Jan. 10, 1967 SHINICHI KAWAGUCHI 3,296,987

CONTROL DEVICE FOR CHANGING THE RANGE OF STARTING POINT AND SWING AMPLITUDE OF A NEEDLE IN A ZIGZAG SEWING MACHINE

Filed July 21, 1965 2 Sheets-Sheet 1

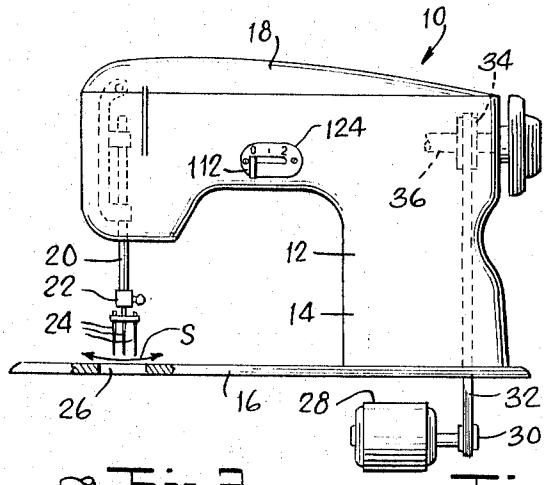


Fig. 1.

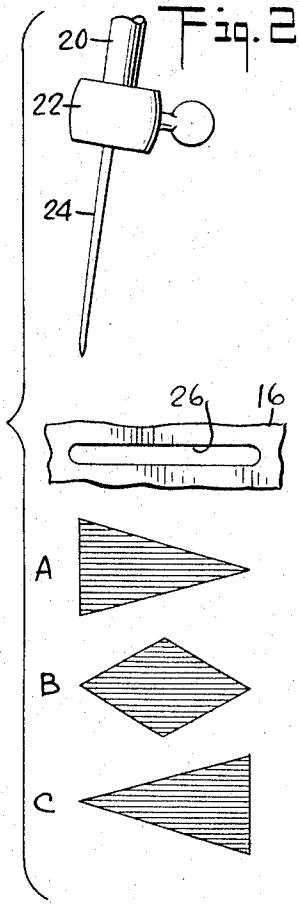


Fig. 2.

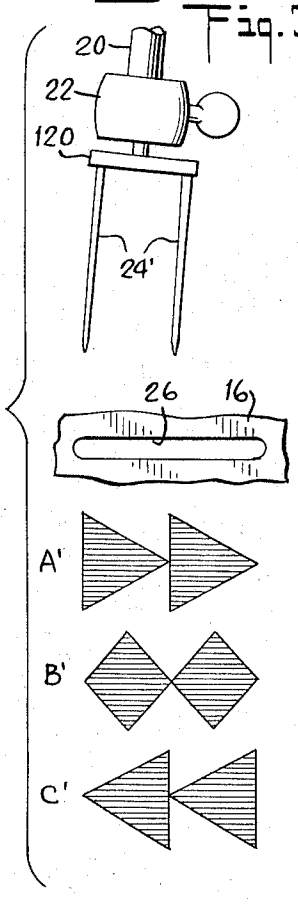


Fig. 3.

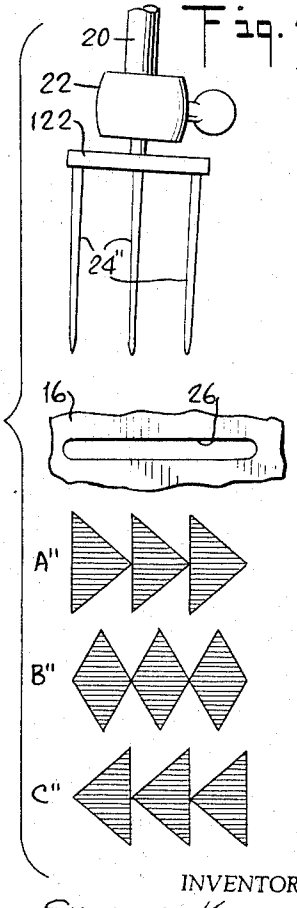


Fig. 4.

INVENTOR.
SHINICHI KAWAGUCHI

BY

Ward, Haselton, McElhannon, Perne, Brooks & Fitzpatrick
ATTORNEYS

Jan. 10, 1967 SHINICHI KAWAGUCHI 3,296,987

CONTROL DEVICE FOR CHANGING THE RANGE OF STARTING POINT AND SWING AMPLITUDE OF A NEEDLE IN A ZIGZAG SEWING MACHINE

Filed July 21, 1965 2 Sheets-Sheet 2

Fig. 5.

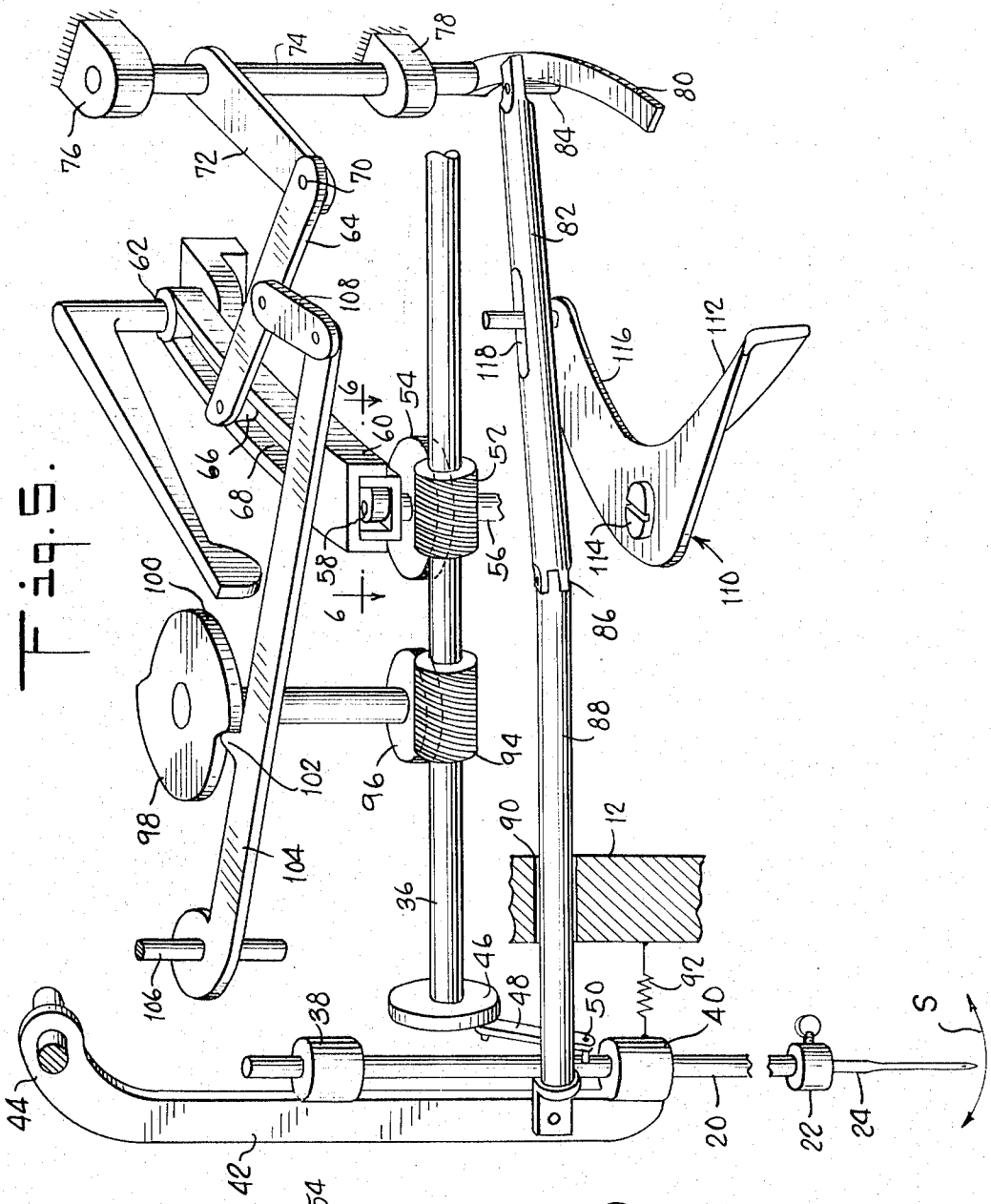
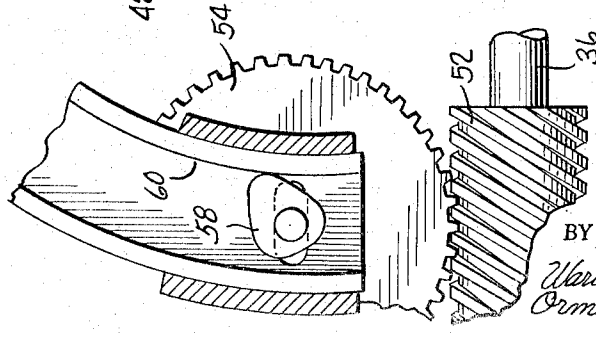


Fig. 6.



INVENTOR.
SHINICHI KAWAGUCHI
BY
Ward, Haselton, McElhannon, Orme, Brooks & Fitzpatrick
ATTORNEYS

United States Patent Office 3,296,987 Patented Jan. 10, 1967

3,296,987

CONTROL DEVICE FOR CHANGING THE RANGE OF STARTING POINT AND SWING AMPLITUDE OF A NEEDLE IN A ZIGZAG SEWING MACHINE

Shinichi Kawaguchi, Tokyo, Japan, assignor to Riccar Sewing Machine Co., Ltd., Tokyo, Japan, a corporation of Japan

Filed July 21, 1965, Ser. No. 473,666
5 Claims. (Cl. 112—158)

This is a continuation-in-part of a copending application Serial No. 264,580 filed March 12, 1963, now abandoned, and entitled Control Device for Changing the Range of Starting Point and Swing Amplitude of Needle in a Zigzag Sewing Machine.

This invention relates to a novel control device for changing the range of needle movement or swing amplitude in a zigzag sewing machine. More specifically, the invention lies in the provision of a novel swing control mechanism in a particular arrangement between a zigzag generating mechanism and the swingable needle of a zigzag sewing machine. The present invention permits optional changing of stitch width and it additionally permits external adjustment (from a point outside the machine), of the needle location when it is at a position of maximum swing amplitude. The particular arrangement of the present invention is particularly useful in connection with the darning of button holes and with embroidery stitching utilizing a plurality of needles.

Usually, when darning button holes on a zigzag sewing machine, any adjustment of stitch width along either side of the button hole necessarily brings about a corresponding change in the actual width of the button hole, i.e., the distance between the two parallel rows of zigzag stitches on either side of the button hole. In order to prevents this, prior machines required very complicated and troublesome manipulation of their various internal cams and connections. Furthermore, many machines did not even permit of variation in stitch width for a given button hole pattern, so that an entirely new button hole pattern had to be substituted.

Also, in the case of embroidery stitching, wherein various colored threads are sewn with a plurality of needles, such as two needles, three needles, etc., it has previously been necessary to change the entire cam arrangement within the machine in order properly to control the relative movements of the needles with respect to each other during the sewing operation. Thus in known machines, it is not possible to switch from one to a plurality of needles without completely rearranging the cam set-up within the machine.

It is an object of the present invention to provide a zigzag control arrangement for controlling the width of zigzag needle movement and to shift the position of the needle at its point of maximum swing so as to eliminate all of the above described difficulties. According to the present invention this is accomplished by the provision of an intermediate mechanism arranged between a zigzag generating mechanism and the needle itself; such mechanism being operable to provide adjustment of the amplitude of movement actually communicated to the needle from the zigzag producing mechanism.

For a more complete understanding of the nature and scope of the present invention, reference may be had to the following detailed description which may be read in connection with the accompanying drawings, illustrating by way of example a preferred embodiment of the invention. In the drawings:

FIG. 1 is a side elevational view of a sewing machine provided with the novel swing amplitude control arrangement of the present invention;

FIGS. 2, 3 and 4 are enlarged fragmentary views illustrating needle arrangements and their relative positions as adjusted by the mechanism of the present invention;

FIG. 5 is an enlarged perspective view of the internal mechanism of the sewing machine of FIG. 1, and

FIG. 6 is a fragmentary sectional view taken along line 6—6 of FIG. 5.

The sewing machine of FIG. 1 is designated by the numeral 10. This machine comprises a housing 12 having a vertical portion 14, which rises upwardly from a base plate 16, and a horizontally extending arm 18 which extends cantilever fashion from the top of the vertical portion 14 over the base plate 16. A needle bar 20 extends downwardly from the outer end of the horizontally extending arm 18 and has attached thereto, by means of an attachment collar 22, one or more needles 24 which reciprocate up and down with the needle bar 20 to penetrate through an opening 26 in the base plate 16.

There is provided an electric drive motor 28 which turns a pulley 30, about which is looped a drive belt 32. The drive belt 32 extends upwardly through the vertical portion 14 of the housing 12 and loops over an input pulley 34 located within the housing. The input pulley 34 is rotatably connected to the main shaft 36 which extends along the inside of the horizontal extending arm 18. Thus the drive motor 28 operates to rotate the main shaft continuously.

Referring now to FIG. 5 it will be seen that the needle bar 20 moves up and down in upper and lower needle bar bearings 38 and 40 which are attached to a bar support 42. The needle bar support is pivotally attached at its upper end 44 to the housing 12 so that it may swing back and forth along the path identified by the letter S in the drawings.

In order to reciprocate the needle bar 20 in its path of vertical movement there is provided on the end of the main shaft 36, a crank 46 to which is pivotally connected a connecting rod 48. The other end of the rod 48 is pivotally connected as at 50 to the needle bar 20 so that as the main shaft 36 rotates, the needle bar 20 will move up and down once for every rotation of the shaft.

There is additionally provided on the main shaft 36 a zigzag worm 52 which engages a zigzag worm wheel 54 mounted to rotate within the housing 12 about a vertical axle 56. A lobe cam 58 is connected to the upper end of the axle 56 and turns along with the zigzag worm wheel 54. The worm and worm wheel produce a 2:1 speed reduction so that the lobe cam 58 will rotate once for each two rotations of the main shaft 36. The lobe cam 58 is of eccentric configuration with respect to its axis of rotation so that during rotation its periphery will generate a periodic displacement along any fixed radial line extending from its axis. As shown in FIG. 6, the cam 58 fits closely within a rocking box 60 of channel-like configuration. The oscillatory motion produced by the cam is thus imparted to the rocking box 60. The rocking box itself is pivotally connected as at 62 to the side of the housing 12. Thus, the lobe cam 58 causes the rocking box to swing back and forth about its pivot point 62.

There is additionally provided a connecting rod 64, which has protruding downwardly from one end thereof a slide element 66, which fits closely but slidably within a rectangular groove 68 which extends along the length of the rocking box 60. The opposite end of the connecting rod 64 is pivotally connected as at 70 to the outer extremity of an upper arm 72. The other end of the arm 72 is securely fastened to a vertical shaft 74 which in turn is mounted for pivotal movement in upper and lower bearings 76 and 78 on the housing 12. A lower arm 80 of arcuate configuration is fixedly attached to the lower end of the vertical shaft 74 so that it will pivot along with the upper arm 72.

There is provided an interlocking shaft 82, one end of which is provided with a lug 84 abutting the lower arm 80, and the other end of which is pivotally connected as at 86 to one end of an abutting rod 88. The abutting rod 88 extends from the pivot point 86 out through a guide opening 90 in the housing 12 and abuts up against the needle bar support 42. A return spring 92 is tensioned between the needle bar support 42 and the housing; and serves to urge the needle bar support toward the right as viewed in FIG. 5. The force of the return spring 92 is communicated via the needle bar support 42 and the abutting rod 88, through the interlocking shaft 82 to urge the lug 84 against the lower arm 80.

It will be appreciated that as the main shaft 36 rotates, this rotation is communicated via the zig-zag worm 52 and the zigzag worm wheel 54 through the lobe cam 58 to oscillate the rocking box 60 about its pivot point 62. This oscillatory movement is communicated through the connecting rod 64, the upper and lower arms 72 and 80 of the vertical shaft 74, the interlocking shaft 82, the abutting rod 88 and the needle bar support 42 to provide zigzag motion in the path of the arrow illustrated at S.

It will further be appreciated that while the lobe cam 58 is of a fixed size, and thereby produces a fixed degree of oscillation to the rocking box 60, the amount of pivotal movement communicated to the vertical shaft 74 will vary as the distance between the slide element 66 and the pivotal connection 62 is changed. That is, as the slide element 66 is moved outwardly toward the lobe cam 58, it will experience greater amplitudes of reciprocal motion and thus produce greater pivotal movement of the vertical shaft 74 and consequently a larger swing to the needle bar support 42. Conversely, as the slide element 66 is moved back toward the pivotal connection 62, the amplitude of needle bar swing will be diminished.

There is additionally provided a pattern worm 94 also connected to turn with the main shaft 36. The pattern worm 94 is meshed with a pattern worm wheel 96 which turns a pattern cam 98. The pattern cam has a specially configured outer periphery 100 which is engaged by a follower element 102 located intermediate the ends of a follower arm 104. One end of the follower arm is pivoted as at 106 to the housing 12 of the machine, while its opposite end is pivotally connected via a link 108 to a point intermediate the ends of the connecting rod 64.

During operation of the machine, the needle bar 20 reciprocates vertically and zigzags as above described. At the same time, the pattern cam 98 rotates and the follower element 102 moves in conjunction with the pattern defined by the peripheral surface 100 of the cam. This movement in turn causes the follower arm 104 to swing about its pivot point 106; so that its opposite end acts through the link 108 to adjust the position of the connecting rod 64. This in turn changes the position of the slide element 66 within the rectangular groove 68 of the rocking box 60; and accordingly, as above described, will vary the amplitude of needle bar swing.

In order to provide adjustment of needle swing amplitude or stitch width according to the present invention there is provided an intermediate amplitude control lever 110 having a protruding arm 112 which extends out from the side of the machine as illustrated in FIG. 1. The intermediate amplitude control lever 110 is pivoted as at 114 within the housing 12; and it includes an actuating arm 116 which engages the interlocking shaft 82 by means of a pin and slot connection 118. By moving the intermediate amplitude control lever 110 and causing it to pivot about the axis 114 the interlocking shaft 82 will be caused to move about its pivot point 86 thus bringing the lug 84 into different positions along the arcuate face of the lower arm 80. The length of the interlocking shaft 82 and the arrangement of the lower arm 80 are made such that when the rocking box 60 is at the center of its swing, the pivot point 86 will be at the center of curvature of the arcuate face of the lower arm 80. Thus

the intermediate amplitude arm lever 110 may be shifted without causing any change in the position of the needle bar 20; yet, when the rocking box 60 begins to reciprocate, its effect upon the movements of the needle bar 20 will be changed according to the position of the intermediate amplitude control lever 110.

It will be noted that with the arrangement of the present invention, no change need be effected either in the lobe cam 58 or in the pattern cam 98; and yet, the amplitude of needle bar movement can be precisely controlled from outside of the machine.

The significance of the above described operation will be appreciated by referring to FIGS. 2, 3 and 4 which show respectively a single needle 24, two needles 24' and three needles 24'' connected via a collar 22 to the lower end of the needle bar 20. In FIG. 2, the collar 22 connects the single needle 24 to the needle bar 20 whereas in FIGS. 3 and 4, needle yokes 120 and 122 connect a pair of needles 24' and a trio of needles 24'' respectively to the needle bar 20.

As illustrated in FIG. 2 when a single needle 24 is used on this machine, the needle swing amplitude for any given pattern can extend over the full length of the needle opening 26 in the base plate 16. Thus for the various sewing patterns illustrated at A, B and C to be made with a single needle the needle swing can be adjusted to traverse the entire length of the needle opening 26. Where two needles are to be used, as for example, when embroidery stitching utilizing two different colored threads or when parallel patterns are to be produced simultaneously, as illsutrated in FIG. 3, two needles 24' are used. However in using two needles, the pattern width must be reduced by one half so that the needles will not, in their extreme positions, impinge upon the base plate 16. Accordingly by adjustment of the intermediate amplitude control lever 110, the interlocking shaft 82 may be brought to a position closer to the axis of the vertical shaft 74 so that the effect of the oscillatory movement of the rocking box 60 will not be as great upon the needle swing. Similarly, where, as illustrated in FIG. 4, three needles 24'' are to be used, and the pattern should be one third the width of the pattern produced by a single needle as illustrated in FIG. 2, the intermediate amplitude control lever 110 is further adjusted to bring the lug 84 of the interlocking shaft 82 even closer to the axis of the vertical shaft 74, thus reducing the needle swing even further.

In order to provide a convenient and accurate adjustment of needle swing amplitude, there may be provided on the outside of the housing 12 an indicator scale 124 showing the numbers 0, 1, 2 and 3 which show that the positions of the protruding arm 112 of the intermediate amplitude control lever 110 when using the various numbers of needles during sewing. Also, when it is desired to vary the amplitude of any given pattern without changing the entire pattern cam, for example, when it is desired to vary the width of a given button hole stitch, the protruding arm 112 of the intermediate amplitude control lever 110 may be adjusted gradually during sewing or it may be set at any given fixed position.

It will be appreciated that when the machine is set to produce nonzigzag or straight sewing and the lobe cam 58 is set to move the rocking box 60 to a position where the lower arm 80 is such that its center of curvature is displaced from the pivot point 86 of the interlocking shaft 82, the intermediate amplitude control lever 110 when pivoted will cause an adjustment of the position of the needle bar support 42 so that the position of the needle bar 20 may be conveniently adjusted.

Having thus described my invention with particular reference to the preferred form thereof, it will be obvious to those skilled in the art to which the invention pertains, after understanding my invention, that various changes and modifications may be made therein without department from the spirit and scope of my invention, as defined by the claims appended thereto.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a zigzag sewing machine having a push rod, a needle bar which moves sidewards in response to said push rod acting thereagainst, an adjustable swing amplitude control mechanism comprising a rocker bar connected at one end to pivot about a fixed point in said machine in a plane parallel to said push rod, a connecting arm also pivoted at one end to a fixed point in said machine, a connecting link pivotally connected at one end to the other end of said connecting arm, the other end of said connecting link being pivotally and slidably connected to said rocker bar at selectable points therealong to control the swing amplitude of said needle bar, an arcuate arm, means mounting said arcuate arm parallel to and rotatable with said connecting arm, an interlocking lever having means pivotally connecting one end thereof to said push rod and control means operatively connected to said lever to cause the other end of said interlocking lever to pivotally and slidably interconnect with said arcuate arm at selected points therealong.

2. Apparatus as in claim 1 wherein said needle bar is resiliently biased against said push rod and said arcuate arm is provided with an arcuate surface facing said push rod and said other end of said interconnecting lever is provided with a depending pin which engages said arcuate face.

3. Apparatus as in claim 2 wherein said interconnecting lever is provided with a slot intermediate its ends and said control means includes a lever pivotally connected to said machine and having a pin at one end thereof which engages said slot.

4. In a zigzag sewing machine having a push rod, a needle bar which moves sidewards in response to said push rod acting thereagainst, an adjustable swing amplitude control mechanism comprising a rocker arm connected at one end to pivot about a fixed point in said machine, a connecting arm also pivoted at one end to a fixed point in said machine, a connecting link pivotally connected at one end to the other end of one of said arms, the other end of said connecting link being pivotally and slidably connected to the other of said arms at selectable points therealong to control the swing amplitude of said needle bar, an arcuate arm, means mounting said arcuate arm to rotate with said connecting arm, an interlocking lever having means pivotally connecting one end thereof to said push rod and control means operatively connected to said lever to cause the other end of said interlocking lever to pivotally and slidably connect with said arcuate arm at selected points therealong.

5. Apparatus as in claim 4 wherein said connecting arm and said arcuate arm are each affixed at their respective pivoted ends to said mounting means, said mounting means comprising a rod mounted for rotatable movement about a fixed axis in said machine.

References Cited by the Examiner

UNITED STATES PATENTS

592,510	10/1897	Parkes	112—158
3,217,677	11/1965	Eguchi	112—158

JORDAN FRANKLIN, *Primary Examiner.*

RICHARD J. SCANLAN, JR., *Examiner.*