The safety device includes a latching member for interlocking with a jogging mechanism of a sewing machine to inhibit zig-zag movement of a reciprocating needle under preselected conditions. The latching member is solenoid actuated through a switch that is controlled in one embodiment by installation of one of two interchangeable throat plates on the work bed of the machine, and controlled in another embodiment by each of two interchangeable throat plates. In each embodiment the latching member is arranged to interlock with the jogging mechanism when the reciprocating needle is being retracted in a needle aperture in the throat plate that is too small to accommodate zig-zag movement of the needle.

18 Claims, 9 Drawing Figures
SEWING MACHINE SAFETY DEVICE

BACKGROUND OF THE INVENTION

This invention relates to safety devices in sewing machines and more particularly to a device that inhibits zig-zag movement of a needle when the machine is set up for a straight stitch sewing operation with a throat plate having a needle aperture that is too small to accommodate zig-zag movement of the needle.

In a zig-zag stitching operation the sewing needle normally jogs from side to side as it reciprocates up and down with respect to a throat plate supported on a work bed of the sewing machine. Ordinarily the throat plate aperture used during zig-zag sewing is formed to accommodate the maximum lateral jogging movement of the sewing needle. However as the work being sewn is unsupported in the area directly over the needle aperture it is usually undesirable to have excessive clearances between the needle and the aperture because the quality of most stitches, whether zig-zag or straight, partly depends upon the amount of support the work receives around the reciprocating needle. Therefore in a straight stitch sewing operation wherein the needle merely reciprocates but does not jog, it is desirable to provide a needle aperture of lesser area than that required for zig-zag sewing. Some known sewing machines include selectable portions to accommodate the formation of straight or zig-zag stitches. These selectable portions usually comprise a throat plate with means for varying the area of the needle aperture, a throat plate having a plurality of individual needle apertures of predetermined size, or interchangeable throat plates each having a different sized needle aperture.

Although the advantage of fine quality stitching is derived in providing a needle aperture of predetermined size to correspond with the type of stitch being sewn there is a consequent danger that a sewing machine will be operated inadvertently with a needle aperture that is too small to accommodate a zig-zag movement of the needle. Thus, for example, a jogging needle might shatter against a throat plate having an aperture that accommodates straight stitching only, possibly injuring the operator and/or damaging the machine or goods being sewn.

U.S. Pat. No. 3,552,337 issued Jan. 5, 1971 deals with this problem by including in a sewing machine a throat plate with an adjustable needle opening and a control linkage for varying the area of the needle opening. The control linkage is also connected to a jogging mechanism to simultaneously regulate the amount of needle jog in accordance with the selected area of the needle opening. This linkage being mechanically connected to the throat plate and the jogging mechanism occupies a substantial amount of space in the sewing machine casing and includes an intricate arrangement of springs, cams and levers, etc. which must be made to precise dimensions to ensure proper operation.

It is thus desirable to provide a compact safety device having relatively few moving parts for inhibiting inadvertent jogging movement of a needle being received in a throat plate needle aperture formed to accommodate straight stitch needle reciprocation.

Among the several objects of the present invention may be noted the provision of a novel safety device for inhibiting inadvertent zig-zag of a needle during a straight stitch sewing operation; a novel sewing machine safety device, operable through electrical switching means, for inhibiting inadvertent zig-zag movement of a needle being received in a straight stitch needle aperture in the throat plate; a novel sewing machine safety device having electrically actuable interlocking means for inhibiting movement of a jogging mechanism during a straight stitch sewing operation; and a novel safety device for a sewing machine that is electrically actuable by a preselected throat plate when installed on the work bed of the sewing machine. Other objects and features will be in part apparent and in part pointed out hereinafter.

SUMMARY OF THE INVENTION

The present invention relates to a novel safety device in a sewing machine for inhibiting zig-zag movement of the needle during a straight stitch sewing operation. The safety device comprises a solenoid actuated latch member energizable through a switch to interlock with the jogging mechanism of the sewing machine while the needle is being reciprocated in a throat plate aperture formed for straight stitching exclusively. The latch member does not interlock with the jogging mechanism while the needle is being reciprocated in a throat plate aperture formed for zig-zag stitching. In one embodiment of the invention the control switch assumes a first contact position upon installation of a preselected throat plate on the work bed of the sewing machine and a second contact position upon removal of the preselected throat plate from the work bed. A second throat plate that is interchangeable with the first throat plate is formed with means for obviating any change in the contact position of the switch when the throat plate is installed on or removed from the work bed. In another embodiment of the invention the contact position of the control switch is dependent upon the particular interchangeable throat plate being accommodated on the work bed.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is an exploded perspective view of a sewing mechanism incorporating one embodiment of the safety device of the present invention;

FIG. 2 is a fragmentary side view thereof, partly in section, showing the safety device positioned to permit lateral jogging movement of the sewing mechanism;

FIG. 3 is a view similar to FIG. 2 showing the safety device positioned to inhibit lateral jogging movement of the sewing mechanism;

FIG. 4 is one form of a simplified schematic control circuit for the safety device shown in the condition which will obtain when a zig-zag stitch throat plate is in place on the sewing machine;

FIG. 5 is a side view partly shown in section of another embodiment of the present invention;

FIG. 6 is a plan view of a needle jogging device suitable for incorporation in the present invention; and

FIGS. 7-9 are sectional views of other embodiments of the present invention.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.
DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings for a detailed description of the present invention a sewing mechanism is generally indicated by the reference number 10 in FIG. 1. The sewing mechanism 10 includes a gate or jogging member 12 pivoted at 14 on a lower leg 16 of a C-shaped bracket 18. A needle bar 20 is journaled in an upper leg 22 of the bracket 18 and also journaled in upper and lower legs 24, 26 of the gate 12 for endwise reciprocal movement. The needle bar 20, which includes a needle 28, passes through an elongated opening 30 in the lower leg 16 of the bracket 18.

The sewing mechanism 10 further includes a drive link 32 comprising an elongated member 34 connected at one end by a fastener 33 and a locating boss 35 to a socket member 36 that is fitted onto a driving post 38 having a ball top 40. The driving post 38 is affixed to the upper leg 24 of the gate 12 and extends through an elongated opening 42 in the upper leg 22 of the bracket 16 to permit lateral movement of the post 38 in the opening 42 and also permit lateral movement of the needle bar 20 in the elongated opening 30 of the lower bracket leg 16. Reference is made to U.S. Pat. No. 3,782,311 issued Jan. 1, 1974 for a more detailed description of the aforementioned structure.

An opposite end of the drive link 32 is connected to a zig-zag driver means element comprising an electromechanical actuator 44. Logic means for controlling the actuator 44, including means for maintaining the drive link 32 at a predetermined lateral position when the zig-zag operation is terminated, are shown schematically in FIG. 4 as reference number 45. The actuator 44 and the logic means 45 are disclosed in detail in U.S. Pat. application Ser. No. 431,649 filed Jan. 8, 1974 and assigned to the present assignee.

A latch member comprising a polyester plastic plug 46 is rigidly secured to the elongated member 34 at an opening 37 by ultrasonic staking or any other suitable means of affixation. The plug 46 includes a conical tapered portion 48 and a reduced tail portion 50.

A resilient deflectable latch member 52 made of AISI 1095 cold rolled carbon spring steel, for example, has one end 53 secured to a bracket 54 by fasteners 51. An opposite free end 55 of the latch member 52 includes an elongated longitudinal opening 56. A generally Y-shaped opening 58, including a slot portion 59, is formed in the latch member 52 between the opening 56 and the secured end portion 53. The bracket 54 is anchored to a fixed frame portion 60 of the sewing machine below the elongated member 34 by fasteners 57. The location of the latch member 52 is predetermined to permit alignment of the elongated opening 56 with the plug member 46 when the zig-zag movement of the drive link 32 is terminated by the actuator 44 to position the needle 28 at its center needle hole position as disclosed in the previously referred to U.S. application Ser. No. 431,649.

A solenoid member 62 is mounted in a yoke 64 for affixation to a side wall 66 of the bracket 54 by fasteners 67. The solenoid 62 includes an armature 68 having an annular groove 70 formed at a free end portion 71 for engagement with the slot portion 59 of the opening 58 in the latch member 52. The solenoid member 62 further includes a pair of electrical terminals 72 and 74 and the terminal 72 being connected to a terminal 76 on a switch member 81.
the plug 46 thus interferes with the elongated opening 56 to prevent lateral movement of the drive link 34 in the direction of the arrow 104 (FIG. 2).

The logic means 45 and the actuator 44 in cooperation with the drive link 32 have the capability of repositioning the needle member 28 in a center needle hole position with respect to the aperture 96 when the circuit between the logic means 45 and the power input 102 is opened as discussed in the previously referred to U.S. Pat. application No. 431,649. With the needle 28 in the center needle hole position, the reduced tail portion 50 of the plug 46 is aligned with the elongated opening 56. This alignment permits the conical portion 48 of the plug 46 to interlock or interfere with the elongated opening 56 when the solenoid 62 is energized to cause the armature 68 to move the latch member 52 against the plug 46. The drive link 32 is thus held in the center needle hole position for straight stitch sewing by both the latch member 52 and the actuator 44. The interlock between the latch member 52 and the drive link 32 at the plug 46 thus ensures that the needle 28 will not zig-zag when the throat plate 94 is installed on the work bed 84 even if the power input 102 should inadvertently electrically bypass the switch 80 to activate the logic means 45. The safety of the operator and damage free condition of the sewing machine, the needle and the work being sewn are thus assured.

In another embodiment of my invention as shown in FIG. 5 a plug member 106 having a conical tapered portion 108 is affixed directly to the end of the solenoid armature 68 in any suitable known manner and a drive link 110 has an opening 112 for accommodating the plug 106. During zig-zag operation of the sewing machine the throat plate 82 having the zig-zag needle aperture 88 (FIG. 2) releases the push button contact member 81 to move the contact member 81 from the terminal 76 to the terminal 78 to deenergize the solenoid 62 and activate the logic means 45 (FIG. 4). The drive link 110 (FIG. 5) can thus move laterally in the direction of the arrow 113 under the influence of the actuator 44 (FIG. 1) without causing interference between the plug member 106 and the opening 112 in the link 110. During a straight stitch sewing operation the throat 94 (FIG. 2) having the straight stitch needle aperture 96 and no recess 98 permits the push button contact member 81 to remain in its normal contact position at the terminal 76 to allow the solenoid 62 to become energized in a manner previously described.

Accordingly the armature 68 can move the plug 106 (FIG. 5) into interlocking interference with the opening 112 at the conical tapered portion 108 to prevent lateral movement of the drive link 110 in the direction of the arrow 113. The drive link 110 can thus be interlocked with the sewing machine frame 60 through the solenoid 62 when the straight stitch sewing function is in operation.

With reference to FIG. 6 a cam controlled drive means element 114 comprises a zig-zag cam 115, a cam follower 116 and a plate 118 arranged to cooperate in a known manner. A drive link 120 has a reduced end portion 122 with a spring 124 for resiliently telescoping the end portion 122 into a groove 126 of a feeler member 128. The end portion 122 is formed with a slot 130 to accommodate a pin 132 fixed to the feeler member 128 and extending into the groove 126. The feeler member 128 abuts the plate 118 which is pivotally supported by the sewing machine frame (not shown).

As will be apparent to those skilled in the art the cam controlled driver means element 114 and the link 120 can be substituted for the actuator 44 and the link 32 of FIG. 1. It should be noted that the cam controlled driver means 114 is adjusted in any suitable known manner, such as by positioning the feeler member 128 opposite to the pivot pin 134 to place the needle 28 at the center needle hole position when a straight stitching operation is required. This adjustment aligns the plug members 46 or 106 with their respective elongated openings 56 or 112 and also aligns the needle 28 with the aperture 96 in the throat plate 94. Once the alignment procedure is completed and the throat plate 94 is installed on the work bed 84 the solenoid 62 is deenergized as previously described. Thus the tapered portions 48 or 108 of the plug members 46 or 106 are accommodated in the respective openings 56 or 112 to latch or interlock with the drive link 32 or 110 during a straight stitch sewing operation.

In another embodiment of my invention shown in FIGS. 7 and 8 a toggle switch 136 is pivoted to the sewing machine base (not shown) below the work bed 84. A straight stitch throat plate 138 and a zig-zag stitch throat plate 140 have respective staggered recesses 142 and 144 to provide clearance for a respective end portion 135, 137 of the switch 136 as it is depressed from one position to another by one of the respective interchangeable throat plates 138, 140 when installed on the sewing machine work bed 84. The toggle switch 136 can thus effect the desired change in the circuit of FIG. 4 since the separate contact positions of the switch 136 respectively correspond to the particular throat plate 138, 140 disposed on the sewing machine work bed 84.

It will be apparent to those skilled in the art that the push button switch terminals 76 and 78 of the FIG. 1 embodiment can be reversed and the reduced and unreduced portions 98, and 100 of the throat plates 82 and 94 similarly reversed to accomplish interlocking operation of the safety device. It is pointed out, however, that the preferred embodiment shown in the accompanying drawings is advantageous because the dangerous condition i.e., zig-zag condition can be rendered possible only when a specially recessed throat plate is utilized. If a plain unrecessed zig-zag throat plate is used inadvertently as for instance from a sewing machine not equipped with this invention, the effect will be to disable the zig-zag mechanism. It will also be apparent that a throat plate having more than one needle aperture can be incorporated in the invention. For example a throat plate 146 (FIG. 9) is provided with both a zig-zag stitch needle opening 148, and a straight stitch needle opening 150 as disclosed in U.S. Pat. No. 3,131,660 issued May 5, 1964. A switch depressing surface 152 and a recess 154 are formed on the underside of the throat plate 146 to respectively correspond with the needle openings 148 and 150. Accordingly the switch 80 is allowed to remain in a desired contact position by either the surface 152 or the recess 154 during an appropriate shift of the throat plate 146 to align one of the apertures 148 or 150 with the needle 28.

Some advantages of the present invention evident from the foregoing description include a safety device actutable to interlock with the jogging mechanism of a sewing machine upon installing or removing a predeter-
3,926,133

7

-mined throat plate from the work bed of a sewing machine, and a safety device that is a compact arrangement of relatively few moving parts within the sewing machine.

In view of the above it will be seen that the several objects of the invention are achieved and other advantageous results obtained.

As various changes can be made in the above constructions without departing from the scope of the invention it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus set forth the nature of the invention what is claimed herein is:

1. In a sewing machine having a needle bar supporting an endwise reciprocatory needle and jogging means cooperating with the needle to laterally jog the needle during the formation of zig-zag stitches, a work bed on the sewing machine, throat plate means accommodated on said work bed having selectable portions to support work against reciprocation of said needle to accommodate the formation of a zig-zag stitch pattern or a straight stitch pattern, and safety means for inhibiting operation of said jogging means, said safety means including switching means responsive to the presence on said work bed of said throat plate means when one of said selected portions is arranged adjacent to the reciprocatory path of said needle to accommodate the formation of one of said stitch patterns.

2. The combination of claim 1 wherein the selectable portions of said throat plate means comprise a first needle aperture for receiving reciprocation of the needle during formation of the zig-zag stitch pattern and a second needle aperture for receiving reciprocation of the needle during formation of the straight stitch pattern.

3. The combination of claim 1 wherein said switching means include a switch actuating member mountable by said throat plate means when one of said selectable portions is arranged adjacent the reciprocatory path of said needle to accommodate the formation of one of said stitch patterns.

4. The combination of claim 1 wherein the selectable portions of said throat plate means comprise first and second throat plate members interchangeable with each other on the work bed, the first throat plate member having an aperture to receive reciprocation of the needle during formation of the zig-zag stitch pattern, the second throat plate member having an aperture to receive reciprocation of the needle during formation of the straight stitch pattern.

5. The combination of claim 4 wherein said switch means comprise a switch actuating member having first and second switch positions, said switch actuating member being disposed below the work bed for cooperation with at least one of said throat plate members, said one throat plate member having means for shifting said switch actuating member from one of said switch positions to the other switch position when said one throat plate is installed on said work bed.

6. The combination of claim 4 wherein said switch means comprise a switch actuating member having first and second switch positions said switch actuating member being disposed below the work bed for cooperation with said first and second throat plate members when either of said throat plate members is installed on said work bed, the first throat plate member engaging said switch actuating member for disposition of the switching means in one of said switch positions, the second throat plate member engaging the switch actuating member for disposition of the switching means in the other said switch position.

7. The combination of claim 1 wherein said jogging means include a jogging member element engageable with the needle bar, a zig-zag driver means element in the sewing machine for driving the jogging member element and a transmission means element interposed between the jogging member element and the zig-zag driver means element for establishing communication between the zig-zag driver means element and the jogging member element, said safety means cooperating with one of said elements through said switching means to inhibit operation of said jogging means.

8. The combination of claim 7 wherein said safety means cooperate with said transmission means element to inhibit operation of said jogging means, said transmission means element including elongated link means having one end portion engageable with the zig-zag driver means element for receiving input jogging movements and an opposite end portion engageable with the jogging member element for providing output jogging movements to the jogging member element in response to the input jogging movements from the zig-zag driver means element.

9. The combination of claim 8 wherein one of the selectable portions of said throat plate means comprise a first needle aperture for receiving reciprocation of the needle during formation of a straight stitch pattern, said sewing machine including a frame and said safety means further comprising interlocking means for inhibiting lateral movement of said link means, said interlocking means including a first latching member mounted to said frame, said first latching member having an interlock position for inhibiting lateral movement of said link means and a noninterlocking position for permitting lateral movement of said link means, said latching member being in one of said positions when one of the selectable portions of said throat plate means is arranged adjacent the reciprocating path of said needle to accommodate formation of one of the stitch patterns.

10. The combination of claim 9 wherein said sewing machine includes electrical control means for controlling said zig-zag driver means element, said first latching member being electrically actuable into said interlock position and said switching means having first and second switch positions, said electrical control means being connected to said switching means at one of said switch positions and said first latch member being connected to said switching means at the other said switch position.

11. The combination of claim 10 wherein said switching means includes a contact member movable from one of said switch positions to the other said switch position such that the first latch member is actuated into said interlock position and the control means is disabled when the contact member is at the other said switch position, the control means being activated and the first latch member being in the noninterlocking position when the contact member is at said one of said switch positions.

12. The combination of claim 11 wherein said electrical control means includes means for locating said needle at a center hole position when the contact member is at the other said switch position wherein the first
latch member is actuated to the interlock position and the control means is disabled.

13. The combination of claim 9 wherein said first latch member is laterally immovable and said link means comprise an elongated link member, said link member being rendered substantially immovable in a lateral direction when said first latch member is in said interlock position, and resilient coupling means interconnecting said link member with said zig-zag driver means element to take up any lateral movement of the zig-zag driver means element when the first latch member is in said interlock position.

14. The combination of claim 9 wherein said link means comprise an elongated link member, said interlocking means comprising a second latch member affixed to and projecting from said link member, said first latch member being deflectable in a non-lateral direction toward said second latch member to latch with said second latch member in said interlock position, said safety means further including a solenoid member having a movable armature with an energized position and a deenergized position, one of the positions of said solenoid armature permitting said first latch member to deflect toward said second latch member into said interlock position to inhibit lateral movement of the link member, the other position of said solenoid armature permitting said first latch member to deflect out of said interlock position to enable said link member to move in said lateral direction.

15. The combination of claim 14 wherein said second latch member includes a plug portion, the first latch member including a deflectable arm having an aperture engageable with said plug portion to form an interference fit with said plug portion when the first latch member is in said interlock position.

16. The combination of claim 9 wherein said link means comprise an elongated link member, said safety means comprising a solenoid member mounted to said frame, said solenoid member having an armature movable in a non-lateral direction from an energized position to a deenergized position, said armature being laterally immovable during energization and deenergization, said first latch member being affixed to a free end of said armature for interlocking engagement with said link member to inhibit movement of the link member in a lateral direction when the solenoid is in one of said positions, the other said position of said solenoid armature enabling said first latch member to unlock with said link member to permit lateral movement of the link member.

17. The combination of claim 16 wherein said link member includes an aperture and said first latch member comprises a plug portion movable in said aperture to form an interference fit and inhibit lateral movement of the link member when said solenoid is in one of said positions, the other said position of said solenoid armature moving said plug portion to a position of noninterference with said aperture to permit lateral movement of said link member.

18. In a sewing machine having a needle bar supporting an endwise reciprocatory needle and jogging means cooperating with the needle to laterally jog the needle during the formation of a zig-zag stitch pattern, a work bed on the sewing machine, throat plate means disposable on the work bed, said throat plate means having a first needle aperture to receive reciprocation of the needle during formation of the zig-zag stitch pattern, said throat plate means having a second needle aperture to receive reciprocation of the needle during formation of a straight stitch pattern, and safety means for inhibiting operation of said jogging means, said safety means including interlocking means actuable into locking engagement with said jogging means and switching means for actuating said interlocking means into locking engagement with said jogging means while said throat plate means is disposed on the work bed with said second needle aperture arranged to accommodate endwise reciprocatory movement of said needle.

* * * * *