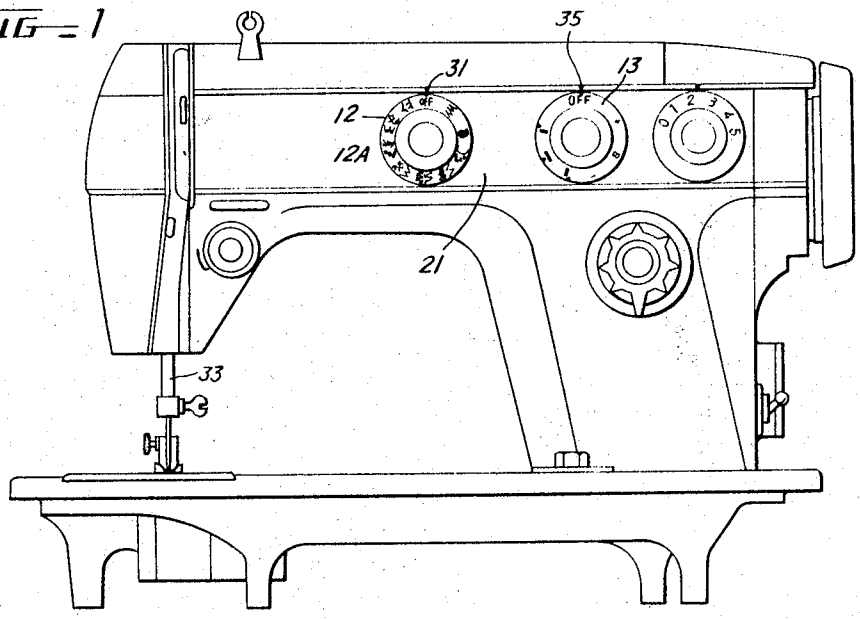
July 15, 1969 NOBORU KASUGA 3,455,258

AUTOMATIC FEED CHANGING DEVICE IN ZIGZAG SEWING MACHINE

Filed Nov. 16, 1965 3 Sheets-Sheet 1

FIG. 1



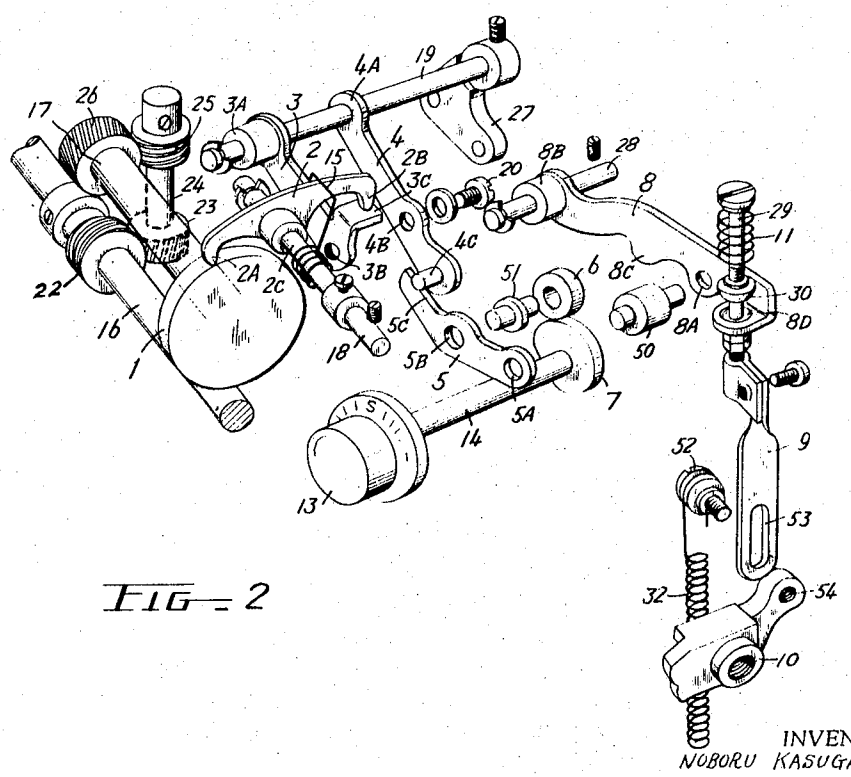


FIG. 2

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AUTOMATIC FEED CHANGING DEVICE IN ZIGZAG SEWING MACHINE

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FIG. 3

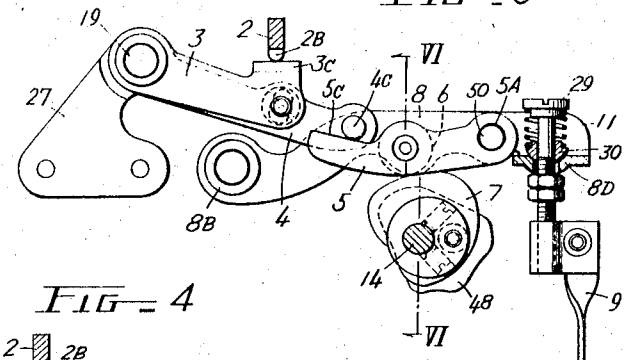


FIG. 4

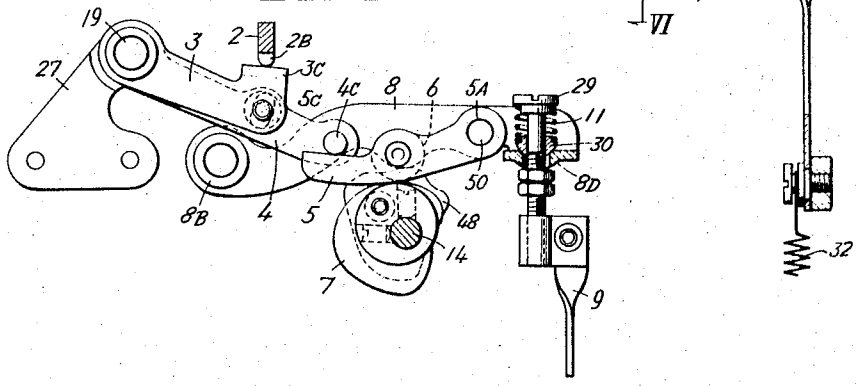


FIG. 5

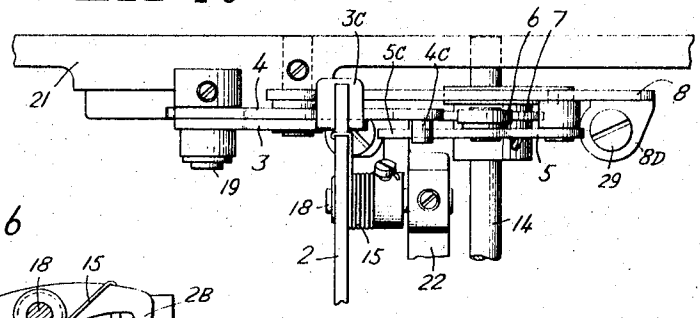
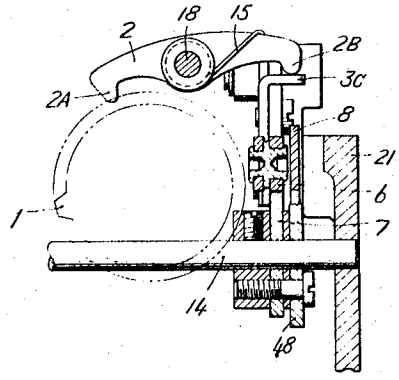


FIG. 6



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AUTOMATIC FEED CHANGING DEVICE IN ZIGZAG SEWING MACHINE

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FIG. 7

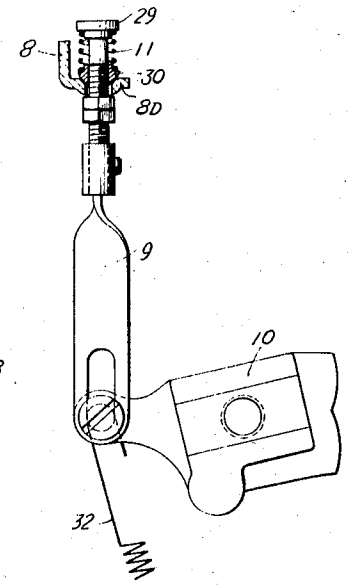


FIG. 8

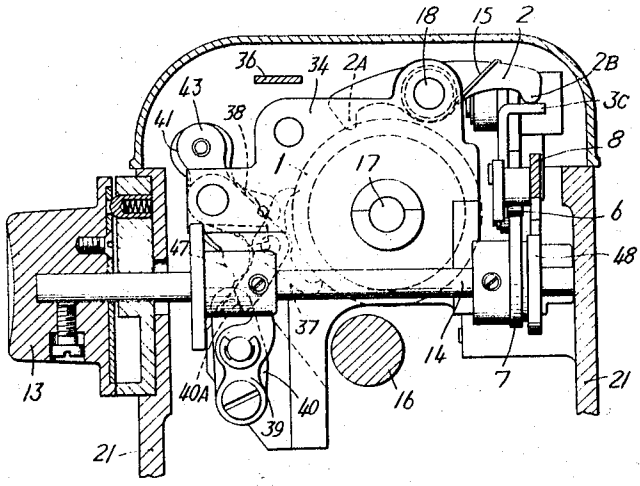


FIG. 9

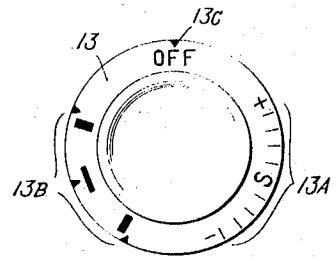
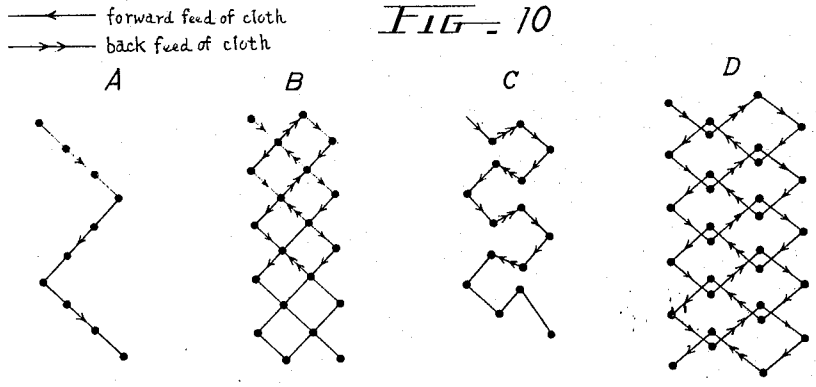


FIG. 10



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United States Patent Office

3,455,258

Patented July 15, 1969

3,455,258

AUTOMATIC FEED CHANGING DEVICE IN ZIGZAG SEWING MACHINE

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Claims priority, application Japan, Nov. 16, 1964, 39/88,765
Int. Cl. D05b 27/08, 3/02
U.S. Cl. 112—210 11 Claims

ABSTRACT OF THE DISCLOSURE

During each zigzag stitch of a sewing machine, the fabric feed of the machine is automatically cyclically set to forward and rearward feeding so that composite stitches result whose ornamental outline depends on the pattern cam controlling the transverse oscillations of the needle bar assembly, and also on the cyclical variation of forward and rearward feeding. A knob is provided for adjusting the device manually between a condition in which forward feeding is greater than rearward feeding, and another condition in which rearward feeding is greater than forward feeding for further influencing the shape of the produced composite stitches.

BACKGROUND OF THE INVENTION

The present invention is concerned with an ornamental zigzag sewing machine having pattern cams for producing ornamental stitches of different shape, and also feeding means which are settable to positions for forward and rearward feeding.

It is known to reverse the feeding of the fabric during the making of a zigzag stitch, but in the construction of the prior art, certain composite stitches are produced by a pattern cam and by reversing of the feeding, and it is not possible to select a respective stitch without reversal of feeding. This results in a limited number of ornamental stitches selected by the same dial knob carrying corresponding indicia.

SUMMARY OF THE INVENTION

It is one object of the invention to provide an ornamental zigzag sewing machine capable of making a wide variety of composite ornamental stitches whose shape is influenced by a pattern cam and by the fabric feeding means of the machine.

Another object of the invention is to provide an automatic cyclical setting of the feeding means to forward and rearward feeding during the making of a zigzag stitch by the needle bar assembly.

Another object of the invention is to provide manually operated means for increasing the effect of the forward feeding, or of the rearward feeding, respectively, to different degrees during the making of an ornamental composite stitch.

With these objects in view, one embodiment of the invention comprises a needle bar assembly which is operatively connected to a pattern cam shaft to be oscillated for producing zigzag stitches, drive means, a feed adjusting device for reversing and varying the feeding speed of the machine, and automatic feed control means driven from the drive means and connected with the feed adjusting device for cyclically setting the same to forward and rearward feeding during each stitch made by the needle bar assembly.

In the preferred embodiment of the invention, the feed adjusting device includes an adjusting member movable from a central neutral position in opposite directions for forward and rearward feeding, respectively. The automatic

feed control means is connected with the adjusting member and has three positions. In the first position, the adjusting member is cyclically moved equal distance in the opposite directions out of the netural position so that the same forward and rearward feeding takes place. In the second position, the adjusting member is moved a greater distance in the direction for forward feeding than in the direction for rearward feeding. In the third position, the adjusting position is moved a greater distance in the direction for rearward feeding than in the direction for forward feeding. Manually operating means are provided for setting the control means between the first, second and third positions, so that the shape of the produced composite stitch can be influenced in accordance with the desired outline of the stitch which will be spread in longitudinal direction when forward feeding prevails, and will have a tendency to be looped when rearward feeding prevails.

In the preferred embodiment of the invention, the manually operated means includes a knob, a shaft, and a cam carried by the shaft and supporting a control lever of the automatic feed control means for oscillation about a fulcrum whose position depends on the angular displacement of the manually operated cam on which the control lever is supported. The control lever is operatively connected to the adjusting member of the feed adjusting device.

In the construction of the present invention, a first dial is provided for setting the machine to different ornamental stitches which are indicated on the dial. A second dial is provided for setting the machine to three different feeding conditions, as explained above. By operation of both dials, a great number of different stitches can be produced, and the shape of the stitches can be selected by the operator by longitudinally expanding or contracting the outline of the basic stitch produced by a pattern cam of the machine.

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 illustrating a sewing machine provided with a feed changing device according to the invention;

FIG. 2 is a fragmentary perspective exploded view illustrating the feed changing device;

FIG. 3 is a fragmentary elevation illustrating the device in one operational position;

FIG. 4 is an elevation illustrating the device in another operational position;

FIG. 5 is a plan view of the device shown in FIGS. 3 and 4;

FIG. 6 is a fragmentary sectional view taken on line VI—VI in FIG. 3;

FIG. 7 is a side elevation illustrating a feed adjusting device, and being partially in section;

FIG. 8 is a cross-sectional view illustrating manually operated means used in the feed changing device of FIGS. 2 to 6, and also serving for controlling a button hole stitching mechanism;

FIG. 9 is a front view illustrating the knob and dial for manually setting the feeding device, and also serving for controlling the button hole stitching device; and

FIG. 10 comprises a first view **10**A illustrating a standard zigzag stitch, a view **10**B illustrating a composite stitch with the feed adjsuting device in a neutral posi-

tion, a view 10C in which the forward feed prevails, and a view 10D in which the rearward feed prevails.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The device is attached to the inside of a housing frame 21 shown in FIG. 1 and is composed of automatic feeder cam 1, its cam follower 2, automatic feeder adjusting plate 3, pattern feeder adjusting arm 4, feeder control lever 5 as shown in FIG. 2. The automatic feeding cam 1 is carried by shaft 17 which is parallel to the main drive shaft 16 of the frame together with the numerous pattern cams (not illustrated). Main drive shaft 1C has a worm gear 22 driving worm gears 23, 25 with intermediate shaft 24, and through gear 25, worm gear 26 on cam shaft 17 so that automatic feed control cam 1 is rotated. Furthermore, the automatic feeding follower 2 is mounted on the follower shaft 18 at the fulcrum 2C in order to oscillate freely. The follower shaft 18 is mounted on the supporting structure 34 (see FIG. 8) of the housing frame 21 parallel to cam shaft 17 so that it cooperates with the feeder control cam 1. At both ends of the follower 2, the pawl portion 2A and 2B are formed, and by the spring 15 wound on the follower shaft 18, one pawl portion is pushed against the pressure receiving portion 3C of the adjusting plate 3 at all times.

As for the automatic feeding adjustment plate 3, and the pattern feeding adjustment arm 4, one portion of each end 3A, 4A is fixed to the shaft 19 inserted into the bearing 27 attached to the housing frame 21. The holes 3B, 4B are connected with joining screw 20 so that an adjustment will be possible and an integrated movement can be obtained. One portion of the adjustment plate 3 is bent to be the pressure receiving projection 3C for the above mentioned pawl portion 2B. Furthermore, the adjustment arm 4 has a pin 4C at the other end. The bore 5A of the control lever 5 receives the pivot 50 inserted into the connecting hole 8A of the button hole feed adjusting arm 8. Furthermore, in the connecting hole 5B a roller 6 is mounted with attaching element 51, and at the tip of the above mentioned pin 4C, the engaging portion 5C is located. The aforementioned button hole feed adjusting arm 8 is mounted on the frame 21 on the supporting shaft 28 by means of a hub forming a fulcrum 8B. At the lower middle portion, a protrusion 8C for the button hole cam is formed and at the other end, there is a bent portion 8D connected to the adjusting rod 9 and through the said adjusting rod 9 to the feed adjusting device 10. At the top of the said adjusting rod 9, the feeder adjusting spring 11 is mounted on the attaching rod 29 and has a spherical portion 30 abutting portion 8D of arm 8. At the connecting portion of the adjusting device below, a tension spring 32 is attached with the fixing element 52 to the attaching portion 54 of the feeder adjusting member 10 passing through slot 53 of the rod 9. Furthermore, adjusting cam 7 which is made to act on the above-mentioned roller 6 of control lever 5 is carried by dial shaft 14 which has outside of the frame 21, the feeder dial knob 13 as indicated in FIG. 1, FIG. 2, FIG. 8 and FIG. 9. The said feeder dial knob 13 has on the surface the feeder indicia 13A, the button hole symbols 13B and the "OFF" symbol 13C as shown in FIG. 9, and also serves for controlling the button hole sewing operation.

In FIG. 1, 12 is the pattern dial knob, and the feeder dial knob 13 mentioned above will be placed nearby on housing frame 21. Then by turning knob 12 until one of the pattern symbols 12A coincides with the index mark 31, the respective follower (not shown) can be selected to engage a pattern selecting cam of a cam drum, and it is a well known fact that by pressing against this, the selected pattern can be stitched by needle bar assembly 33. Furthermore, as for the actual structure for performing the button hole stitching, a button hole feeder cam 48, see FIGS. 3, 4, 8, will be made to contact the button hole feed adjusting arm 8. Furthermore, on the dial knob shaft 14, the button hole amplitude adjusting cam 47 is fixed as shown in FIG. 8, and the button hole adjusting arm 40 and the adjusting arm 39 will be made to come into contact with the said cam 47. Furthermore, another position adjusting arm 43 and amplitude adjusting arm 41 are provided as shown in FIG. 8. By turning the dial 13, and operating it so that the button hole symbol 13B will coincide with the index mark 15, the button hole amplitude adjusting cam 47 will turn, and the follower cam 37 will be adjusted and operated via the pin 40A on the adjusting arm 40, the button hole adjusting arm 39 and the position adjusting arm 43. At the same time, the above mentioned feeder adjusting cam 48 will be operated, and by the feeder adjusting arm 8, the feeder adjusting device 10 will operate to form the button hole. It is made so that the lateral stitches on the left and right and the bar tack stitches at the ends of the lateral stitches will be formed. The automatic feed reversal during the making of the lateral rows of button hole stitches is not an object of the invention. The device is operated as follows. The dial knob 13 which is also employed for the sewing of the button hole in the above-mentioned operation is turned out of the button hole position 13B so that the feeder symbol 13A will be located at the top, and coincide it with index mark 35. Then, as shown in FIG. 3, the roller 6 of the control lever 5 will be raised by manually operated cam 7 to an operative position. By locating the "OFF" symbol 13C at the top position, coinciding with the index 35, the cam 7 will turn to the position shown in FIG. 4, in which the minimum radius portion of cam 7 is in contact with roller 6 which will be lowered, as compared with the position of FIG. 3. However, if dial knob 13 is turned to indicia 13A, roller 6 is made to rise by cam 7 as shown in FIG. 3, and the control lever 5 will be angularly adjusted about the pivot point 50, 5A of the adjusting arm 8 which is held down by spring 32 while fulcrum member 51 and the contact portion 5C will be pushed up, the pin 4C of the adjusting arm 4 will also be pushed up, and the adjusting plate 3 which moves with said adjusting arm 4 is pushed upwards and turned, and the pressure contact projection 3C will push up the pawl portion 2B of the follower 2 against the spring 15 mounted on the follower shaft 18. Consequently, the other pawl portion 2A which was spaced from feed control cam 1 in the position of FIG. 3, will be put into contact with the automatic feed control cam 1 and an oscillatory motion will be transmitted by pin 4C to portion 5C of control lever 5. Since the pressure exerted on control lever 5 cannot displace cam 7, the same acts as a supporting fulcrum, and connector pivot 50 oscillates opposite to portion 5C of control lever 5 to cyclically raise portion 8D of adjusting arm 8.

As shown in FIG. 4, if the minimum radius portion of the cam 7 is put into contact with the roller 6, the pawl portion 2B of the follower 2 will be pulled down by the spring 15 via the mechanism outlined above, and the pawl portion 2A will be released from the feeder cam 1, but if the device is set to the position of FIG. 3, super stitch patterns can be made. The main drive shaft 16 revolves and the speed of revolution of cam shaft 17 is reduced by gear train 22–26. With the device set to the position of FIG. 3, the surface of portion 3C of the pattern feeder adjusting plate 3 is made to move vertically by the follower 2, and this movement is transmitted to the pattern feeder control lever 5 via the adjusting arm 4 and pin 4C. Therefore, the said feeder control lever 5 will oscillate with the roller 6 resting on cam 7 as the fulcrum. The oscillation is transmitted to the adjusting arm 8 by the pivot 50, and adjusting rod 9 will perform a vertical reciprocating movement lifting pin 52 against tension spring 32 from the lower end of slot 53 and oscillating adjustment member 10 of the above-mentioned feed adjusting mechanism. In this way, there will be a change in the angular position of the feed adjusting member 10. Thus, by the change in the

feed adjusting member **10**, the feed is changed between forward and rearward feed and composite stitch patterns are formed.

The adjusting device **10** is normally set in the direction for forward feed by the tension spring **32** and if it is pulled up by the adjusting rod **9**, it will be set in the direction for rearward feed. The safety spring **11** located at the top of the adjusting rod will be compressed when excessive load is exerted on rod **9** in order to prevent damage to the mechanism if the feeding mechanism is blocked.

In the above-mentioned manner, in case of using this invention, besides the amplitude change and the forward feed of conventional zigzag sewing machines, the sewing of super stitch patterns by automatic changes in the feed of the fabric can be effected in addition to the stitch pattern produced by the needle bar assembly. By the operation of the dial **12** for the known pattern selecting mechanism, a certain follower, not shown, is placed in close contact with the selected cam on cam shaft **17**. For instance, after selecting a certain pattern such as that shown in FIG. 10A, if the sewing machine is driven in this state, only forward stitches will be made in the direction of the arrows, but if the present invention is employed and the feed dial **13** is operated so that the standard "S" of the feed symbol **13A** coincides with the index **35**, the automatic cyclical feed adjustment by feeder cam **1** for equal alternate forward and rearward feeding is obtained, and the above-mentioned pattern of FIG. 10A will change and become a super pattern as shown in FIG. 10B in which equal forward and rearward feeding movements alternate after each stitch as indicated by single and double arrows.

When knob **13** is in the position S, cam **7** is in a "neutral" position in which the oscillation of control lever **5** produces equal forward and rearward alternating feed movements. If the plus (+) side symbol of the feeder indicia **13A** is selected in this state, and the forward feeding is large, the rearward feeding will become small. The FIG. 10B pattern is changed as shown in 10C. The degree of this change is determined by the plus (+) side reading of the dial **13**. On the contrary, if the minus (—) side of the feeding indicia **13A** is selected, the forward feed amount will become less than in the neutral position "S," and the reverse movement will become great. Consequently, the stitches will partially overlap and the pattern of FIG. 10B will be changed as shown in FIG. 10D, which is drawn to a larger scale than FIGS. 10A to 10C. The relative adjustment between the forward and rearward feeding is due to the fact that the position of the fulcurm of control lever **5** is shifted when cam **7** is angularly displaced a small positive or negative angle out of the "neutral" position of FIG. 3, since the displacement of the fulcrum changes the ratio of the lever arms of control lever **5**. The shape of the composite stitch pattern can be adjusted by making fine adjustments of the feeder dial **13** on the plus side and minus sides, and by manually changing the angular position of cam **7** continuously. By doing so, a large variety of modified stitches can be accomplished. The contact pressure towards the cam is generally great. Therefore, the slightest displacement of the follower **2** which may wear out, can be adjusted and compensated. In case the standard stitches as shown in FIG. 10B are desired, by making adjustments for the displacement or distortion caused by wear or other reasons, undesired pattern deformations such as those shown in FIGS. 10C and 10D can be prevented adequately.

As mentioned above, by this invention the feeding speed can be adjusted by utilizing the button hole stitching dial **13**, and so-called super stitches can be formed. Thus, the composition of modified stitches is comparatively simple, and the operation is easy which is one of the characteristics of this invention. Furthermore, since a separate dial preferably the buton hole dial **13**, and not the pattern dial **12** is used, the pattern dial can be provided with the greatest possible number of pattern indicia, and in addition to this, by making fine adjustments of dial knob **13** to the plus side or minus side, an even greater variety of patterns can be obtained by distortion of the basic stitch. Furthermore, at the same time, inaccuracy of the stitches caused by wear and other reasons can be corrected as required, and accurate pattern can be maintained at all times.

By turning dial knob **12**, a selected pattern cam, not shown, can be rendered operative to oscillate a cam follower which controls the zigzag movement of the needle bar assembly **33**, as is well known to those skilled in the art. When dial **13** is placed in the position "OFF," with indicia **13C** located opposite index mark **35**, the stitch produced by the respective pattern cam is made, for example, the stitch shown in FIG. 10A, since eccentric cam **7** holds control lever **5** and thereby cam follower means **2, 3, 4, 4C** in an inoperative position in which feed control cam **1** does not operate cam follower **2**. When dial knob **13** is turned to the position S, the cam follower means **2, 3, 4, 5** become operative and feed adjusting arm **8** is oscillated by control lever **5** through connector **50** to oscillate the feed adjusting member **10** equal distances in the directions for forward and rearward feeding so that a symmetrical modificaion of the stitch is obtained, as shown for the plain zigzag stitch in FIG. 10B. When dial knob **13** is either turned in the plus direction for increasing the forward feed, or in the minus direction for reducing the forward feed as compared with the rearward feed, the composite stitch of FIG. 10B is spread out in longitudinal direction as shown in FIG. 10C, or pushed together to interloop as shown in FIG. 10D.

However, if the stitch pattern of FIG. 10B is desired, and due to wear of the parts a perhaps less distorted stitch pattern resembling stitch patterns **10C** or **10D** is obtained, an adjustment of knob **13C** out of its neutral position will obtain a correction and the desired stitch pattern shown in FIG. 10B.

The indicia **13A** and **13C** for varying the automatic feed adjustment are provided on knob **13** which also serves for setting the machine in a known manner to button hole stitching operations, but this is only due to the desirability of providing as few knobs as possible. The control of the buton hole stitches by a dial could be made independently of the control of the forward and rearward feed for the purposes of the present invention. However, the preferred embodiment of the present invention provides a particularly simple structure since the feed adjusting arm **8** is not only used for reversing the feed on the two sides of a button hole, but also for distorting the pattern stitches in accordance with the present invention while the button hole mechanism is not used.

I claim:

1. A zigzag sewing machine comprising, in combination, a needle bar assembly; a pattern cam means for oscillating said needle bar assembly to make consecutive groups of zigzag stitches; drive means for driving said pattern cam means; a feed device for feeding a fabric forwardly during at least one, and rearwardly during at least one of said zigzag stitches of each of said group of zigzag stitches; and means including a control member for adjusting said feed device so as to adjust the distance the fabric is fed during at least one of said zigzag stitches of each of said group of zigzag stitches; and manually operated means including a part defining a fulcrum and supporting said control member for pivotal movement about said part and being manually controlled to displace the fulcrum relative to said control member for adjusting the ratio of the distances which the fabric is fed in forward and rearward directions during each zigzag stitch.

2. A zigzag sewing machine, comprising, in combination, a needle bar assembly; a pattern cam means for

oscillating said needle bar assembly to make consecutive groups of zigzag stitches; drive means for driving said pattern cam means; a feed device for feeding a fabric under said needle bar assembly forwardly during at least one of said stitches and rearwardly during at least one of said stitches of said group of zigzag stitches; adjusting means movable from a central neutral position in opposite directions for setting said feed device to forward and rearward feeding; and automatic feed control means driven from said drive means and connected with said adjusting means for cyclically setting said feed device to forward and rearward feeding while said needle bar assembly makes successive stitches of said groups of zigzag stitches, said automatic feed control means including a control member connected with said adjusting means and having a first position for cyclically moving said adjusting means equal distances in said opposite directions out of said neutral position so that the same forward and rearward feeding takes place, a second position for cyclically moving said adjusting means a greater distance in the direction for forward feeding than in the direction for rearward feeding, and a third position for cyclically moving said adjusting means a greater distance in the direction for rearward feeding than in the direction for forward feeding; and manually operated means for setting said control member between said first, second and third positions, and including a part for supporting said control member for pivotal movement about a fulcrum and being manually controlled to displace the fulcrum of said control member so that the same is set to said first, second and third positions.

3. A sewing machine as claimed in claim 2 wherein said manually operated means includes a knob and a knob shaft secured to said knob, and wherein said part is a cam secured to said knob shaft and having cam lobes of different height for supporting said control member for pivotal movement in said first, second and third positions.

4. A sewing machine as claimed in claim 2 wherein said automatic feed control means include a rotary feed control cam driven from said drive means, and oscillatory cam follower means cooperating with said control cam and connected with said control member for oscillating the same about said fulcrum.

5. A sewing machine as claimed in claim 4 wherein said cam follower means include a cam follower cooperating with said control cam, and lever means mounted for pivotal movement and having a first portion engaged by said cam follower so that said lever means are oscillated, and a second portion in contact with said control member for oscillating the same.

6. A sewing machine as claimed in claim 5 wherein said feed device includes biasing means for urging said adjusting means to move in said direction for forward feeding; and wherein said cam follower means are driven by said feed control cam to urge said adjusting means against said biasing means in said direction for rearward feeding.

7. A sewing machine as claimed in claim 2 wherein said manually operated means include a first knob having indicia representing different forward and rearward feeding speeds and the neutral position of said adjusting means; and comprising a second knob having indicia for indicating a plurality of different ornamental stitches adapted to be made by said needle bar assembly under the control of said patern cam shaft so that by setting of said first and second knobs to different indicia different composite stitches are obtained.

8. A sewing machine as claimed in claim 2, wherein said automatic feed control means include a feed control cam driven from said drive means, cam follower means cooperating with said feed control cam, and means connecting said cam follower means with said feed adjusting means for setting the feed device to forward and rearward feeding in accordance with the shape of said feed control cam.

9. A zigzag sewing machine comprising, in combination, a needle bar assembly; pattern cam means for oscillating said needle bar assembly to make consecutive zigzag stitches; drive means for driving said pattern cam means; a feed device having first and second positions for feeding a fabric under said needle bar assembly forwardly and rearwardly, respectively, and including biasing means for urging said feed device into said first position for forward feeding; and automatic feed control means including a feed cam means driven from said drive means, cam follower means cooperating with said feed cam means, and an oscillatory control member operated by said cam follower means and connected with said feed device for alternately setting said feed device to said first and second positions for forward and rearward feeding, said control member having a first position for setting said feed device to feed a fabric equal distances in forward and rearward directions, a second position setting said feed device for feeding the fabric a greater distance in forward direction than in rearward direction, and a third position setting said feed device for feeding the fabric a greater distance in rearward direction than in forward direction; and a single manually operable member connected with said control member and with said cam follower means, and having first, second, and third positions for setting said control member to said first, second, and third positions, respectively, and a fourth position for separating said cam follower means from said feed cam means so that said control member does not oscillate for controlling said feed device so that said feed device feeds the fabric in said forward direction.

10. A zigzag sewing machine as claimed in claim 9 wherein said manually operable member includes a knob mounted for manual turning movement between said first, second, third, and fourth positions.

11. A zigzag sewing machine as claimed in claim 10 wherein said knob has three additional positions for setting said feed device to forward and rearward feeding, and to non-feeding during the sewing of button holes.

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U.S. Cl. X.R.

112—158