April 28, 1964 G. MEIER 3,130,697

CONTROL SYSTEM FOR ZIG-ZAG SEWING MACHINES

Filed Nov. 1, 1961

FIG. 1

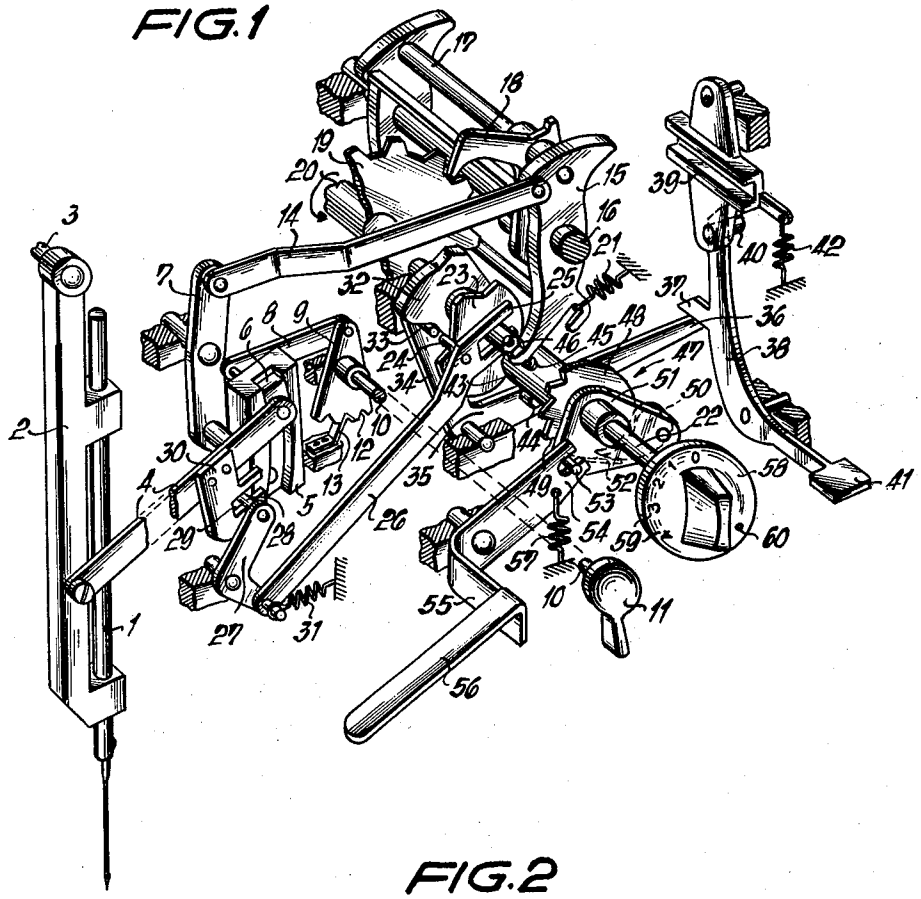
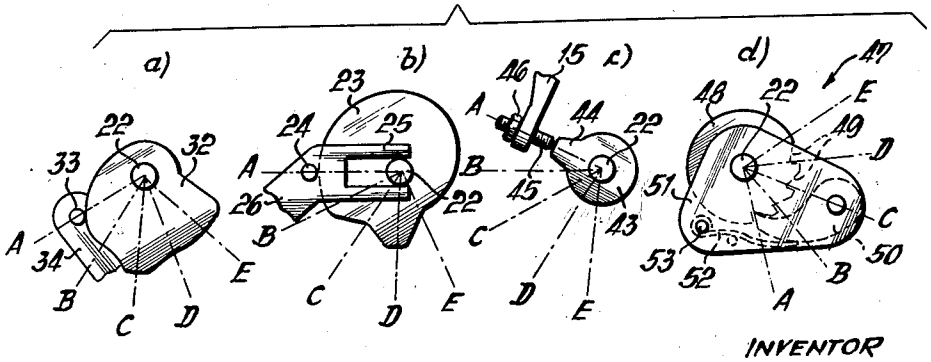


FIG. 2



INVENTOR
Günther MEIER
BY
ATTORNEY

United States Patent Office 3,130,697 Patented Apr. 28, 1964

3,130,697

CONTROL SYSTEM FOR ZIG-ZAG SEWING MACHINES

Günther Meier, Weingarten, near Karlsruhe, Germany, assignor to Gritzner-Kayser Aktiengesellschaft, Karlsruhe-Durlach, Germany, a corporation of Germany

Filed Nov. 1, 1961, Ser. No. 149,359
Claims priority, application Germany Nov. 9, 1960
10 Claims. (Cl. 112—158)

The present invention relates to zig-zag sewing machines also being adapted for the sewing of buttonholes comprising a pair of parallel rows of zig-zag bordering stitches of predetermined overstitch width on opposite sides of the buttonhole slit and a pair of sets of barring stitches of substantially twice said width and located at the opposite ends of the rows of bordering stitches. It is customary in the carrying out of a buttonhole sewing operation to feed the work piece or fabric forwardly and rearwardly in the direction of the buttonhole slit and to oscillate the reciprocating needle cooperating in a known manner with the stitch forming tools of the sewing machine in a direction transverse to the feeding direction at the appropriate amplitudes and at the proper positions in relation to said slit, in such a manner as to enable the sequential sewing of the first row of bordering stitches in one direction, of the first barring stitches at the end of said bordering stitches, of the second row of bordering stitches in the opposite direction, and finally of the second barring stitches at the end of the second bordering stitches, to effect a complete buttonhole sewing operation or cycle.

More particularly, the invention is concerned with the sewing of buttonholes by a conventional zig-zag sewing machine being equipped with multiple control means for the control of the stitching position, of the overstitch width of the zig-zag stitches, and of the work feed direction, an important object of the invention being the provision of uni-control or operating means for the operation of said control means in a manner as to substantially exclude errors, delays or damage to the machine or its operating parts during and after a buttonhole sewing operation or cycle.

Another object of the invention is the provision of simplified buttonhole sewing control means structurally and operably connected with or embodied in a zig-zag sewing machine by which a buttonhole sewing operation or cycle may be carried out expeditiously and reliably by relatively inexperienced labor, or substantially without reliance or dependence upon the personal factor or attention on the part of the operating personnel.

Another object of the invention is the provision of a zig-zag sewing machine adapted for use selectively for ornamental or decorative and the like ordinary zig-zag stitching, as well as for the sewing of buttonholes in a semi-automatic manner without the interchange of parts and by the operation of relatively simple control means, to change from one to the other mode of operation, and vice versa.

Yet another object of the invention is the provision of control mechanism of the general type mentioned for a buttonhole sewing machine which is both simple in design and construction as well as efficient in operation, and which can be embodied in conventional zig-zag sewing machines economically and without requiring essential changes in the basic design and construction of the machines.

The invention, both as to its ancillary objects and novel aspects, will be better understood from the following detailed description taken in conjunction with the accompanying drawing, forming part of this specification and in which:

FIG. 1 is a perspective representation of a buttonhole sewing control mechanism for zig-zag sewing machines constructed in accordance with the principles of the invention, with only those conventional parts of the machine, such as the needle bar oscillating member and drive shaft, being included in the drawing as are necessary for the understanding of the invention; and

FIG. 2 schematically illustrates the various control means or cams of FIG. 1 and associated actuating means in their relative operating positions during the course of a buttonhole sewing cycle or operation.

With the foregoing objects in view, the invention involves generally the provision or utilization of control mechanism structurally embodied in a zig-zag sewing machine for the sewing of buttonholes and comprising essentially multiple control means to reverse the stitching direction from forward to reverse stitching and vice versa, to change the overstitch width between the values corresponding to the width of the buttonhole bordering and barring stitches, respectively, and to control the stitching position for producing the right and left rows of the buttonhole bordering titches. There is further provided in accordance with the invention a uni-control member in the form of an operating key, push button or the like for the step-by-step adjustment of said multiple control means, to establish the necessary sequential operating conditions or adjustments during a buttonhole sewing operation or cycle by the simple and repeated operation or actuation of said key or the like control member, in such a manner as to enable the operator to devote her full attention to the sewing operation and to substantially exclude errors, delays as well as other defects and difficulties interfering with the operation of the machine.

According to the preferred embodiment of the invention as shown by the drawing, there is provided for this purpose a common control shaft carrying a plurality of cam means cooperating with suitable cam follower means each being operably connected with one of said multiple control means (feed direction, overstitch width, and stitching position). The control shaft is provided with means for step-by-step rotation, such as by the provision of a ratchet mechanism operable by a control key or the like operating member, and the cam means of the multiple control means are so designed as to effect a series of sequential relative settings or controls of said control means as are required for the carrying out of the coordinated steps or operations of a complete buttonhole sewing cycle, by the simple sequential depression of said key or actuation of the like operating member, in a manner as will become further apparent as the detailed description proceeds.

According to an improved feature of the invention, the ratchet mechanism for the step-by-step operation of the control shaft may comprise a ratchet disk having teeth extending over a fractional portion only of the circumference of said disk and cooperating with a pawl being actuated by the control key or the like member, whereby to avoid undue or accidental operation of the control mechanism upon completion of a sewing cycle or operation. In order to commence a new sewing operation, means may be provided to adjust said shaft to a starting position, in the manner described in greater detail hereafter. According to the invention, the unused portion of the ratchet disk may be utilized for the gradual control of the zig-zag amplitudes or overstitch width when using the machine for ordinary zig-zag, such as decorative, stitching, in the manner as will become more apparent as the following description proceeds in reference to the drawings.

Referring more particularly to the drawing, the numeral 1 represents the needle bar of a conventional zig-zag sewing machine mounted for reciprocation in an oscillatable needle bar frame or holder 2 being pivoted at one end, as at 3, to the frame or housing of the sewing machine, in a manner well known in the art. Hinged to the holder 2 is one end of a connecting or control rod 4 which carries a sliding block 6 at its opposite end movable within a slotted link or oscillation control member 5.

The lower end of the member 5 is hinged to the lower arm of a double lever 7 pivotally mounted upon the frame or housing of the machine and the upper end of the member 5 is hinged to a link 8 being connected to a rotatable member 9. The latter has a rotatable supporting shaft 10 the projecting end of which carries a control knob 11 for the adjustment of the zig-zag stitching position. The latter may be fixed or set by the provision of grooves or notches 12 in the member 9 cooperating with a stationary locking spring or pawl 13.

The upper arm of the double lever 7 is hinged to one end of a connecting arm or rod 14 which has its opposite end in turn hinged to a double-lever rocker arm 15 being rotatably mounted upon a shaft 16 rigid with the frame of the sewing machine and carrying a further shaft 17. Adjustably mounted upon the shaft 17 is a follower member or finger 18 having its end arranged to engage the toothed contour of a cam disk 19 mounted upon a further shaft 20 being parallel to the shaft 16 and rotated by the drive means of the sewing machine through suitable motion-transmitting means (not shown), as indicated by the circular arrow in the drawing. As a consequence, the needle holder 2 is continuously oscillated in a direction at right angle to the feed direction of a fabric or work piece being operated on by the sewing machine as a result of the rocking movement of the member 15 imparted thereto by the follower 18 camming with the toothed disk 19 and by way of the linkage or connecting mechanism 4, 5, 6, 7, 14, the range or amplitude of the oscillations being determined by the height of the teeth of the disk 19, on the one hand, and by the amplitude limiting control or adjustment acting upon the members 4 and 15 to be described presently, on the other hand. A spring 21 having one end engaging the member 25 and being secured at its opposite end to the housing serves to maintain a continuous resilient engagement between the finger 18 and the cam teeth of the disk 19.

In order to adjust the overstitch width either gradually during ordinary zig-zag stitching or between the values required for the sewing of the buttonhole bordering and borrowing stitches, respectively, there is provided a control shaft 22 rotatably mounted upon the frame or housing of the machine and carrying a first cam or control disk 23 cooperating with a pin or cam follower 24 which is secured to an end of a forked rod 26 having its bifurcated portion 25 arranged to embrace the shaft 22 and having its opposite end hinged to one arm of a bell crank lever 27 being pivotally mounted upon the sewing machine frame or housing. The remaining arm of the lever 27 carries a pin or bolt 28 engaging the slot 29 of a further forked member 30 secured to the needle bar actuating rod 4. A spring 31 having one end secured to the hinge between the rod 26 and lever 27 and having its opposite end secured to the housing acts to maintain a continuous resilient engagement between the pin or follower 24 and the contour of the control disk or cam 23.

Mounted upon the shaft 22 is a further control disk or cam 32 cooperating with a pin or cam follower 33 which is secured to the arm 34 of an angular lever 35 rotatably mounted upon the machine frame or housing. The remaining arm 36 of the lever 35 is arranged to engage the stop 37 of an adjusting lever 38 forming part of a conventional feed or stitch controller for varying the stitching length and feed direction, to change from forward to reverse stitching and vice versa, in a manner well known in the art. Lever 38 is rotatably mounted upon the machine housing and has one arm arranged to engage a pin

40 secured to the stitch control member 39, while the remaining arm carries a key or the like control member 41 for the control of the feed movement and/or direction. A spring 42 serves to normally urge the stitch control guide 39 to a position for forward stitching to an extent whereby the pin 33 resiliently engages the contour of the cam 32 by way of the connecting elements 35, 36, 37, 38, 40.

As is understood, the stitch controller may comprise a sliding block movable within the member 39 in a manner similar to the block 6, said block forming an adjustable hinge in the train of the work feeding mechanism and determining the extent of the feed movement, in a manner well known and understood by those skilled in the art.

Further mounted upon the shaft 22 is a cam or disk 43 having a projection 44 arranged to engage an adjustable limiting element in the form of a screw 45 mounted upon the rocker arm or member 15 and being locked in the adjusted position by a securing nut 46.

Finally mounted upon the control shaft 22 is a ratchet mechanism 47 comprising a ratchet disk 48 secured to said shaft and being provided with peripheral ratchet teeth 49 which extend over a fractional circumferential portion only of said disk, said teeth cooperating with a pawl 50 linked to an actuating disk or element 51 which is rotatably mounted upon the shaft 22, said pawl being urged into engagement with the teeth 49 by the action of a spring 52. A pin 53 extending from the disk 51 is embraced by the bifurcated end of a double-arm control lever 55 which is rotatably mounted upon the machine housing and has a cooperating arm 56 projecting from said housing and forming a manual control key for the sequential or step-by-step rotation of the shaft by the mechanism 47. A spring 57 serves to normally urge the key 56 to an upward or starting position.

The end of the shaft 22 carries a control knob 58 projecting outwardly from the sewing machine and cooperating with a fixed scale 59 indicating the overstitch width during use of the machine for ordinary zig-zag stitching. For buttonhole sewing, the knob 58 is operated to a position corresponding to a mark or index 60 being separate from the scale 59, whereby to set or adjust the control parts to the starting position for the commencement of a buttonhole sewing cycle, as described in further detail hereafter.

FIG. 1 shows the individual parts of the control mechanism in the position for ordinary zig-zag sewing by the machine with the needle centering or stitching position being varied or controlled by adjustment of the knob 11, to displace the member 5 by the rod 8, and with the overstitch width being controlled by adjustment of the knob 58 in cooperation with the scale 59, to vary the position of the sliding block 6 within the member 5 determining the amplitude of the oscillating movement imparted upon the rod 4 and in turn upon the needle bar holder 2. The stitching length and/or direction may be adjusted by operation of the key 41. During this ordinary operation of the sewing machine, the overstitch width as indicated by the scale 59 is controlled by the portion of cam 23, FIG. 2*b*, adjacent to and separate from the portion being operative during a buttonhole sewing operation embraced by positions A–E and described presently, in that the contour of the disk 23 determines the position of the sliding block 6 in the member 5 through the follower 24 forked rod 26, bell crank lever 27, the bifurcated element 30 and rod 4, in such a manner that the oscillations imparted to the follower 18 by the cam disk 19 and transmitted to the member 5 through the elements 14 and 7, are applied to the rod 4 and in turn to the needle bar or holder 2 with an amplitude varying between a maximum and zero depending upon the adjustment of the block 6 in accordance with the scale 59. During this operating range, the disk 32 controlling the stitching length and the cam 43 are inoperative or without effect.

If it is now desired to utilize the machine for the sewing of a buttonhole in the manner described, the control knob **11** is first adjusted to the "right" needle centering or stitching position to displace the member **5** towards the right by way of the elements **8** and **9**, in the manner described and understood, knob **11** remaining in this position throughout the buttonhole sewing operation or cycle. Furthermore, the control knob **58** is rotated in clockwise direction until the index **60** points in the upward or vertical direction coinciding with the starting position for a buttonhole sewing operation. As a consequence, the control disks **23**, **32** and **43**, as well as the ratchet disk **48** are operated to the position A in respect to their followers **24**, **33** and **45**, as illustrated in FIGS. 2*a*–2*d*, respectively. The latter indicate the shape as well as the relative position of the disks **23**, **32**, **43** and ratchet **48** with the various adjusting positions during a buttonhole sewing cycle relative to the cooperating or follower elements **24**, **33**, **45** and **50** corresponding to the dot-dash lines A–E representing the sequential partial buttonhole sewing operations.

More particularly, in the position A which corresponds to the starting of a buttonhole sewing operation, the disk **32**, FIG. 2*a*, urges the stitch control member **39** to a position corresponding to a relatively small stitching length or feed in the forward direction by way of the linkage or connecting mechanism described hereinbefore. Furthermore, in the position A the contour of the control disk **23**, FIG. 2*b*, by way of the connecting mechanism described, results in the displacement of the sliding block **6** to its lowermost position within the groove of the member **5**, whereby to in turn result in a maximum overstitch width of the needle bar, say 4 mm. by way of example, were it not for the projection **44** of the cam or disk **43** engaging the stop **45**, FIG. 2*c*, and causing a limiting or reduction of the amplitude of the rocker arm **15** actuated by the follower **18** to one half or 2 mm. by virtue of the resilient engagement of the follower **18** with the cam disk **19** through the action of the spring **21**. It is thus possible in the position A of the control elements to commence the sewing of the left row of buttonhole bordering stitches in the forward direction and with an overstitch width of 2 mm. in accordance with the example given. In other words, control of the needle oscillating amplitude to change from barring to bordering stitches, and vice versa, results in effectively varying the mean stitching or needle centering position as required for the buttonhole sewing.

After completion of the left hand bordering stitches, the key **56** is depressed whereby to rotate the element **51** and in turn the pawl **50** and ratchet disk **48** in clockwise direction and to advance the latter by one ratchet tooth spacing interval to the positions B as indicated in FIG. 2. As a consequence, the control disks **23**, **32** and the cam **43** have been rotated by the same angular distance and engage their cooperating follower or control elements **24**, **33** and **45** at peripheral points intersecting the lines B shown in the drawing. As a result, control disk **32** causes a reduction of the feeding speed to zero, while the disk **23** restores the original maximum overstitch width of 4 mm. by disengagement of the stop or limiting element **45** from the projection **44** of the cam **43**. The first barring stitches can now be sewn at the end of the lefthand bordering stitches of the buttonhole.

Key **56** is now again depressed, whereby to move the pawl **50** and in turn the ratchet and control disks to the position marked C in the drawing. As a consequence, disk **32** causes the stitch control **39** to be adjusted to a position for reverse stitching, while the disk **23** causes a displacement of the sliding block **6** to the center of the member **5**, to result in a reduction of the overstitch width from 4 mm. to 2 mm., to enable the sewing of the right row of bordering stitches. In other words, the change of the oscillations imparted to the needle bar by the members **28** and **45** from the normal 4 mm. amplitude corresponding to the width of the barring stitches to one half or 2 mm. corresponding to the width of the bordering stitches is such as to eliminate different halves of the oscillating amplitude, in such a manner as to result in a simultaneous change of the stitching position from one to the other of the rows of bordering stitches. As will be understood, however, separate stitch position control means may be provided being operated by the shaft through a cam and follower in a manner analogous to the controls of the overstitch width and feed direction.

After completion of the second row of bordering stitches, the key **56** is again depressed to advance the shaft **22** by a further tooth interval of the ratchet **42** and to operate the parts to the relative positions as indicated by the lines D in FIG. 2. As a consequence, the work feed is again reduced to zero by the disk **32** and the overstitch width restored to its full value of 4 mm. to enable the sewing of the second barring stitches of the buttonhole, in a manner readily understood from the foregoing.

By finally depressing the key **56** the parts are adjusted to the E-position as shown by the drawing, whereby to result in both the feed and overstitch width to be at zero. In this position, the buttonhole may be finished by locking the projecting ends of the threads and the machine may be used as a zig-gaz sewing machine in the ordinary fashion with the scale **59** indicating the overstitch width, in the manner described hereinbefore.

The fact that the ratchet teeth **49** being equal in number to the control or adjusting positions for the carrying out of a complete buttonhole sewing cycle extend over a fractional portion only of the periphery of the ratchet disk **48**, with the remaining portion of the disk advantageously serving for the gradual control of the overstitch width during ordinary zig-zag stitching, makes it impossible to operate the control parts after completion of a buttonhole sewing operation by inadvertent depression of the key **56**. In order to start the sewing of another buttonhole, adjustment of the control device to the starting position marked by the index **60** is required, in the manner described hereinbefore.

In the foregoing the invention has been described in reference to a specific illustrative device. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts and elements for those shown and described herein for illustration, may be made without departing from the broader scope and spirit of the invention as set forth in the appended claims. The specification and drawing are accordingly to be regarded in an illustrative rather than in a restrictive sense.

I claim:

1. In a zig-zag sewing machine of the type including a needle bar supporting a reciprocatory needle and mounted for oscillation transversely to the feed direction, drive means for said machine, and means operated by said drive means and including motion-transmitting means between said drive means and said needle bar, to oscillate said needle within a predetermined zig-zag overstitch width; first mechanism for stitching button holes composed of a pair of adjoining rows of zig-zag bordering stitches and zig-zag barring stitches at the opposite ends of said bordering stitches having a width substantially twice the width of said bordering stitches, said mechanism comprising first control means to reduce the feeding speed to zero and to change from forward to reverse stitching, and vice versa, second control means operative upon a first intermediate point of said motion-transmitting means, to limit the amplitude of the needle oscillations such as to change from barring to bordering stitches, and vice versa, third control means operative upon a second intermediate point of said motion-transmitting means, to vary the amplitude of the needle oscillations, a common control shaft, a plurality of control cams carried by said shaft, said cams being equal in number to the number of said control means and having fractional peripheral cam surfaces, a cam follower for cooperation with each said cam

surfaces and means operably connecting the same with one of said control means, operating means including a unitary control member for step-by-step rotating said shaft, to effect the sequential partial buttonhole sewing operations of producing, through a first fractional angular adjusting range of said shaft, bordering stitches in a first direction by a first actuation of said member, of arresting the feed movement and sewing first barring stitches by a second actuation of said member, of reversing the feed direction and producing second bordering stitches by a third actuation of said member, and of again arresting the feed movement and sewing second barring stitches by a final actuation of said member, and further mechanism independent of said first mechanism and operative within a second angular adjusting range of said shaft, to gradually vary the amplitude of the needle oscillations.

2. In a zig-zag sewing machine as claimed in claim 1, said operating means comprising a ratchet disk mounted upon said shaft, a spring-urged pawl cooperating therewith and actuatable by said control member, said disk having ratchet teeth equal in number to the sequential partial operations of said control means to effect a complete buttonhole sewing operation and extending over a first fractional peripheral portion of said disk, a further control member to set said shaft to a position for commencing a buttonhole sewing operation by said first control member, the cam for said third control means being further designed to effect a gradual control of the needle oscillating amplitude during rotation of said shaft within said second adjusting range thereof.

3. The combination with a zig-zag sewing machine including a needle bar supporting a reciprocatory needle and mounted for oscillation transversely to the feed direction, drive means for said machine, and means operated by said drive means and including motion-transmitting means between said drive means and said needle bar, to oscillate said needle within a predetermined zig-zag overswitch width; of first mechanism for producing buttonholes composed of a pair of adjoining rows of zig-zag bordering stitches and of zig-zag barring stitches at the opposite ends of said bordering stitches having a width substantially twice the width of said bordering stitches, said mechanism comprising plural control means to reverse the feeding direction, to change the needle oscillating amplitudes from bordering to barring stitches, and vice versa, and to vary the effective stitching position, a common control shaft, a plurality of control cams carried by said shaft, said cams being equal in number to the number of said control means and having fractional peripheral cam surfaces, a cam follower for cooperation with each said cam surfaces and means operably connecting the same with one of said control means, operating means including a unitary control member for step-by-step rotating said shaft, said cams being designed to effect a series of coordinated sequential settings of said control means such as to effect the sequential partial buttonhole sewing operations of producing, through a first fractional angular adjusting range of said shaft, bordering stitching in a first direction by a first actuation of said member, of arresting the feed movement and sewing first barring stitches by a second actuation of said member, of reversing the feed direction and sewing bordering stitches in the opposite direction by a third actuation of said member, and again arresting the feed movement and sewing second barring stitches by final actuation of said member, and further mechanism independent of said first mechanism and operative within a second fractional angular adjusting range of said shaft, to gradually vary the amplitude of the needle oscillations.

4. In a zig-zag sewing machine as claimed in claim 3, said operating means being comprised of a ratchet disk mounted upon said shaft, a spring-urged pawl cooperating therewith and actuatable by said control member, said disk having ratchet teeth equal in number to the sequential partial operations of said control means for effecting a complete buttonhole sewing operation and extending over a first fractional peripheral portion of said disk, a further control member to set said shaft to a starting position for commencing a buttonhole sewing operation by said first control member, said cams being further designed to effect a gradual control of said needle oscillating amplitude by rotation of said shaft by said further control member within said second adjusting range thereof.

5. In a zig-zag sewing machine of the type including a needle bar supporting a reciprocatory needle and mounted for oscillation transversely to the work feed direction, drive means for said machine and motion-transmitting means between said drive means and said bar, to oscillate said needle; first operating mechanism for sewing buttonholes comprising first control means to reduce the feeding speed and to change from forward to reverse stitching, and vice versa, second control means operative upon said motion-transmitting means, to vary the mean needle position and oscillating amplitude between buttonhole bordering and barring stitches, a common control shaft, control cams for each said control means mounted upon said shaft, cam follower means cooperating with each of said cams and operably connected with one of said control means, said cams having control surfaces cooperating with the associated follower means within a first fractional angular adjusting range of said shaft, actuating means including a unitary control member to step-by-step rotate said shaft, to adjust said cams for the carrying out of a series of sequential buttonhole sewing operations by repetitive operation of said control member, and further operating mechanism independent of said first mechanism and controlled by said shaft, said last mechanism being operative within a second fractional angular adjusting range of said shaft, to gradually vary the amplitude of the needle oscillations during ordinary zig-zag stitching by said machine.

6. In a zig-zag sewing machine as claimed in claim 5 said further operating mechanism being comprised of the control cam for said second control means having an additional cam surface effective within said second adjusting range of said shaft.

7. In a zig-zag sewing machine as claimed in claim 5, including means to independently control the feeding speed and direction within said second adjusting range of said shaft.

8. In a zig-zag sewing machine as claimed in claim 5, including means to independently control the feeding speed and/or direction and the mean zig-zag stitching posititon within said second adjusting range of said shaft.

9. In a zig-zag sewing machine as claimed in claim 5, said actuating means being comprised of a ratchet disk operably connected with said shaft and including a pawl actuatable by said control member.

10. In a zig-zag sewing machine as claimed in claim 9, said disk having ratchet teeth being equal in number to the sequential buttonhole sewing operations and extending over a fractional peripheral portion of said disk, and further means to adjust said shaft to a first position for commencing a buttonhole sewing operation and to a second position for the carrying out of said ordinary zig-zag stitching.

References Cited in the file of this patent

UNITED STATES PATENTS

2,755,674	Archer	July 24, 1956
2,905,119	Bono	Sept. 22, 1959
2,966,869	Fischer	Jan. 3, 1961
2,979,002	Casas-Robert et al.	Apr. 11, 1961
3,083,657	Theenhausen et al.	Apr. 2, 1963

FOREIGN PATENTS

564,305	Italy	June 14, 1957