The present invention relates to improvements in zigzag stitch sewing machines of the laterally vibrating needle type, and has for an object to provide such a machine with a novel mechanism including a rotary pattern cam for producing the lateral needle vibrations.

Another object of the invention is to provide an improved rotary cam mechanism which is designed in a manner such that various cams may be substituted for the purpose of producing different types of ornamental zigzag stitches.

A further object of the invention is to provide in combination with a rotary pattern cam mechanism manually controllable means for altering the pattern of lateral needle vibrations generated by the pattern cam.

With the above and other objects in view, the invention comprises the devices, combinations and arrangements of parts hereinafter described in connection with the accompanying drawings, which illustrate a preferred embodiment of the invention, from which the several features of the invention and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings:

Fig. 1 represents a side elevation, partly in section, of a sewing machine containing the present improvements.

Fig. 2 represents a rear side elevation of the bracket-arm of the machine.

Fig. 3 represents a sectional view taken substantially along the line 3—3 of Fig. 1.

Fig. 4 represents a sectional view taken substantially along the line 4—4 of Fig. 1.

Fig. 5 represents a top plan view of a portion of the bracket-arm with the bracket-arm cover removed.

Figs. 6 and 7 represent cross-sectional views of the adjusting shaft in its supporting bushing with the neutral position controlling lever at different limits of movement in the respective views.

Figs. 8 and 9 represent detail views of the needle-gate vibrating pitman and diagrammatically illustrate the effects of the pitman controlling mechanism in causing the needle to vibrate across and from one side of the neutral position of non-vibration of the needle.

The present improvements are illustrated in the drawings and herein described as embodied in a zigzag stitch sewing machine of a type disclosed in United States patent of Alfred Tieler, No. 2,014,916, dated September 17, 1935. Furthermore, the manually controlled adjusting means employed in connection with the present sewing machine for affecting the lateral movements of the needle is disclosed and described in detail in United States patent application Serial No. 538,828, filed May 25, 1953, by Ralph E. Johnson and Alexander F. Kerr, now Patent No. 2,713,838, dated July 26, 1955.

Referring to the drawings, the sewing machine illustrated has a bed-plate 15, affording a work-support from one end of which bed-plate rises the hollow standard 16 of a bracket-arm 17, overhanging the bed-plate and terminating at its free end in the head 18.

The bracket-arm 17 is open at its upper portion so as to form a substantially trough-shaped unit and this opening is adapted to be closed by means of a cover-plate 19 which is removably secured in position by a plurality of screws 20—28.

Rotatably journaled in suitable bearings provided in the bracket-arm 17 is a horizontally disposed main shaft 21, extending lengthwise of the bracket-arm and carrying at one end a driving pulley 22. At its opposite end, the main shaft 21 carries a counterbalanced crank 23 provided with a crank-pin 24 connected by a jointed link 25 to a collar 26 suitably secured upon a vertically disposed needle-bar 27.

The needle-bar 27 carries at its lower end a needle 28 and is journaled for endwise reciprocation in suitable bearings provided in a vibratory gate 29. The gate 29 is pivotally hung upon a screw stud 30 carried by a supporting member 31 adjustably threaded into the upper wall of the bracket-arm head 18 to provide for swinging movements of the gate 29 about a pivotal axis substantially transverse to the axis of rotation of the main shaft 21.

Cooperating with the needle 28 below the cloth-plate and in the formation of lock stitches is a loop-taker 32 supported for rotation in a vertical plane parallel to and rearwardly of the plane of needle vibration. The loop-taker is rotated twice for each complete needle reciprocation by suitable driving connections with the main shaft 21. Suitable feeding mechanism of the lower four-motion type is provided for advancing work past the needle in a direction transverse to the plane of needle vibration, and any usual or suitable presser-foot 33 may be secured to a conventional presser-bar 34 so as to oppose the work-engaging portion of the feeding mechanism in a conventional manner.

Extending horizontally from the lower end of the needle-bar gate 29 is an arm 35 of which the free end portion extends externally of the bracket-arm head and carries a pivot block 36. Embracing the pivot block 36 is a forked end of a rock-arm 37 depending from the lower end of a short rock-shaft 38 disposed horizontally transverse to the main shaft 21 and suitably journaled at the under side of the bracket head 18. Extending upwardly from the rock shaft 38 at the rearward side of the head 18 is a rock-arm 39 of which the upper end is connected by a pivot screw 40 (see Fig. 2) to one end of a pitman 41 disposed horizontally and externally at the rearward side of the bracket-arm 17. The other end of the pitman 41 is pivotally connected by means of a pin 42 to a link 43, the other end portion of which is in turn connected by means of a second pin 44 to an arm 45 depending from a cam-actuated member 46 which is pivotally mounted within the bracket-arm 17 of the sewing machine by means of a horizontal pin 47 which extends transversely across the sewing machine bracket-arm to be received within oppositely disposed apertures 48 and 49 formed in the bracket-arm. A set screw 50 locks the pin 49 in its proper position within the bracket-arm.

Projecting upwardly and laterally from the member 46 is a second arm 51 which extends through an aperture 52 formed within the cover-plate 19 so as to be positioned outside the confines of the sewing machine frame. As may be best understood by reference to Figs. 1, 3 and 5, the arm 51 is provided with a longitudinal aperture 53 containing a cam follower 54 which is locked within the aperture 53 by means of a set screw 55.

The cam follower 54 is forced into engagement with the periphery of a rotary cam 56 by means of a pair of compression springs. One of these compression springs 57 is disposed within the hollow head portion of the bracket-arm with one end portion of the spring located within an aperture 58 formed within the head so as to maintain the spring in a proper position whereby the
other end portion thereof may bear against the lower portion of the needle-bar gate 29 for the purpose of boring the needle-bar gate in a direction away from the sewing machine head thereby to urge the cam follower 56 into engagement with the periphery of the cam 56. A second compression spring 59 is mounted about a pin 60 and is secured at its upper portion to a boss 61 carrying the pin 60, which boss is in turn formed as an integral portion of the removable cover-plate 19. As may be observed from Figs. 1 and 3, the spring 59 is disposed directly over the member 46 so that the lower end portion of the spring will urge the member downwardly about the pivot pin 47 thereby to complement the spring 57 in urging the cam follower 54 against the peripheral portion of the rotary cam 56.

Referring particularly to Figs. 3 and 5, the cam 56 is provided with an aperture 62 so that the cam may be removably disposed over the threaded end portion 63 and against the shoulder portion 64 of a cam shaft 65. More specifically, the cam shaft 65 has its shoulder 64 provided with a pin 66 which is received within an appropriate aperture 67 formed within the cam 56 for the purpose of locating the cam in its proper position upon the cam shaft. A thumb-screw 68 is adapted to be received over the threaded end portion 63 of the cam shaft for the purpose of locking the cam 56 in its operative position.

The cam shaft 65 is journaled in the front and rear walls of the bracket-arm 17 in bearing bushings 69 and 70, said cam shaft 65 being disposed above and horizontally transverse to the main shaft 21. A spiral gear 71 carried by the main shaft 21 drives a spiral gear 72 secured upon the cam shaft 65 whereby the latter is rotated, for example, at 5/8 the speed of rotation of the main shaft 21.

From the foregoing, it will be understood that, during the operation of the machine, the cam 56 being carried by the rotary stub shaft 65 will rotate about the cam-shaft axis and thus actuate the cam follower 54 to the end that the member 46 will rise and fall in a manner as dictated by the peripheral shape of the cam and, thus, the pitman 41 through the medium of the arm 45 and link 43 will have its right-hand end portion, as viewed in Fig. 8, shifted up and down.

In order to translate the lateral vibratory movements of the pitman 41 into effective endwise reciprocatory movements, thereby to impart swinging movements to the needle-bar gate 29, a guide block 73 (see Figs. 2 and 4), is suitably secured upon the pitman 41 as by a pin 74. Each guide-block 73 is shiftable disposed within a guideway 75 constructed by a rearwardly open slot formed in the outer or rearwardly exposed face of an accurately and bodily adjustable guide-head 76. The guideway 75 and the block 73 preferably have straight sides but, if desired, the guideway and the block may each be arcuate with its center of curvature in one position of the guide head 76 lying in the pivotal axis of the pitman 41 afforded by its pivotal connection 40 with the rock-arm 39.

The guide-head 76 has a hub 77 extending freely through an opening 78 in the rear wall of the bracket 17 whereby the portion of the guide-head containing the guideway 75 is disposed at the rear of the bracket-arm. The guide-head hub 77 is secured by a set screw 79 upon an adjusting shaft 80 disposed parallel to the cam shaft 65 and having its longitudinal axis in substantially the horizontal plane.

The adjusting shaft 80 of the guide-head 76 is rotatably journaled in a bearing sleeve 81 in the form of a hollow shaft telescopically arranged in a coxial relation with the adjusting shaft and supported for turning and bodily lateral movements thereof by a supporting member in the form of a fixed bushing 82 secured by one or more screws, not herein shown, in a bearing boss 83 provided in the front wall of the bracket-arm 17. The opposite ends of the bearing sleeve 81 are fitted to slide in parallel guide slots 84, 84 provided in the opposite ends of the bushing 82, such guide slots being elongated in a direction corresponding to the general direction of the center line of the guideway 75 at its limit of angular movement in which the needle has its maximum lateral throw. The guide slots 84, 84 and the adjusting shaft 80 determine the different neutral positions of non-vibration of the needle, it will be understood that the maximum field of vibration of the needle remains fixed on changing from one to another neutral position of non-vibration of the needle.

This arrangement has the advantage of maintaining co-operative relationship between the needle and the loop-taker within predetermined limits of lateral throw of the needle so that within said limits no provision need be made for imparting compensating movements to the loop-taker regardless of the neutral position adjustment of the controlling assembly thereof. In order manually to effect bodily shifting movement of the adjusting shaft 80 and therefore the axis of angular adjustment of the guide-head 76, an eccentric 85 is secured, by a set screw not herein shown, upon the bearing sleeve 81 within the ends of the latter. The eccentric 85 is disposed within a bearing sleeve 82 between the ends of the bearing containing the guide slots 84, 84, the opposed and parallel walls 87 which define the recess 86 being substantially transverse to the length of the guide slots 84 diametrically of the bushing. The front end of the bearing sleeve 81 extends beyond the front end of the bushing 82 and carries, rigidly, an operating arm 83 disposed externally on the front wall of the bracket-arm 17.

By turning the operating arm 83 from one limit of movement shown in Fig. 6 of the drawings to the other limit of movement shown in Fig. 7, a combination turning and sliding movement is imparted to the eccentric 85 within the confines of the wall 87, 87 of the bushing 82 due to the fact that the bearing sleeve 81 which carries the eccentric 85 is confined by the guide slots 84, 84. The described movement of the eccentric 85 carries the bearing sleeve 81 from one end to the other of the guide slots 84 and thereby effects a bodily lateral shifting movement of the angular adjustment axis of the guide head 76 between fixed limits. Obviously, the operating arm 88 may be turned a less distance than its full throw, if desired, while opposed adjusting screws 89, 89 (see Fig. 5), threaded into the forward face of the bearing may be employed to limit the lateral movement of the bearing sleeve 81 in the guide slots 84, 84. The front end of the adjusting shaft 80 extends forwardly beyond the front end of the bearing sleeve 82 and secured thereto by means not herein described, is a hand lever 90 operable to turn angularly the guide head 76 and thereby change the amplitude of needle vibration. For a more complete description and disclosure of the present manual needle-vibration controlling mechanism, reference may be had to the above noted United States patent application Serial No. 356,928.

In connection with the manually adjusting levers 88 and 90 mentioned hereinabove, it is sufficient to say that the member 88 has cooperating therewith an indicia plate 91 having, as best disclosed in Figs. 5, 6 and 7, three indicia figures 92, 93 and 94 of which the figure 93 indicates the central or null position of the needle illustrated by solid lines in Fig. 8, while the figure 92 indicates an extreme left-hand adjustment of the needle as indicated by solid lines in Fig. 9. The figure 94 illustrates an extreme right-hand position of the needle which is not illustrated in the present drawings.

In the mid-position of the operating arm 88, illustrated
in Fig. 6 of the drawings, the fulcrum axis of the adjusting shaft 80 is disposed at mid-position of its movement within the inclined slots 84, 84 of the bushing 82, and the non-vibration path of the needle is located centrally of its field of vibration as illustrated in Fig. 8 and the drawings. Referring particularly to Fig. 8, it will be observed that the handle 88 is disposed in alignment with the indicia figure 93 thus indicating that the needle is in its central position. In this position of the lever 88, and when the hand lever 90 employed to control the vibration amplitude of the pivot screw 40 is released, the shaft 80 of the adjusting mechanism is located centrally of its field of vibration. This is due to the position of the guideway 75 which, as shown in full lines in Fig. 8, is now disposed in a neutral position wherein the guide-block 73 idly traverses said guideway in a path P—P which has the pivot screw 40 as its center, but no appreciable endwise movement is imparted to the pinman 41. If the handle 90 is now turned in a counterclockwise direction, as viewed in Fig. 1, the guideway 75 will be correspondingly turned angularly into a position of maximum influence upon the pinman 41, the center R of the guide block 73 now traversing a path PPI which extends equal distances to opposite sides of its neutral adjustment or central axis R of the guideway 75. Consequently, the component of said movement of the guide block 73 projected upon the line A—B represents the extent of endwise movement imparted to the pinman 41 to vibrate the needle laterally; the throw of the needle to opposite sides of its neutral path of reciprocation being obviously equal. In the described position of the operating arm 88, any positions of the hand lever 90 from zero to maximum throw of the needle will be visibly indicated by the index figures 96 of the member 91 and the arrow 95 of the arm 90.

When the operating arm 88 is turned to its left-hand limit of its movement, see Fig. 7, while the hand lever 90 remains at its position as illustrated in Fig. 1, the fulcrum axis of the adjusting shaft 80 will be laterally displaced in a direction corresponding substantially to the length of the guideway 75, that is in substantially the path PPI illustrated in Fig. 8. As heretofore explained, this is due to the fact that the guide slots 84, 84 are elongated in a direction substantially corresponding to the path PPI.

Referring now more particularly to Fig. 9, it will be observed that the lateral shifting of the adjusting shaft 80 from the position illustrated in Fig. 8 has displaced the fulcrum or central axis R of the guideway 75 into coincidence with the lower limit of movement of the center of the guide block 73. Consequently, operation of the hand lever 90 now affects angular adjustment of the guideway 75 about said lower point and the guide block 73 has a path of travel bearing from its neutral path P—P to its path PPI of maximum influence upon the pinman 41, the neutral path of reciprocation of the needle being entirely at the left-hand side of its field of vibration as shown in Fig. 9.

By the same token, it will be appreciated that if the handle 88 is moved to its extreme right-hand position of said indicia device 94, the needle will be shifted to its extreme right-hand position and, thus, the neutral path of reciprocation of the needle will be entirely at the right-hand side of its field of vibration all of which is disclosed and described in the above noted pending United States patent application Serial No. 356,922.

From the above, it is to be understood that the present mechanism is characterized by having a rotary pattern cam which is adapted to impart lateral zigzag movements to the needle. This cam mechanism is designed in a manner such that various cams may be substituted for the purpose of providing different types of ornamental zigzag stitches. For example, the cam 56 disclosed in Figs. 8 and 9 of the patent drawings is adapted to produce a conventional zigzag stitch of the type illustrated in these drawings wherein the hand lever 90 is shifted to its zero position, but, of course, various other cams having different peripheral configurations may be substituted for the cam 56 so as to produce various types of motion patterns for the needle. However, in addition to being cam actuated the present sewing machine is provided with means for altering the amplitude of lateral vibration and means for varying the null or central point of the needle. In other words, various selective cams may be employed for imparting divers patterns of lateral motion to the needle but at the same time the amplitude of this motion, as well as the central position of the needle, may be varied by movement of the hand lever arms 88 and 90. Thus, with the present mechanism the operator by means of the handle 90 may quickly adjust the machine for performing straight stitches in spite of the fact that the machine is provided with a particular type of rotary cam.

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

1. A sewing machine having a hollow bracket-arm terminating at its free end in a head, said bracket-arm having an opening provided within the upper front side portion thereof, a vibratory needle-bar gate mounted in said bracket-arm head, a pinman disposed behind the front wall of said bracket-arm and extending toward said head, operative connections between one end of said pitman and said needle-bar gate, a rotary cam removably disposed at the front side of said bracket-arm and adjacent said bracket-arm opening, a cam follower pivotally secured to and at a location within said bracket-arm with a portion thereof extending transversely of said bracket-arm opening and outside the confines of said bracket-arm and engaging said rotary cam, and means connecting said cam follower with the other end of said pitman thereby to impart a predetermined pattern of movement to said pitman.

2. A sewing machine having a hollow bracket-arm terminating at its free end in a head, said bracket-arm having an opening provided within the upper front side portion thereof, a vibratory needle-bar gate mounted in said bracket-arm head, a pinman disposed behind the front wall of said bracket-arm and extending toward said head, operative connections between one end of said pitman and said needle-bar gate, a rotary shaft mounted crosswise within said bracket-arm and having one end thereof extending through the front wall of said bracket-arm, a rotary cam removable mounted upon the exposed end of said rotary shaft at the front side of said bracket-arm and adjacent said bracket-arm opening, a cam follower pivotally secured to and at a location within said bracket-arm with a portion thereof extending transversely of said bracket-arm through said bracket-arm opening and outside the confines of said bracket-arm and engaging said rotary cam, and means connecting said cam follower with the other end of said pitman thereby to impart a predetermined pattern of movement to said pitman.

3. A sewing machine having a hollow bracket-arm terminating at its free end in a head, said bracket-arm having an opening provided within the upper front side portion thereof, a vibratory needle-bar gate mounted in said bracket-arm head, a pinman disposed behind the front wall of said bracket-arm and extending toward said head, operative connections between one end of said pitman and said needle-bar gate, a rotary shaft mounted crosswise within said bracket-arm and having one end thereof extending through the front wall of said bracket-arm and adjacent said bracket-arm opening, a rotary cam removably mounted upon the exposed end of said rotary shaft at the front side of said bracket-arm, a cam follower pivotally secured to and at a location within said bracket-arm with a portion thereof extending transversely of said bracket-arm...
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A. A sewing machine having a hollow bracket-arm terminating at its free end in a head, said bracket-arm having an opening provided within the upper front side portion thereof, a vibratory needle-bar gate mounted in said head, a rotary shaft journaled lengthwise of and within said bracket-arm, a pitman disposed substantially lengthwise of said bracket-arm and having one end operatively connected with said needle-bar gate, a horizontal stub shaft journaled crosswise of and within said bracket-arm and being geared for rotation to said main shaft with one end portion of said stub shaft being positioned at the front side of said bracket-arm, a pattern cam being removably carried upon and for rotation with the front end portion of said stub shaft adjacent said bracket-arm opening, a cam follower pivotally mounted within said bracket-arm about a horizontal axis disposed crosswise of said bracket-arm and having a portion thereof extending through said bracket-arm opening and outside the confines of said bracket-arm and engaging said rotary cam, means connecting said cam follower with the other end of said pitman thereby to impart a predetermined pattern of movement to said pitman, and a manually controllable handle mounted upon the front exposed wall of said bracket-arm and connected through such wall with said pitman for varying the pattern of movement imparted to said pitman by said cam.

4. A sewing machine having a hollow bracket-arm terminating at its free end in a head, said bracket-arm having an opening provided within the upper front side portion thereof, a vibratory needle-bar gate mounted in said head, a rotary shaft journaled lengthwise of and within said bracket-arm, a pitman disposed substantially lengthwise of said bracket-arm and having one end operatively connected with said needle-bar gate, a horizontal stub shaft journaled crosswise of and within said bracket-arm and being geared for rotation to said main shaft with one end portion of said stub shaft being positioned at the front side of said bracket-arm, a pattern cam being removably carried upon and for rotation with the front end portion of said stub shaft adjacent said bracket-arm opening, a cam follower pivotally mounted within said bracket-arm about a horizontal axis disposed crosswise of said bracket-arm and having a portion thereof extending through said bracket-arm opening and outside the confines of said bracket-arm and engaging said cam, a link connecting said cam follower with said pitman, said cam follower being biased against said cam so as to impart a predetermined pattern of lateral vibratory movement to said pitman, and means for translating the lateral vibratory movements of the pitman into endwise needle-bar gate vibrating movements including, an angularly adjustable guide-head having a guideway formed therein, a stud carried by said pitman and disposed in said guideway, an adjusting shaft journaled crosswise of and within said bracket-arm in parallel relation with said stub shaft and carrying said guide-head, and a manually operable member carried by said adjusting shaft at the front side of said bracket-arm.

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