FEEDING ARRANGEMENT FOR ZIGZAG SEWING MACHINE

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ABSTRACT

The feeding of a sewing machine can be automatically controlled by a cam, or manually controlled by a knob. Manual control means, which preferably can also be used for making buttonholes by setting the feed regulator to forward feeding, reverse feeding and minimum feeding, also connect and disconnect the cam follower from the cam of the automatic operating mechanism so that manual control and automatic operation of the feed regulator do not interfere.

20 Claims, 19 Drawing Figures
FEEDING ARRANGEMENT FOR ZIGZAG SEWING MACHINE

This is a continuation of application Ser. No. 645,585, filed June 12, 1967.

BACKGROUND OF THE INVENTION

The present invention relates to automatic zigzag sewing machines provided with a buttonhole-stitching device capable of producing parallel rows of zigzag stitches on the sides of a buttonhole, and longer bar tack stitches at the ends of the buttonhole.

SUMMARY OF THE INVENTION

It is one object of the invention to provide an improved feeding arrangement for a zigzag sewing machine of comparatively simple construction permitting automatic and semi-automatic stitching of buttonholes.

Another object of the invention is to prevent interference between manual and automatic control means for the feed regulator of the sewing machine.

With these objects in view, the present invention relates to a feeding arrangement for an automatic zigzag sewing machine which has a drive shaft. One embodiment of the feeding arrangement comprises a feed regulator for varying for reversing the feeding direction, the feeding speed, operating means for the regulator, manual feed control means connected with the operating means for manually adjusting the feeding speed, automatic operating mechanism directly connected with the regulator for operating the same, and manual control means for selectively rendering the automatic operating mechanism operative or inoperative.

The feeding arrangement of the invention is provided in a sewing machine whose needle bar assembly can be selectively placed in a left-field position, a right-field position, and a central-field position. During sewing of a buttonhole, the field positions are used for properly placing the stitches on the sides and ends of the buttonhole. The machine can also be automatically set to a twin needle operation in which the amplitude of the zigzag stitches is automatically reduced.

In the preferred embodiment of the invention, the control knob by which the positions of the buttonhole stitches are controlled, is also used for placing the machine in a condition in which automatic feeding takes place.

In the preferred embodiment of the invention, the automatic operating mechanism of the feed regulator includes a cam driven by the drive shaft of the machine, and a cam follower connected with the regulator. When automatic feed is not desired, the cam follower is separated from the cam, which is accomplished by a knob preferably controlling the buttonhole stitching. This knob turns a shaft provided with cams controlling cam followers by which the feed direction and the amplitude of the buttonhole stitches is determined.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front view of a sewing machine according to the invention;

FIG. 2 is a side view of the sewing machine;

FIG. 3 is a fragmentary sectional view illustrating a cam device controlling the amplitude of zigzag stitches, and automatic feeding;

FIG. 4 is a plan view of the cam device of FIG. 3;

FIG. 5 illustrates the cam device of FIG. 4 in another operational position;

FIG. 6 is a fragmentary sectional view taken on line VI—VI in FIG. 1, and illustrating manually operated control cams;

FIG. 7 is a fragmentary front view illustrating dial knobs used for the device of FIG. 6;

FIG. 8 is a fragmentary view illustrating mechanism for oscillating the needle bar assembly, and for placing the same in different field positions;

FIG. 9 is a fragmentary view illustrating part of the mechanism of FIG. 8 for varying the field position of the needle bar assembly;

FIG. 10 is a sectional view taken on line X—X in FIG. 9;

FIG. 11 is a vertical sectional view illustrating additional mechanism for varying the stitch amplitude and for limiting the stitch amplitude during twin needle operations;

FIG. 12 is a side view of the mechanism illustrated in FIG. 11;

FIG. 13 is a cross-sectional view including a side view of the feed-regulating mechanism;

FIG. 14 is a fragmentary sectional view corresponding to FIG. 13 and illustrating the feed-regulating mechanism in an operational condition in which it is automatically operated;

FIG. 15 is a fragmentary sectional view corresponding to FIG. 13 and illustrating another operational condition of the feed-regulating mechanism permitting manual control during buttonhole-stitching operations;

FIG. 16 is a longitudinal sectional view through the housing of the sewing machine, and including a front view of the feed-regulating mechanism;

FIG. 17 is a fragmentary perspective view illustrating the automatic operating mechanism for the feed-regulating mechanism;

FIG. 18 is a cross-sectional view taken on line XVIII—XVIII in FIG. 1 and illustrating the opening of a cover for removing the cam device; and

FIG. 19 is a fragmentary plan view illustrating a device for opening and locking the cover.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1 and 2, a housing 1 is mounted on a table or bed 2, and comprises a top portion 3 having an opening 104 normally covered by a movable cover 105 and permitting access to exchangeable cams, as will be described hereinafter. A lateral portion 4 of the housing is also detachable and permits access to the needle bar assembly which comprises a needle bar 5 and a presser foot 6. FIGS. 1 and 2 also show a takeup lever 7 for the thread, a thread-tensioning device 8, a flywheel 9 for the main shaft, a thread-winding device 10 and a spool holder pin 108.

At the front of the housing, dial knobs are provided for manual control of the several functions of the machine. A central dial knob 12 is turnable to control buttonhole-stitching operations, and an annular dial knob 11 surrounds dial knob 12 and serves for placing the needle bar assembly in left, middle and right-field positions, or for setting the machine to twin needle operations. The indicia on dial knobs 11 and 12 cooperate with a fixed mark 49, as also shown in FIG. 7.

An amplitude-regulating lever 14 has a shaft 47 and is turnable between six positions indicated by a fixed dial on the housing. A turnable and axially movable knob 13 mounted on dial frame 15 controls the feeding mechanism for transporting the material to be sewn under the presser foot and has an indicator 16.

The sewing machine is provided with a zigzag stitching mechanism, an automatic feed mechanism, a feed control mechanism, an amplitude-regulating mechanism, a field-position-changing mechanism, a mechanism controlling twin needle operations, and a buttonhole-stitching mechanism which is adapted to vary the amplitude of zigzag stitches, the feeding speed, and the setting of the needle bar assembly to different field positions when a buttonhole is sewn. The buttonhole-stitching mechanism is controlled by dial knob 12. Dial knob 13 controls the feeding mechanism during buttonhole-stitching.

Referring first to the zigzag-stitching mechanism, as shown in FIGS. 3, 4, 5, 6, and 18, a camshaft 17 carries a detachable cam device 18 including cams 18A and 18B. As best seen in FIG. 4, camshaft 17 has a fixed arm 17A with a fixed coupling...
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pin 17B. Cams 18A and 18B have openings engaged by coupling pin 17B and rotate with camshaft 17. An elastic coupling member 113 is fixed in the central openings 118 of cams 18A and 18B. As best seen in FIG. 18, camshaft 17 is mounted on a bearing 21A mounted on a slanted support plate 20 which is fixed by screws 124, 125 to supporting brackets 114, 115 of the housing. A gear 23 is secured to shaft 17 and meshes with a worm gear 22 fixed on the main drive shaft 16 so that the cams are rotated. Cam 18A cooperates with a cam follower 19 which transmit oscillatory movement to needle bar 5 through connecting rod 33. A transversely oscillating arm 34, an oscillating rod 35, pivot 41 and needle bar support member 37, as shown in FIGS. 3 and 8, so as to cause the zigzag movement of the needle bar. Cam device 18 may include a single pattern cam 18A or a set of pattern cams 18A for controlling the zigzag movement, and a cam 18B associated with automatic feeding.

The peripheral cam portions of the cams overlap and the cam lugs are of different radial height. Cam follower 19 is mounted on a pivot 29 of a carrier lever 25 which is turnable on a pivot 27 on support plate 21. A cam follower 24 cooperating with feed control cam 18B is mounted on a pivot 30 of a carrier lever 26 which is supported for angular movement on a pivot 28 carried by support plate 20, as shown in FIGS. 4, 5 and 17. Torsion springs 92, 93 and 94 act on the lever carriers to displace the same to a position in which pins 31, 32 at the ends of the same engage control cams 52 and 59 by which the position of carrier levers 26, 25 and thereby of the fulcrums 27, 30 of the cam followers 22, 25, 24 can be adjusted by turning dial knob 12 with shaft 48, as seen in FIG. 6.

Cam follower 19 is a double armed lever having an end portion 19A engaging the periphery of cam 18A. Carrier lever 25 does not normally move, so that the outer end portion 19B transmits the oscillatory movement to the flange 33C of a connecting rod 33 against the action of a coil spring 95 which abuts a projecting lug 20A on support plate 20, as best seen in FIGS. 4, 5 and 17. A nut 123 holds flange 33C in an adjusted position. Connecting rod 33 has a portion 33A, and a portion 33B on which spring 95 is mounted, and which is movable in a hole of lug 20A. Rod portion 33A is connected by pivot 40 to the outer end of an oscillatory arm 34. As also shown in FIGS. 8 to 10, oscillatory arm 34 is mounted on a pivot 39 of a field position control lever 38. Oscillatory arm 34 has a cam ridge 34A which is located between a follower pin 36 on oscillating rod 35 and a projection 136, as best seen in FIG. 11. The side of cam ridge 34A confronting follower pin 36 is located adjacent a depressed groove of oscillatory arm 34 which is thicker on the other side of cam ridge 34A. The end of follower pin 36 is guided in the groove of oscillatory arm 34.

When cam follower 19 is oscillated by cam 18A, the oscillating arm is transmitted to oscillatory arm 34 and through the cam ridge 34A to follower pin 36 so that the needle bar assembly is oscillated about pivot 44 by oscillating rod 35, as best seen in FIG. 8. The amplitude of the oscillation depends on the distance of follower pin 36 from the pivot 39 of oscillatory arm 34, and can be reduced to zero. Downward movement of the follower pin 36, as viewed in FIG. 11, will reduce the amplitude of the stitches.

One end of rod 35 is pivoted at 41 to support member 37 of the needle bar assembly, as shown in FIG. 8, while the other end is connected by a pivot 42 to an amplitude regulating rod 43 which is pivotally connected to an amplitude-regulating arm 46 with a hub 146 turned on an amplitude-regulating shaft 47 supported in a bearing member 135 on the dial frame 15 which is fixed to housing 1.

The amplitude-regulating lever 14 is secured by screw 147 to shaft 47 so that the same can be turned by manual operation of amplitude-regulating lever 14. The other end of shaft 47 is secured by a screw 167 to an amplitude-regulating plate member 67 which has transversely projecting portions 67A and 67C, see FIGS. 11 and 12. Portion 67A engages a portion of amplitude-regulating arm 46 so that regulating arm 46 is coupled with regulating plate member 67 under the action of a spring 68 wound around shaft 47 and engaging arm 46 and plate member 67, as best seen in FIG. 11.

Plate member 67 has an arm 67B to which one end of a spring 69 is secured whose other end is fixed to a bracket, not shown, on the housing of the machine. Spring 69 urges plate member 67 to turn together with arm 46 in counterclockwise direction as viewed in FIG. 11 so that rod 43 is urged to move rod 35 with follower pin 36 toward the full extent of oscillatory arm 34 to reduce the amplitude of the zigzag stitches to zero.

A member 96 is secured by screws 121 to the inner face of the dial plate 15 and cooperates with a limit plate 70 which retains projection 67C of plate member 67, so as to stop the same. Plate member 67 is turned by displacement of limit plate 70 while the engagement between projection 67C and limit plate 70 is maintained.

Referring now to the control of the field positions of the needle bar assembly, and to the operations controlled by dial knobs 11 and 12, as best seen in FIG. 6 a control shaft 48 is inserted through a front wall of housing 1 and extends to a rear wall 1' of the same. Dial knob 12 is fixed to control shaft 48 by a screw 122, while the annular dial knob 11 is fixed to a hollow control shaft 11A through which control shaft 48 passes, so that knobs 11 and 12 can be turned relative to each other about a common axis. Hollow shaft 11A is mounted on an indicia plate 49 which is fixed to the front wall of housing 1.

Control shaft 48 carries control cams associated with buttonhole-stitching operations which involve the stitching of the ends of a buttonhole by small zigzag stitches, the stitching of the ends of the buttonhole by longer bar tack stitches, and the feeding of the material in forward direction while a first row of lateral stitches is made, and in reverse direction while the other row of lateral stitches is made.

Cam 50 regulates the amplitude of the buttonhole stitches, cam 51 controls the feed direction of the material, feed cam 52 controls automatic feeding, field cam 53 controls the field positions of the buttonhole stitches, and limit cam 54 determines the position of the ends of the stitches. Cams 50 to 54 are respectively secured to shaft 48 and to each other by screws 150 to 154.

The hollow shaft 11A carries a fixed cam 55 which controls changing of the field positions of the needle bar assembly during ornamental stitching, and a cam 56 which controls the amplitude of the stitches during operations with twin needles. Cams 55 and 56 are secured to each other by a pin 155, and to hollow shaft 11A by a screw 156.

The machine housing has a support portion 20B, see FIG. 8, on which a shaft 58 is mounted, see also FIGS. 9 and 10. Field-position control lever 38, which supports pivot 39 of oscillatory arm 34, is transversely mounted on shaft 58 together with a field-positioning-regulating arm 59. A leaf spring 60 secured to support plate 20, urges lever 38 into engagement with control cam 53. A spring 61, best seen in FIG. 10, is interposed between the field-position control lever 38 and field-position-regulating arm 59 so that arm 59 is urged into engagement with cam 55 so that the engaging end portion 59A abuts the periphery of cam 55. By turning of cam 55 by means of dial knob 11, regulating arm 59 is displaced to three positions. The upper portions of arm 59 and lever 38 are positioned to have overlapping portions 38B and 59B. A screw 62 is threaded into portion 59B and has an end in contact with portion 38 so that arm 59 transmits the movements thereof caused by cam 55 to arm 38, causing displacement of pivot 39 of the oscillating arm 34. Consequently, oscillating arm 34 is controlled by cams 53 and 55 to cause operations of the needle bar in three field positions, namely in two lateral field positions, and in a central field position as indicated by the indicia L,M and R on dial knob 11 which operates cam 55, but the field positions are also controlled by turning of cam 53 by dial knob 12.

Dial knob 11 also controls twin or double needle operations. As shown in FIGS. 11 and 12, a limit lever 63 is pivotally mounted on the housing of the machine and has an engaging portion 63A cooperating with cam 56 on the hollow shaft 11A. A spring 65 is wound about the pivot 64 of limit lever 63.
and urges its portion 63B into engagement with a limit pin 66 on amplitude-regulating arm 46, as shown in FIGS. 11 and 12. Dial knob 11 has an indicia "twine" in addition to the indicia L, M, R, as best seen in FIG. 7, so that the dial knob can be set in accordance with the fixed mark 49 on an indicia plate 49, see FIGS. 6 and 12. When dial knob 11 is set to "twine," cam 56 turns limit lever 63 to the position shown in dotted lines in FIG. 11 so that portion 63B engages pin 66 and turns the same to the position shown in dotted lines whereby the turning movement of amplitude-regulating arm 46, and thereby the displacement of amplitude-regulating rod 43 is limited in such a manner that the follower pin 36 of oscillating rod 35 is placed in the middle of cam ridge 34A to reduce the amplitude of the oscillation of the needle bar to half the maximum amplitude, as required for twin needle operations.

At the same time, cam 55 turns regulating arm 59 to place the needle bar in the left-field position. Even if amplitude-regulating lever 14 is turned to a position for producing the maximum zigzag stitch amplitude, spring 68, which causes engagement between amplitude-regulating arm 46 and amplitude-regulating plate 67, yields so that the turning of amplitude-regulating arm 46 can be limited for double or twin needle stitching operations.

The buttonhole-stitching operations are controlled by dial knob 12 which has indicia 1, 2, 3, S and Off. Indicia 1, 2 and 3 respectively correspond to stitches on the left side of the buttonhole, bar tack stitches at the end of the buttonhole, and stitches on the right side of the buttonhole. The indicia S represents automatic feeding. When shaft 48 is turned by dial knob 12, and an indicia is aligned with the index mark 49 on indicia plate 49, the cams on shaft 48 are turned to a position for effecting the desired operation.

As also shown in FIGS. 4 and 5, amplitude cam 50 cooperates with pin 31 on carrier lever 25, and feed cam 52 cooperates with pin 32 of carrier lever 26 so that the fulcrums 29 and 30 of cam followers 19 and 24 are displaced.

Feed-regulating cam 51 cooperates with a cam follower 85 mounted on a pivot 97, as shown in FIG. 16. Cam 54 cooperates with a cam follower screw 100 secured to a cam follower arm 98 and urged by spring 103 into engagement with cam 54.

When cam 50 is turned by turning dial knob 12 to one of the positions 1, 2, 3, a cam lug 58A displaces pin 31 and carrier lever 25. At the same time, feedback cam 53 operates cam follower 38 independently of cam follower 59 to place the same in the left field position. Cam 54 operates cam follower arm 98 to engage with portion 98A, portion 33A of connecting rod 33 so that rod 33 is displaced to the left as viewed in FIGS. 4, 5 and 8. The displacement of carrier lever 25 under the control of amplitude cam 50 changes the depth of engagement between portion 31A of cam 19 and cam 18A, which determines the displacement of rod 35 under the control of limit cam 54 determines the position of the ends of the stitches which are made in a field position determined by field cam 53.

When dial knob 12 is turned to place indicia "Off" on index mark 49, all cam followers are in an inactive position in which a straight line of stitches is made by the machine. Field cam 53 carries a pin 101, see FIG. 8, by whose action arm 102 of follower 105, see FIGS. 1, 3, and 19 is operated. Arm 102 is mounted on shaft 99 which also carries follower 98 of cam 54 and is biased by a spring 103. Turning of cam 53 with pin 101 effects turning of arm 102 to a position in which cover 105 is opened. As best seen in FIGS. 18 and 19, cover 105 is connected by hinges 106, 106' connecting portion 107, 107' and is automatically opened by spring 108' connected to hing portions 106, 106" which requires manual closing of cover 105. When cover 105 is pressed down, catch portion 111A of a lever 111 which is pivoted at 110 engages a portion 109 on the back of the cover so that cover 105 is held closed. As shown in FIGS. 3 and 8, the end of lever 111 is connected to a supporting portion 107, 107' and automatically opened by spring 108' connected to hing portions 106, 106" which requires manual closing of cover 105. When cover 105 is opened, catch portion 111A is disengaged from holding portion 109 of the cover so that the same is opened by spring 108'. The cover is automatically opened when the dial knob 12 is set to the "Off" position. As best seen in FIG. 4, cams 50 and 52, turning at the same time, displace carrier levers 25, 32 to displace lower pins 31, 32 so that cam followers 19 and 24 release cams 18A and 18B permitting the taking out of the cams through the opening 104, and replacement of the cams.

When dial knob 12 is turned to a position in which indicia S registers with index mark 49', feed cam 52 is turned to a position in which a high point thereof acts on pin 32 to displace carrier lever 26 with follower 35 to so that the same engages the periphery of feed cam 18B.

Referring now to FIGS. 1, 13, 14 and 15, the dial knob 13 has a bearing 72 mounted on the inside of dial frame 15 by means of screw 126. A regulating shaft 71 is mounted in bearing 72 for axial movement together with dial knob 13 with which it is threadedly connected by threads 71A. A spindle 73 is mounted in a bore of shaft 71 and has a pair of spaced flanges 73A located on opposite sides of a pin 90 on the arm 75 of a regulator 74, as also shown in FIG. 17. When dial knob 13 is turned, shaft 71 is axially moved by the thread 71A to adjust regulator 74 through spindle 73 and arm 75.

Feed regulator 74 includes a main body 74, a plate 76, and arm 75. Plate 76 is fixed to the main body 74 by screws 174, and has a projection 76A engaged by the pin 77 of the feed-regulating arm 77. Portion 76B cooperates with arm 75, and a spring 78 is secured to a pin 76C on plate 76 for holding regulator 74 in a position corresponding to forward feeding of the material. Arm 75 and regulator 74 are mounted on shaft 79 for individual turning movement. When spindle 73 is operated, arm 75 is turned by pin 90 and pressed against portions 76B of plate 76, see FIG. 15, so that regulator 74 is turned against the action of spring 78 to regulate the feeding.

Spring 78 also acts on plate 76, regulator 74, arm 75, spindle 73 and shaft 71 to urge dial knob 13 in outward direction to a position in which flange 13C abuts the inner shoulder 15C of dial frame 15.

Dial frame 15 has a tubular portion 15A provided with axially extending parallel grooves 15B cooperating with a pin 80 which is yieldingly mounted on a spring in a recess of dial knob 13 so that knob 13 can be turned, but is guided for straight axial movement, when manually depressed. A screw 81 on a portion of bearing 72 limits inward movement of knob 13 in axial direction by engaging a face 13A of the knob. When the indicia 13B of knob 13 is turned to a position located opposite a mark on dial 130 on dial frame 15, shaft 71 is screwed into and out of knob 13 to angularly adjust feed regulator 74 which causes variation of the forward-feeding speed to different feeding speeds indicated by the indicia on index plate 130. This is effected in a well-known manner by adjusting the position of cam 116 on shaft 16 and of the forked rod 117.

When knob 13 is pressed in and cam face 13A inwardly moved together with shaft 71, and the cam face 13A engages the stop screw 81, knob 13 turns the feed regulator 74 in reverse direction and holds it in a position for reverse feeding. By this construction, reverse feeding equivalent to forward feeding is obtained.

As described above, the automatic feed cam 18B drives cam follower 24 when the machine is set to automatic feeding. Portion 24B of cam follower 24 engages portion 77A of the feed-regulating arm 77 which is pivotally connected at 84 to the end of a carrier member 82 whose fulcrum is formed by a shaft 83, as shown in FIG. 13. An adjusting screw 119 controls the position of carrier member 82 and is inserted into a hole 120 of an inner wall of housing 1, while a flange 127 of the adjusting screw 119 is in contact with the inner surface of the housing wall. By turning adjusting screw 119 from outside of the housing, the position of carrier 82 and thereby the displacement of shaft 84 is adjusted for changing the pitch of the automatic feed. The automatic feed is selected by dial 12 which acts on cam 52 which shifts carrier lever 26 to move the cam follower 24 into engagement with the automatic feed cam 18B.
A pin 77B carried by the lower portion of arm 77 in engagement with plate 76 of the regulator 74 transmits the movement of cam follower 24 to the automatic regulating arm 77 as shown by arrows in FIG. 14. Regulator 74 operates in this manner independently of the manual regulation of the feeding.

When automatic feeding is disconnected by operation of knob 12, cam follower 24 is disengaged from feed cam 18B so that pin 77B of arm 77 is moved away from plate 76 by the action of spring 115.

FIG. 16 shows the control of the feeding mechanism during buttonhole stitching. Cam 51 is turned by follower projection 85B and acts on cam follower projection 85B of feed-control arm 85 to turn the same about pivot 97 so that end portion 85A is displaced to act on a rod 86 which is biased by a spring 89 in downward direction. As best seen in FIG. 17, a connecting member 87 has a spindle whose end portion is threaded into an opening at the upper end of rod 86 and which passes freely through a bore in the end portion 85A. A coil spring 88 abuts end portion 85A and the head of connecting member 87. Displacement of rod 86 with connecting member 87 relative to the end portion 85A will cause compression of coil spring 88 which performs the function of a buffer spring and provides lost motion in the event that feed control arm 85 is improperly operated in relation to the feed regulator 74 for turning cam 51 acting on cam follower projection 85B. Under normal operating conditions, spring 89 pulls feed control arm 85 by means of rod 86, connecting member 87, and coil spring 88 downward so that cam follower projection 85B resiliently engages cam 51. Rod 86 has a slot 86A receiving a coupling pin 91 carried by one end of arm 75, as shown in FIG. 14.

Feed cam 51 operated by dial knob 12 changes the position of control rod 86 between three positions. Rod 86 moves regulator 74 through the lost motion connection 86A, 91 and arm 75. By setting dial knob 12 between positions 1, 2 and 3, the regulator 74 is angularly turned to produce forward feed in position “1,” to stop the feed, or feed very slowly in position “2,” and reverse the feed in position “3.” The pitch of the feed in positions 1 and 3 is determined by the shape of feed cam 51 so that the pitch of the feed is a maximum when knob 12 is in positions “1” and “3.”

The feeding pitch for buttonhole stitches is determined in this manner. However, in order to adapt the feeding pitch to different fed materials, the feed-control mechanism of the invention permits a variation of the feeding pitch by operation of knob 12.

As shown in FIG. 15, arm 75 is connected with control rod 86 and spindle 73 by connecting pins 90, 91 so that when control rod 86 is moved up and down, operating arm 75 is also moved together with spindle 73. This causes control shaft 71 to move with spindle 73 and feed knob 13 to the right and left as viewed in the drawing. Knob 13 is stopped at the time when the control rod 86 is firmly connected with arm 75 through pin 91 and slot 86A when knob 12 is in position “1” and has displaced cam 51 to a corresponding position, or control rod 86 is lifted in position “3” so that knob 13 is moved inwardly when the cam face 13A is in contact with a stop screw 81, as shown in FIG. 13. When knob 13 is turned over indicia 131, indicating buttonhole stitching, the pivotal movement of arm 75 under control of cam 51 and rod 86 is independent of the turning of knob 13 since flange 13C is separated from the shoulder 15C of the dial plate 15.

When knob 13 is operated, and indicia line 13B is placed in the region of the indicia 131, FIG. 1, by turning knob 13, arm 75 pivots slightly corresponding to a turning angle of knob 13, and cam 51 moves rod 86 upward, as explained above, so that the feeding pitch is finer than in the positions “1” and “3” of knob 12. In this case, the play in the connection between pin 91 of arm 75 and control rod 86 is absorbed by spring 88.

From the above description of a preferred embodiment of the invention best shown in FIG. 17, it will be apparent that the feeding arrangement of the invention comprises a feed regulator 74 for varying and reversing the feeding speed and reversing the feeding direction, operating and means 75 for controlling regulator 74, 76, manual feed control means 13, 71, 73, 90 connected with the operating means 75 for manually adjusting the feeding speed, automatic operating mechanism including cam 52, 18B, cam follower 24, and lever 77 directly connected with regulator 74 for operating the same, and manual control means including knob 12, shaft 48, cam 51, feed control arm 85, and control rod 86 connected with operating means 75 by pin 91 for setting regulator 74 to forward or to reverse feeding speed and minimum feeding, and further including cam 52, 18B, cam follower 24, an automatic operating mechanism with cam 18B which is driven by drive means 18, 17. During operation of operating means 75 by manual means 13, 71, 73, 90, the automatic operating mechanism is inoperative, and follower 24 disconnected from cam 18B.

It will be understood that each of the elements described above, or two or more together, may also find useful application in other types of automatic zigzag sewing machines differing from the types described above.

While the invention has been illustrated and described as embodied in a feeding arrangement for automatically and manually controlling the feeding speed of the machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended:

1. An automatic sewing machine having drive means, in combination, a feeding arrangement comprising a feed regulator for varying the stitch length and for reversing the feeding direction; operating means for said regulator; manual feed control means connected with said operating means for manual adjustment of said regulator; means for mounting said feed regulator for movement relative to said operating means; automatic operating mechanism driven by said drive means and directly connected with said regulator for operating the same; and manual control means for selectively rendering said automatic operating mechanism operative and inoperative.

2. A feeding arrangement as claimed in claim 1 wherein said automatic operating mechanism includes a cam driven from said drive means, and a cam follower cooperating with said cam, and wherein said manual control means include means for separating said cam follower from said cam for rendering said automatic operating mechanism inoperative.

3. A feeding arrangement as claimed in claim 1 wherein said manual control means include a control cam for selectively rendering said automatic operating mechanism operative and inoperative.

4. A feeding arrangement as claimed in claim 1 wherein said automatic operating mechanism includes a drive cam driven by said drive means, a cam follower cooperating with said drive cam, means connecting said cam follower with said feed regulator, and a carrier lever having a pivot supporting said cam follower for angular movement; and wherein said manual control means include a control cam cooperating with said carrier lever for displacing said pivot between a first position cooperating with said drive cam and a second inoperative position spaced from the same.

5. A feeding arrangement as claimed in claim 1 wherein said operating means includes an operating arm for controlling said feed regulator and having a pin; and wherein said manual control means include a knob, a control cam operated by said knob, a cam follower means operated by said control cam, a member having a slot in which said pin is located, connecting
means including a buffer spring connecting said cam follower means with said slotted member so that turning of said knob causes angular displacement of said operating arm, and springs acting on said operating arm and on said slotted member.

6. A feeding arrangement as claimed in claim 5 wherein said cam follower means include a cam follower cooperating with said control cam, said spring which acts on said slotted member urging said cam follower into engagement with said control cam, wherein said connecting means include a connecting member secured to said slotted member, and passing through said cam follower, and wherein said buffer spring abuts said cam follower and said connecting member.

7. A feeding arrangement as claimed in claim 1 wherein said automatic operating mechanism includes a cam driven by said drive means, a cam follower cooperating with said cam, a lever connecting said cam follower with said regulator, a supporting member supporting said lever for pivotal movement, and means adjusting said lever for adjusting the fulcrum of said lever and thereby the manner in which said regulator is controlled from said driven cam.

8. A feeding arrangement as claimed in claim 1 wherein said manual control means include a shaft and a control cam on said shaft; said sewing machine comprising a pattern cam, a cam follower lever cooperating with said pattern cam; a needle bar assembly oscillated by said cam follower lever, and a housing in which said pattern cam is located, said housing having an opening in the region of said pattern cam and a cover for closing said opening; and comprising an arm operated by said control cam and connected with said cover for opening the same in a predetermined angular position of said shaft and said control cam; and means connecting said shaft with said cam follower lever and spacing the latter in said predetermined position of said shaft from said pattern cam when the latter is accessible through said opening in said housing.

9. In an automatic sewing machine having drive means, in combination, a feeding arrangement comprising a feed regulator for varying the stitch length and for reversing the feeding direction; operating means for said regulator; manual feed control means connected with said operating means for manually adjusting the feeding speed, said manual feed control means including a knob mounted for turning movement about an axis and for axial movement, and having a thread, and connecting means mounted for axial movement connecting said knob with said operating means and including a thread engaging said thread so that said feed regulator is gradually adjusted by said operating means when said knob is turned and said connecting means is axially moved by said threads, and rapidly adjusted when said knob is moved in axial direction with said connecting means; automatic operating mechanism driven by said drive means directly connected with said regulator and operating the same; and manual control means for selectively rendering said automatic operating mechanism operative and inoperative.

10. In an automatic sewing machine having drive means, in combination, a feeding arrangement comprising a feed regulator for varying the feed length and for reversing the feeding direction; operating means for said regulator; manual feed control means connected with said operating means for manually adjusting the feeding speed; automatic operating mechanism driven by said drive means directly connected with said regulator and operating the same; and manual control means including a knob, a cam turned by said knob, a cam follower cooperating with said cam, connecting means secured to said cam follower, lost-motion means connecting said connecting means with said operating means, and including a member secured to said connecting means, and a spring acting on said member and urging said cam follower into engagement with said cam.

11. A feeding arrangement as claimed in claim 10 wherein said lost-motion means includes a pin connected with said operating means; and wherein said member has a slot in which said pin is located.

12. In an automatic zigzag sewing machine having drive means, in combination, a feeding arrangement comprising, a feed regulator for varying the stitch length and for reversing the feeding direction; operating means for said regulator; manual feed control means connected with said operating means for manually adjusting the feeding speed; automatic operating mechanism driven by said drive means and directly connected with said regulator and operating the same; and manual buttonhole control means connected with said operating means for setting said regulator to forward feeding, reverse feeding, and minimum feeding, and for selectively rendering said automatic operating mechanism operative and inoperative.

13. A sewing machine as claimed in claim 12 including a needle bar assembly mounted for oscillatory movement, and for movement between three field positions; and wherein said manual buttonhole control means include a first control cam and first cam follower means for shifting said needle bar assembly between said three field positions, and a second control cam, and second cam follower means connecting said second control cam with said needle bar assembly for determining the amplitude of the oscillatory movement of the needle bar assembly dependent on the field position of the same, a third control cam, and third cam follower means connecting said third control cam with said sewing means of said feed regulator for setting the same to forward feeding when said needle bar assembly is in one lateral field position, to reverse feeding when said needle bar assembly is in the other lateral field position, and to minimum feeding when said needle bar assembly is in a central field position, and a shaft supporting said first, second and third control cams and being manually turnable.

14. A sewing machine as claimed in claim 13 wherein said manual buttonhole control means include a fourth control cam on said shaft for selectively rendering said automatic operating mechanism operative and inoperative.

15. A sewing machine as claimed in claim 14 and including a fifth control cam on said shaft, fifth cam follower means cooperating with said fifth control cam and having a pivot, a cam follower lever mounted on said pivot, and a pattern cam driven by said drive means and cooperating with said cam follower lever, a needle bar assembly, means connecting said needle bar assembly with said cam follower lever so that the needle bar assembly is oscillated, whereby adjustment of said pivot by turning of said fifth control cam to a predetermined position determines the amplitude of the oscillatory movement of said needle bar assembly during buttonhole stitching.

16. A sewing machine as claimed in claim 14 comprising a hollow shaft mounted for rotation on said shaft, manual means for turning said hollow shaft, a field position cam secured to said hollow shaft, and cam follower means connecting said field position cam with said needle bar assembly for shifting the same between two lateral and one central field positions.

17. A sewing machine as claimed in claim 16 and including a twin needle limit cam on said hollow shaft, and cam follower means controlled by the twin needle limiting cam for limiting the amplitude of the oscillatory movement of said needle bar assembly, said manual means for turning said hollow shaft having a position in which said twin needle limiting cam is operative.

18. A sewing machine as claimed in claim 16 comprising a needle bar assembly mounted for oscillatory movement, a cam driven by said drive means, cam follower means connecting said cam with said needle bar assembly and including an oscillatory arm, a cam follower having a pivot supporting said oscillatory arm, and a manually operable means including a cam for moving said cam follower so that said pivot is displaced for varying the field position of said needle bar assembly; and wherein said manual buttonhole control means
include a control cam, and a control cam follower cooperating with said control cam and engaging said cam follower for displacing the same whereby said needle bar assembly is shifted between different field positions when said manual buttonhole control means sets said regulator to forward, reverse and minimum feeding.

19. A sewing machine as claimed in claim 18 and including adjustable threaded means for connecting said control cam follower with said cam follower.

20. A sewing machine as claimed in claim 19 including a follower between said needle bar assembly and said oscillatory arm movable relative to said oscillatory arm for varying the effective radius of the same and thereby the amplitude of oscillation of said needle bar assembly; and including a manually operated lever, and connecting means connecting said lever with said follower to vary the amplitude oscillation of said needle bar assembly; and further including manual means for limiting the movement of said connecting means and thereby the maximum amplitude of oscillation of said needle bar assembly.