 51 and 52 which together with the cross-members 55 and 56 form a supporting frame 53 for the guide bars 50. A drive screw 60 extends between the end members 51 and 52 and engages a driving lug 61 attached to the first carriage 48. The drive screw 60 is rotated through gears 62 and 63 which are driven by a servo motor 64 supported by the end member 51. Rotation of the drive screw 60 moves the first carriage 48 in either direction along the guide bars 50 depending upon the direction of rotation of the drive screw 60. Movement of the first carriage 48 along the guide bars 50 provides movement of the holding means 32 along an X axis of movement.

The supporting frame 53 is mounted on a second carriage means 58. The second carriage means 58 includes guide members 68 which run on the guide bars 69. The guide bars 69 extend between end members 70 and 71 which together with the cross members 73 and 74 form a supporting frame 72. Extending between the end members 70 and 71 is a second drive screw 75. The second drive screw 75 engages a driving lug 76 attached to the second carriage 58. The drive screw 75 is rotated by a servo motor 82 through gears 80 and 81.

Rotation of the drive screw 75 moves the second carriage 58 in either direction along the guide bars 69 depending upon the direction of rotation of the drive screw 75. Movement of the second carriage 58 along the guide bar 69 provides movement of the holding means 32 along a Y axis of movement. The X and Y axes are rigidly mounted perpendicular to each other and movement along these axes provides linear movement of the holding means 32 in its horizontal plane. The linear movement of the holding means 32 is the resultant of the motion of the first carriage 48 along the X axis and the motion of the second carriage 58 along the Y axis.

The supporting frame 72 is mounted on a vertical shaft 85 which is rotatably mounted in a thrust bearing attached to the table 20. The axis of the shaft 85, called the Z axis, is coincident with the point of sewing 42 on the collar 33 so that rotation of the shaft about its axis will rotate the X and Y axes and thus the first carriage 48 and the second carriage 58 about the point of sewing 42.

Rotation of the shaft 85 is provided by a servo motor 88 driving a bull gear 89 mounted on the shaft 85. Such rotative motion about the Z axis does not change the resultant linear motion of the point of sewing 42 which is controlled by movement along the X and Y axes.

The guide means 40 provides a resultant linear motion of the holding means 32 along the X and Y axes such that movement of the point of sewing 42 on the cloth coincides with the direction and average velocity of feed dogs 26 regardless of the amount of rotation of the X and Y axes about the Z axis, as will be explained with reference to FIG. 6. The speed of the sewing machine motor 90 is measured by a tachometer 91, as seen in FIG. 6. The tachometer 91 generates a voltage proportional to the speed of motor 90 and supplies this voltage to a resolver 92. The resolver 92 is geared to the bull gear 89 controlling rotation about the Z axis, and is a conventional commercial device which divides the signal from the tachometer 91 into two trigonometrical components. One of the components is equal in magnitude to a function of the output of the tachometer times the sine of the angle of rotation of the X and Y axes, and the other component is equal in magnitude to a function of the output of the tachometer times the cosine of the angle of rotation.

Motors 64 and 82 are two phase servo motors with integrally mounted tachometers 93 and 94, respectively, to provide a feed back device. The primaries of the tachometers 93, 94 and of tachometer 91 and the primaries of motors 64 and 82 are energized by a reference voltage. The phase of the output volage of tachometer 93 is 90 degrees from the reference and is 180 degrees from the phase of one of the component output voltages of the resolver 92. These voltages are summed negatively in summing amplifier 95 and their difference which is either

90 degrees or 270 degrees from the reference, indicating an error in the speed of the motor 64, is amplified by amplifier 96 and supplied to a phase shifting device 97 and then to the control winding of the servo motor 64. The voltage to the control winding of motor 64 maintains the speed of the motor 64 at a value and direction called for by the output component of the resolver 92.

The summing amplifier 95 is an isolation amplifier which electrically isolates the signal from the resolver 92 and the tachometer 93. The phase shifting device 97 corrects any phase shift of the signals so that the reference voltage and control voltage to the motor 64 will be exactly 90 degrees apart to obtain maximum power output from the voltage input. In addition, since the reference windings and control windings of motor 64 are 90 mechanical degrees apart, the speed of motor 64 will be the same in both directions.

Similarly, the phase of the output voltage of tachometer 94 is 90 degrees from the reference and is 180 degrees from the phase of the other component output voltage of the resolver 92. These voltages are summed negatively in summing amplifier 100 and their difference which is either 90 degrees or 270 degrees from the reference, indicating an error in the speed of the motor 82, is amplified by amplifier 101 and is supplied through phase shifting device 102 to the control winding of the servo motor 82. The error voltage drives motor 82 at a speed and direction responsive to the output component of the resolver 92.

By this means the speed of the servo motors 64 and 82 and thus the velocity of the carriage 48 along the X axis and of the carriage 58 along the Y axis is a function of the speed of the sewing machine times the sine and consine, respectively, of the angle of rotation of the X and Y axes from a reference. The resultant velocity of the clamp 32, which is resultant of the velocities along the X and Y axes, is therefore:

$$R=C\sqrt{(V\sin\theta)^2+(V\cos\theta)^2}$$
$$=C\sqrt{V^2}=CV$$

where V is the speed of the sewing machine as measured by the tachometer 91 and θ is the angle of rotation of the X and Y axes from the reference and C is a constant.

Thus, the resultant velocity of the holding means 32 is always proportional to the velocity of the sewing machine, and with a selective mounting of the resolver 92 the motion is always in the direction of sewing of the sewing machine.

The flexibility of the cloth is sufficient to absorb the variations between the incremental motion of the feed dogs 26 and the uniform motion of the holding means 32.

In addition to the resultant linear motion, the guide means 40 rotates the holding means 32 about the Z axis to cause the point of stitch 42 to place a locus of stitches at a substantially equal distance from the edge of the irregular shaped cloth piece 33. The guide means 40 includes a sensing means 122 which provides a signal responsive to any position deviation of the edge of the cloth piece 33 from a reference edge position as the cloth enters the sewing machine. This signal actuates the motor 88 which rotates the holding means 32 about the Z axis with a proper direction and degree of rotation to return the edge of the cloth to the reference edge position as the cloth moves through the sewing machine.

Sensing means 122 are shown in FIGS. 4 and 5 as including a light source 123 enclosed in a container 124 having mirrors 125, 126 and focusing lenses 127 and 128 which focus three spots of light 130, 131, 132 on the throat plate 30 of the sewing machine. The throat plate 30 when not covered by a piece of cloth 33 reflects the spots of light 130, 131 and 132 to three photoelectric cells 133, 134 and 135, respectively.

Light spot 130 is focused as a band positioned on the throat plate 30 perpendicular to the desired edge position so that the cloth piece 33 when properly positioned covers half of the light band 130. Any variation in the position of the edge of the cloth to cover more or less of the band increases or decreases the intensity of the signal received by the photoelectric cell 133. The signal received by cell 133 is biased to produce a zero signal when the cloth piece 33 covers half of the light band 130. As more or less of the band of light 130 is covered, a positive or negative signal is generated having an amplitude dependent upon the extent of the variation of the cloth edge.

The signal from the sensing means 122 is modulated by a 60 cycle modulator 136, FIG. 6. The modulated signal is supplied to a summing amplifier 138, an amplifier 139 and to the control winding of the servo motor 88 controlling rotative motion of the holding means 32. The primary winding of servo motor 88 and the primary winding of a tachometer 140 which measures the rotational velocity of motor 88 are energized by a reference phase voltage. The phase relation of the signal from the modulator 136 is either 90 degrees or 270 degrees from the reference phase depending upon whether a positive or negative signal is received from the sensing means 122. The output of the tachometer 140 is 180 degrees from the signal from the modulator 136 and these two signals are summed negatively in summing amplifier 138 so that the tachometer creates a drag or viscous damping on the system to prevent extreme oscillations.

The sharpness of the turning radius and line of sewing produced by the sensing means 122 is limited by the relation of the forward velocity of the clamp 32 to the rotative velocity of the clamp. For this reason, guiding means 40 uses the two spots of light 131 and 132 for guiding the clamp 32 around angular direction changes greater than the turning radius provided by the first sensing means 122.

The operation using these two spots of light will be explained with reference first to FIG. 7. The sewing machine is started by pushing the rest button 200 to actuate relay 201 and then pushing the "sew" switch 206 which actuates relay 207 thereby completing a circuit from a source 190 through the closed contacts of relay 207 and closed contacts of relay 208 to operate relay 209 and energize the coil 210 which starts the sewing machine motor. Operation of relay 201 further energizes through normally closed contacts on relay 217 the coil of relay 218 which energizes the primary winding of motor 88 controlling the rotation about the Z axis. During operation of the sewing machine, the sensing means 122 actuates the control winding of motor 88 and guides the direction of motion of the line of stitches as above explained.

Switches 203, 204, 205 and 239 are limit switches on the travel of carriages 48 and 58 along the X and Y axes. Operation of any of these switches immediately stops the sewing machine 25.

As the point of sewing approaches an angular direction change which is greater than the sensing means 122 can follow, the spot of light 131 is uncovered by the cloth, as seen by FIG. 9. The light 131 is reflected by the throat plate 30, FIG. 2, to energize photoelectric cell 134. When cell 134 is energized, it operates relay 217, FIG. 7. Operation of relay 217 breaks the circuit energizing the relay 218 for motor 88 controlling rotation of the holding means 32 about the Z axis.

The guide means 40 continues to guide cloth through the sewing machine in the direction in which it was at the time relay 217 operated. As sewing and movement of the cloth continue, the spot of light 132 is uncovered by the edge of the cloth, FIG. 10, and is reflected by throat plate 30 to energize photoelectric cell 135. When cell 135 is energized, it operates relay 225, FIG. 7, which in turn operates relay 208 completing a circuit to relay 227 which operates solenoid 227a and lifts the pressure foot 29, FIG. 3.

As seen in FIGS. 2 and 3, a second or outer pressure foot 105 extends partly around the pressure foot 29 but outside the feed dogs 26 so that pressure by foot 105 only holds the cloth 33 against the throat plate 30 and not against the feed dogs 26. Pressure foot 105 is raised by

solenoid 106*a* attached to sewing machine 25. Spring 107 maintains a downward pressure on foot 105 when solenoid 106*a* is not operated. Solenoid 106*a* is operated by relay 106.

At this point, sewing stopped and the pressure foot 29 raised, the position of the needle may be either up with a partial advance effected by the feed dogs 26, or the needle may be down forming a stitch. The position of the needle is indicated by switch 226, FIG. 7, which is open when the needle is down. The operation of relay 227 as just indicated operates solenoid 227*a* to raise foot 29 and also completes an electrical circuit operating relay 230. Assuming the sewing needle is down as indicated by the opening of switch 226, the operation of relay 230 then completes a circuit through closed contacts on this relay and on relay 231 which operates relay 106. Solenoid 106*a* is then energized by source 190 through closed contacts on relay 106 and raises foot 105. Operation of relay 106 also completes a circuit operating relay 232 which again completes a circuit through closed contacts on relay 231 to re-energize the coil 218 of the motor 88 providing rotation about the Z axis.

If instead of being down the sewing needle 27 is up, then switch 226 will be closed operating relay 231. When relay 231 is operated this of course prevents operation of relay 106 through the just mentioned closed contacts on relay 231. Instead, the operation of relay 231 completes a circuit through another pair of closed contacts on this relay and on relay 230 energizing relay 235. Relay 235 energizes relay 209 which energizes the coil 210 to operate the sewing machine motor and advance the needle 27 until it is in a down position as indicated by opening of switch 226. The pressure foot 105 does not rise until the needle 27 is down. As the pressure foot 29 is raised and the pressure foot 105 is down, the cloth does not advance as the needle 27 is lowered. Thus a stitch is formed at the exact apex of the angular direction change of the line of stitches. When the needle 27 has been lowered, solenoid 106*a* raises the pressure foot 105 and re-energizes motor 88 as described above.

When motor 88 is re-energized, it rotates the holding means around the Z axis and realigns the direction of sewing with the edge of the cloth 33, as seen in FIG. 11. As the cloth rotates, the spot of light 132 is again covered by the edge of the cloth and relay 225 is de-energized. However, because relay 208 is held in by a holding circuit, including closed contacts on relay 232, the sewing machine 25 does not operate at this time. As the piece of cloth is rotated further, the spot of light 131 is covered thereby de-energizing relay 217. When relay 217 opens it breaks the circuit to the relay 106 which working through the solenoid 106*a* holds the pressure foot 105 in a raised position. Relay 106 thus drops out and the pressure foot 105 is lowered by spring 107. The dropping out of relay 106 also causes the de-energizing of relay 232 and the breaking of the holding circuit for relay 208. The release of relay 208 reconnects the sewing machine to the current source 190 and breaks the circuit to the solenoid 227 holding the pressure foot 29 in a raised position. The circuit now has returned to its normal sewing condition and sewing continues under the guidance of the sensing means 122.

The guiding means 40 guides the first collar 33 through the sewing machine 25 placing a line of stitches at a predetermined distance from the edge of the collar. A lock out switch 238, FIG. 7 and FIG. 13 responsive to angular position of the holding means 32, de-actuates the circuitry of cells 134 and 135 to permit the sewing machine 25 to continue to sew across the break between adjacent collars 33 and 34. The guiding device continues guidance of the second collar 34 through the sewing machine 25 during which time the first collar 33 may be replaced with the next collar to be sewn. Lock out switch 238 is responsive to the angular position of the holding means and is actuated by roller 236 operating in cam 237 of shaft 85.

Wires to the various motors and control devices carried by carriages 48 and 58 are brought out through a commutator (not shown) so that the carriages 48 and 58 may continue to rotate as successive collars 33 are fed through the sewing machine 25.

It will be understood that light spots 130, 131, and 132 may be positioned to respond to any angular direction and may also be positioned to provide obtuse angular direction changes as well as acute angular direction changes.

It will also be understood that various other changes in the details of the invention which has been described and illustrated above may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claims.

We claim:

1. In an apparatus for sewing at a constant predetermined distance from and along the edges of an irregularly contoured piece of cloth, a motor operated sewing machine having a reciprocating needle for forming a line of stitching in said cloth piece and having feed dogs for causing incremental feed of the cloth piece in one direction past said needle, and guide means for orientating said cloth piece relative to the direction of feed of said feed dogs such that the line of stitching applied to the cloth piece in said direction of feed of the feed dogs follows substantially the irregular contour of said cloth piece, said guide means comprising a clamping means for holding said cloth piece horizontally and positioning said cloth piece in said feed dogs, a first and second carriage positioned substantially perpendicularly to each other supporting said clamping means and adapted to move said clamping means along a resultant path in a horizontal plane as determined by the individual movement of each carriage for sewing along the relatively small angular changes in direction of the edges of said cloth piece, and means mounting said clamping means for rotation about the axis of the needle and adapted to move said clamping means about said axis for sewing along the relatively large angular changes in direction of the edges of said cloth piece.

2. An apparatus as claimed in claim 1 including a photoelectric sensing means for detecting in advance of the sewing operation a relatively large angular change in direction in the edge of the cloth piece being sewn, and control means actuated by said sensing means to cause, in sequence, the insertion of the sewing needle into the cloth piece at the apex of said angular change, the deactivation of the motor operating said sewing machine and its feed dogs, the rotation of the clamping means and of the cloth piece about said sewing needle and through said large angular change in direction to permit continued sewing of said cloth piece substantially parallel to the edge of the cloth piece and in the direction of feed of said feed dogs, and the reactivation of the motor operating said sewing machine and its feed dogs.

References Cited in the file of this patent

UNITED STATES PATENTS

2,684,651	Bihaly	July 27, 1954
2,710,934	Senn	July 14, 1955
2,838,967	Meyer	June 17, 1958
2,866,145	Peaslee et al.	Dec. 23, 1958
2,880,683	Abel	Apr. 7, 1959
2,882,476	Wetzel	Apr. 14, 1959
2,887,638	Cail et al.	May 19, 1959
2,921,547	Artzt et al.	Jan. 19, 1960
2,939,367	Thomas	June 7, 1960
2,971,483	Cordier	Feb. 14, 1961
3,001,489	Bond et al.	Sept. 26, 1961