This invention relates, in general, to a zig-zag sewing machine, and in particular, to a sewing machine having a needlebar adapted to move about a swinging axle and laterally to the direct line of advance of the fabric and like material, means being provided for the automatic control of the zig-zag overstitch width and of the stitch field position, together with means for moving the loop taker sideways.


In a known zig-zag sewing machine of the aforesaid type an angular twisting of the needlebar frame occurs about a vertical pivot axis which itself is fixed in position.

This angular twisting of the needlebar frame has the serious disadvantage that, for larger deflection values, the decorative picture produced undergoes a highly undesirable distortion. In addition, this present invention the zig-zag stitch line produced is arcuate.

One object of the present invention is to provide a zig-zag sewing machine in which provision is made for displacing laterally beyond itself, to the right and to the left, the maximum zig-zag overstitch width which can be obtained with the machine and within which the zig-zag overstitch can be produced in various widths and the needle can be displaced in a known manner within the lateral limits of these widths, as such and additionally to the aforesaid movements, for example starting from their limits. This cannot be achieved with prior art zig-zag sewing machines, or at least cannot be achieved without a highly undesirable distortion being so great that a satisfactory solution of the problem is out of the question.

A prior art machine has been disclosed in which the entire machine head can be displaced sideways, but with this machine only simple zig-zag stitches can be produced and the problem considered here did not arise at all.

In order to achieve the purpose of the present invention and in particular in order to avoid the aforesaid disadvantages of a distorted sewing pattern, it is another object of the present invention to provide a machine having means for obtaining the displacing of the swinging axe and means for obtaining the lateral displacement of the loop taker, together with the lateral displacement of the swinging axe or pivot.

In particular, the displacement of the swinging pivot or axe, and also the means for the lateral displacement of the loop taker together with the lateral displacement of the swinging axe, ensure during the performance of these movements the lateral displacement of the maximum zig-zag overstitch width beyond itself.

Consequently, it is another object of the present invention to provide means ensuring the solution of the problem described above and effectuating the production of completely faultless decorative stitch patterns, which may, for example, also be of decisive importance in monogram embroidery.

Means for effecting the displacement of the swinging axe consists preferably in rockably mounting the horizontally disposed swinging axe of the needle bar frame on a carrier rod which is mounted in bearings and is slideable in axial direction thereof.

In the machine according to the present invention, the term "swinging axe," as used in the specification and claims, includes rotating axes or pivots in vertical and horizontal directions, while oscillatory axes are also to be comprised by this term, as well as other forms of the same.

Yet a further object of the present invention resides in the provision of means facilitating a positive regulation of the overstitch widths and of the needle displacements or movements within lateral confines of said widths.

These and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawings showing preferred embodiments of the invention.

FIGS. 1 and 2 show diagrammatically the construction of a machine according to the present invention.

FIGS. 3 and 4 show various sewing patterns that can be produced with this machine.

FIGS. 5 and 6 show a loop taker drive in elevation and in section, and

FIGS. 7 and 8 show another loop taker drive in two sections.

In FIGS. 1 and 2, which should be placed side by side, the contour of the housing 100 of the machine is shown diagrammatically in chain-dotted lines. Some parts of the machine, the construction and functions of which are known to those skilled in the art, are also shown in chain-dotted lines. These parts, which for the most part will not be mentioned hereinbelow, are merely indicated, in order to facilitate the understanding of the construction and mode of operation of the machine.

The main shaft 101, which is mounted in the usual manner in the machine housing 100, is also mounted in a horizontally slideable housing 102, which contains a conventional mechanism for obtaining the zig-zag overstitch size and a conventional mechanism for the adjustment of the stitch field position. These mechanisms do not require detailed explanation. It is essential that the housing 102 containing these mechanisms should be horizontally reciprocable in accordance with the double arrow 103 (FIG. 2), as will hereinafter be explained in detail.

A horizontal rod 104, rigidly secured to the slideable housing 102, is mounted in the machine housing 100 by means of the diagrammatically illustrated bearings 105 and 106.

The needlebar frame 108, in which the needlebar 109 is vertically reciprocated in known manner, is swingably mounted on a swinging axe 107 fastened to the rod 104, while the needle clamp 110, the needle 111, and fastening screw 112 for the needle participate in this movement.

On the lower part of the needlebar frame 108, one end of the known zig-zag deflecting bar 114 is mounted at 113, while its other end is driven for the purpose of producing the zig-zag deflection by a swinging part (not shown) which is disposed in the housing 102.

In order to be able to horizontally reciprocate the mechanism housing 102 in the direction of the double arrow 103, it is jointed at 115 at the top (FIG. 2) on a beam 116, which extends substantially in vertical direction and on which, at approximately half-way up its height, a
horizontal pin 117 is rigidly secured, said pin being guided horizontally in the guide 118 provided on the machine housing 100. The beam 116 is jointed at 119 to a link 120, which in turn is pivotally connected at 121 to the bottom end of a rocking lever 123 rockable about the fixed pivot point 122. This rocking lever 123 carries a feeder finger 124 in contact with the control cam 125.

When the feeder finger 124, which is biased by a spring (not shown), follows the control cam 125, the link 120 pivotally moves in a substantially horizontal movement in the direction of the double arrow 126, and this movement is transmitted to the cam disc mechanism containing housing 102 and through rod 104, which is horizontally reciprocable in the direction of arrows 104A to the swinging axle or pivot 107 of the needlebar frame 106, whereby the stitch field is displaced.

Cam 125 which has a clutch 149 may be rotated step by step, for example from the main drive shaft 101 via eccentric 160 and oscillating connecting rod 151. If desired, the connecting rod 151 may be adjusted to provide no oscillation and cam arrangement 125, 149 may be manually operated.

The zig-zag overstitch width is not dependent on this displacement of the stitch field, and for any stitch field position any desired overstitch width can be adjusted up to the maximum overstitch width dictated by known mechanism. The reciprocating movement in the direction of the double arrow 126 is also transmitted from the lower ends of the arrows 127A of the beam 116, as shown by arrows 127A, to the loop taker 128, which is represented diagrammatically by a circle and which is thus displaced in the same manner as the stitch field position of the needlebar.

The beam 116 is jointed at 127 to a bushing 130 which is rotatable on the loop taker drive shaft 129 and which is disposed between two adjusting rings 131 fastened on the shaft 129.

The taker drive shaft 129 is mounted in the bearings 132, 133, and 134 provided on the machine housing 100 and is driven through gears 135 and 136. The gear 135 is mounted on a shaft 137 which is driven by means of a transmission pulley 138 and a transmission belt 139 from the main shaft 101.

The gear 136 is mounted so as to be axially lightly slidable on the key 140, which connects it rotationally to the taker drive shaft 129 and on the axial displacement of the shaft 136, the gear 135 is prevented from participating in this axial displacement by stops (not shown) in the form of rollers.

The loop taker 128 corresponds substantially to that illustrated in FIGS. 5 and 6. FIGS. 5 and 6 show in elevation and section, respectively, a loop taker 128 having an axis oriented in the direction of sewing. The rotating loop taker drive shaft 129, which corresponds to the drive shaft 129 in FIGS. 1 and 2, and which is axially displaceable as shown by arrows 129A, enables the taker 128 to participate in the movement extending transversely to the direction of advance of the material. The bearing 75 of the loop taker shaft 87 for the loop taker 128 is fastened to the guide bolts 76 which are movable in the guide bushings 78 provided in the sewing machine housing.

A pair of spiral gears 79 transmits the rotary movement from the loop taker drive shaft 129 to the loop taker shaft 87. A flap 81 and a retaining spring 82 fitted thereto are likewise connected to the movable bearing 75.

The parts 75, 76, 79, 81, 82 and 128 are mounted through the block 83 to the taker drive shaft 129, the block 83 being held in position at its sides by two securing rings 85 mounted on the drive shaft 129 and therefore having to follow axial reciprocating movements 129A of the shaft 129. The block 83 has a bearing 84, in which the shaft 129 performs its rotating movement.

The same description applies to FIGS. 7 and 8, in which the parts and their movements correspond with those of FIGS. 5 and 6, as that relating to the latter figure.
the effective eccentricity is increased which has the consequence of an increased stroke of the connecting rod and according to a quicker rotation of the control cams.

Since the eccentric shaft is connected in a known manner (not shown) to the feeder device for the cloth, the pitch of the stitches always remains constant, while the length of the decorative stitch pattern becomes larger, the slower the rotation of the control cams. Of course, it is not absolutely necessary to effect the formation of the decorative pattern automatically with the aid of the control cams and alternatively, the control cams can be made inoperative in any way—for example by adjustment of the feeler 124—so as to control the formation of decorative stitches manually.

Instead of mounting the lever 150 on the switching pin 149, it may alternatively be mounted loosely rotatably on the shaft of the control cam 125, and a spring-biased pawl may be arranged at its free end.

On the shaft then a ratchet wheel would be mounted which is moved on stepwise by the pawl always in the same direction when the lever 150 is turned to-and-fro, namely at any time one tooth, or two or more teeth, depending on the amplitude of the oscillation. The effect would be the same as with the regulator illustrated, the switching pin 149 and the clamping or clutch means 152—155 obviously being dispensed with.

The advantage of the machine consists in the solution of the problem set forth above, namely of displacing the maximum overstitch width to the right and to the left laterally beyond its limits, without the stitch pattern being thereby distorted, in a manner which would, for example, be unacceptable for monogram embroidery.

The width of the working field need not of course always be fully utilized during use, but it is also possible to work in a narrower zone than would be possible per se in consequence of the construction of the machine.

At this point it should be particularly stressed that it is possible for the outermost lefthand and righthand stitch field positions also to be sewn in each case with straight stitches or zig-zag stitches of small overstitch width, as can be done with the zig-zag stitch of maximum overstitch width. This is illustrated for example in FIGS. 3 and 4. In the bottom part of FIGS. 3 and 4 from the middle downwards can be seen the zig-zag stitches of small overstitch width just mentioned and also the possibility of distribution of the zig-zag stitches over the entire working field of the needle.

For the lateral parallel displacement of the needlebar frame member of the take 128, hand operating means, which are not specially shown in the drawings, can also be provided.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a zig-zag sewing machine including a main frame, a needle frame pivotally mounted on said main frame, a needle reciprocatable up and downwardly in said frame, means to reciprocate said needle, and means to swing said needle frame about its pivot in timed relationship to the reciprocation of said needle, the improvement, comprising a loop take disposed below said main frame and pivotally connected to said frame, a loop take operated to cooperate with said reciprocating needle means and being operatively connected to said needle reciprocating means, and means connected to said needle reciprocating means, said loop take and said needle frame to displace said needle frame pivot and said loop take laterally in timed operative relationship, said loop take being displaced only when said pivot point is displaced.

2. In a zig-zag sewing machine according to claim 1, including an axially slideable horizontal rod supported on said main frame, said needle bar being pivotally connected to said axially slideable horizontal rod.

3. In a zig-zag sewing machine according to claim 1, wherein said last named means includes a beam connected to said needle reciprocating means and disposed to displace said needle frame and said loop take.

4. In a zig-zag sewing machine according to claim 1, wherein said means to displace said needle frame pivot and said loop take laterally includes oscillatable cam means connected to said loop take to displace said loop take, and adjustable drive means connected said oscillatable cam means and said needle reciprocating means to synchronize movements of said loop take and said needle frame in accordance with the movement of said needle reciprocating means.

5. In a zig-zag sewing machine according to claim 4, wherein said needle reciprocating means includes a main drive shaft.

6. In a zig-zag sewing machine according to claim 5, wherein said oscillating cam drive means includes a tubular member, a cam affixed to said tubular member, a switching pin inside said tubular member having at least one substantially triangular recess defined therein between its outer walls and the inner walls of said tubular member, and a cylindrical ball in said recess adapted to be wedged between the wall of said tubular member and said switching pin upon rotation in only one direction whereby to move said cam upon movement of said switching pin in said direction.

7. A zig-zag sewing machine including a main frame, a rod axially slidably mounted on said main frame, a needle frame pivotally mounted on said rod, means to swing said needle frame about its pivot on said rod, a needle reciprocatable within said needle frame, means to reciprocate said needle, a loop take disposed below said needle to cooperate therewith, and synchronizing means connected to said means to swing said needle frame, to said loop take, to said needle reciprocating means and to said rod to displace said rod and the needle frame pivot and said loop take laterally together.

8. A zig-zag sewing machine according to claim 7, wherein said needle reciprocating means includes a rotatable shaft, and said synchronizing means includes cam means connected to said shaft arranged to shift the position of said loop take in timed relationship to said needle reciprocating means.

9. A zig-zag sewing machine comprising a main frame, a horizontal shaft member axially slideable in said main frame, a needle frame pivotally mounted on said shaft member, a needle reciprocatable in said needle frame, means to reciprocate said needle including a main shaft, means to swing said needle frame about its pivot in timed relationship to its reciprocation, a loop take driven shaft, a loop take disposed below said needle driven by said shaft, an oscillating connecting rod pivotally connected to said loop take shaft and to said means to swing said needle about its pivot, cam means connected to said oscillatory connecting rod intermediate its length, and to said main shaft to shift said connecting rod and said loop take during the reciprocation of said needle and means connected to said cam means to shift said needle frame pivot in timed relation to movement of said loop take.

10. A zig-zag sewing machine according to claim 9, wherein said cam means includes an oscillatable cam connected to said main shaft and follower means engaged with said cam and connected to said connecting rod to shift said connecting rod during movement of said cam.

11. A zig-zag sewing machine according to claim 9, including means for rotating said loop take in a plane parallel to the axis of the drive shaft.

12. In a zig-zag sewing machine according to a main frame, a needle frame pivotally mounted on said main frame, a needle reciprocatable upwardly and downwardly in said needle frame, means to reciprocate said needle,
and means to swing said needle frame about its pivot in timed relationship to the reciprocation of said needle, the improvement, comprising a loop taker disposed to cooperate with said reciprocating needle and being operatively connected to said needle reciprocating means, and means connected to said needle reciprocating means, said loop taker and said needle frame including a sliding member to displace said needle frame pivot and said loop taker laterally in timed operative relationship.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,232,263</td>
<td>Finch</td>
<td>July 3, 1917</td>
</tr>
<tr>
<td>1,980,278</td>
<td>Lockenvitz</td>
<td>Nov. 13, 1934</td>
</tr>
<tr>
<td>2,559,438</td>
<td>Jocsak et al.</td>
<td>July 3, 1951</td>
</tr>
<tr>
<td>2,579,248</td>
<td>Austlid</td>
<td>Dec. 18, 1951</td>
</tr>
</tbody>
</table>