ABSTRACT OF THE DISCLOSURE

A mechanism for a sewing machine comprising a cam controlled feed regulating mechanism driven from the machine actuating mechanism and including operator influenced control means for selectively coupling or uncoupling the standard feed regulating linkage to a lever which is oscillated by the control cam to produce at a predetermined rate feeding alternately in forward and reverse directions.

BACKGROUND OF THE INVENTION

Field of the invention

This invention pertains to lock stitch sewing machines, and more particularly to a novel and improved arrangement in a lockstitch sewing machine for producing lockstitches which are characterized by great elasticity lengthwise of the seam.

Background of the prior art

Conventional lockstitches (Federal Stitch type 301) are formed by a needle thread and a bobbin thread looped together at each needle penetration, with successive needle penetrations spaced in one direction along the seam and with the threads extending directly between successive needle penetrations, one above the other beneath the work fabric. This stitch finds wide use wherever it is desired to produce a tight seam that will not ravel and will have the same appearance on both the top and the bottom. However, these conventional lockstitches find little use where the nature of the fabric requires a degree of elasticity or resiliency, since beyond the resiliency of the thread itself, such conventional lockstitches provide substantially no extensibility lengthwise of the seam.

It is generally known in the art to form a lengthwise resilient lockstitch seam formed by the use of backup or reverse stitches. Also, it is known broadly to provide a sewing machine with a cam controlled feed mechanism for producing a backup stitch. (Some of the prior art disclose structure wherein the control element by which the feed manually may be regulated also is the element by which the influence of the feed cam may be rendered effective or interrupted. These prior art disclosures have both the needle and the feed controlling cams contained in one cam stack. Other prior art disclosures additionally include means for varying the ratio of cam motion to feed motion.) These prior art arrangements, however, require complex and intricate mechanism and require that the machine operator must set a number of control handles for producing the desired resilient lockstitch seam.

SUMMARY

Since the nonraveling feature of a lockstitch seam is frequently desired in resilient extensible fabrics, the seam provided by the present invention is particularly advantageous. In accordance with the present invention the desired seam elasticity is obtained by the addition to a conventional lockstitch sewing machine of a relatively simple manually controlled feed regulating mechanism for producing feed alternately in forward and reverse directions with the forward feed being substantially longer than that in the reverse direction. The resulting lockstitches thus periodically overlap so that the points of needle penetration of the overlapped stitches will converge when the fabric thereafter is stretched. The overlapping portions of the lockstitch seam provide the degree of elasticity desired for extensibility of the seam with the fabric.

The novel mechanism of the present invention accomplishes the above by providing a manually operable cam controlled feed regulating mechanism utilizing preferably a three-cornered or constant breadth cam driven from the sewing machine actuating mechanism separately from the cam stack and at a speed relative to that of the arm shaft. Operator controlled means, including only a depressible button, are provided for selectively coupling or uncoupling the standard feed regulating linkage to a lever which is rocked by the aforementioned cam, the camematics being so oriented to produce feeding alternately in forward and reverse directions with the forward feeding steps preferably being substantially three times longer than those in the reverse direction. The complex control arrangements found in the prior art are thus avoided in the novel mechanism of the present invention and a relatively simple but novel mechanism is provided for producing a lockstitch characterized by a relatively high degree of elasticity.

Accordingly, it is an object of this invention to provide a novel and improved backup stitch mechanism for a lockstitch sewing machine that is of relatively simple construction and produces a seam characterized by lengthwise elasticity or resiliency.

Another object of this invention is to provide for a lockstitch sewing machine, a novel and improved backup stitch mechanism which is readily accessible and easily controlled by the operator when it is desired to switch from manual to cam feed control.

It is a further object of this invention to provide a novel and improved simple construction for alternately producing a forward stitch at a predetermined rate and a reverse stitch at a substantially greater rate whereby the seam produced is characterized by great elasticity.

It is also an object of this invention to provide a cam controlled feed regulating mechanism driven from the machine actuating mechanism separately from the cam stack and at a speed relative to that of the arm shaft of the sewing machine, and which can be selectively coupled or uncoupled to an oscillating lever to produce feeding alternately in forward and reverse directions.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the functions, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 represents a head end elevational view of a sewing machine with a vertical section taken substantially through the work support and a portion of the standard wall broken away illustrating a preferred embodiment of this invention;

FIG. 2 represents a partial front view taken substantially along the line 2—2 of FIG. 1;

FIG. 3 represents a cross sectional view taken substantially along the line 3—3 of FIG. 1 illustrating the backup stitch mechanism of the present invention in unco-
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FIG. 4 represents an enlarged partial perspective view of the present invention as seen from the right front corner of FIG. 3;

FIG. 5 represents an enlarged fragmentary perspective view of the present invention substantially similar to FIG. 3, with the backup stitch mechanism in coupled relation relative to the machine actuating mechanism; and

FIG. 7 represents a typical stitch formation produced by the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more specifically to the accompanying drawings wherein like reference numerals designate similar parts throughout the various views, the preferred embodiment of this invention is incorporated in a familiar lockstitch type sewing machine built substantially in accordance with the Singer-owned United States Patent No. 3,115,855, issued Dec. 31, 1963, to S. J. Ketterer, to which reference is made for a more complete understanding of the same.

The sewing machine frame includes a bed 10 from which rises a hollow standard 11 supporting a bracket arm (not shown) overlapping the bed 10. The bracket arm terminates in a hollow head (not shown) in which is mounted a standard reciprocatory needle bar mechanism generally designated 13 and a presser-bar 14. A main shaft 12 journaled lengthwise of the bracket arm drives all of the moving parts of the sewing machine and may be actuated by an electric motor, foot treadle or the like (not shown).

Journaled in the bed 10 of the sewing machine beneath a slide plate 15 is a standard lockstitch forming mechanism designated generally by the reference numeral 16 including a loop taker designated generally as 19 which is carried by a loop taker shaft 20. The loop taker is driven from the main shaft by means of a vertical hook drive shaft 17 in the standard 11 driven by a meshing pair of bevel gears 18-18. Reference is made to United States Patent No. 2,966,130, issued Dec. 27, 1960, to R. E. Johnson, and assigned to the assignee of the present invention, for a more thorough and complete description of an exemplary type of the preferred stitch forming mechanism used with the present invention for cooperation with the needle carrying needle bar 13 for formation of the desired lockstitches.

Illustrated in FIG. 1 is a work feeding mechanism, preferably of the conventional drop feed variety, including a presser foot 21, which cooperates with a throat plate 22 and a work engaging feed dog 23 in feeding of the work over the work supporting surface of the bed 10. The feed dog 23 is secured in a conventional manner to a feed bar 24 beneath the bed 10 whose feed advance and return movements are imparted thereto from an oscillating rock shaft 25 connected to the feed bar by means of a rock arm 26. The feed advance rock shaft 25 is oscillated by means of conventional connections comprising a feed-advance pitman 27, having a fork or pair of bifurcated jaws 27' at its upper end embracing an eccentric 28 on the main shaft 12 in the standard 11. These connections include conventional regulating means designated generally as 29 for varying the stitch length, discussed in detail hereinafter. Rising and falling motion is imparted to the feed bar from an oscillating feed lift rock shaft 30 in the bed 10 of the sewing machine. The feed lift rock shaft 30 is provided with a rock arm 31 connected to the feed bar 24 by means of a link 32. Oscillations are imparted to the feed lift rock shaft by means of conventional connections, including a lift pitman 33 in the standard of the sewing machine driven from a feed lift eccentric (not shown) carried by a strap 34 journaled on the main shaft 12. It is well established in the art that the work feeding mechanism is timed relative to the needle reciprocation so that the feed dog is lifted and advanced while the needle is raised out of any work on the throat plate, and the feed dog is lowered beneath the throat plate and returned while the needle descends.

The stitch length regulating means 29 will be described only insofar as deemed necessary for a proper understanding of the present invention. Reference is made to the United States Patent No. 2,970,556, issued Feb. 7, 1961, to R. E. Johnson, assigned to the assignee of the present invention, for a detailed description of a preferred standard length regulating means used with the present invention. Upon oscillation of the pitman 27 by the eccentric 28, endwise motion is imparted to the pitman 33 by a feed regulator block 35 pivotally mounted on an integrally formed pro-tuding shelf of the standard by a mounting stud 36 held in place by a washer 37, a helical spring 38 and a partially split retaining clamp 39. The regulator block 35 has a guide channel or slideway 40 in which is slidably mounted a slide block 41 pivoted about an axis 42 to the feed advance pitman 27. As thoroughly discussed in the latter Johnson Patent No. 2,970,556, tilting movement of the slideway 40 in one direction imparts forward feed motion to the pitman 27, while movement in the opposite direction imparts reverse feed motions to the pitman in a relationship increasing as the degree of the tilt becomes greater in either direction.

The regulator block 35 manually is adjusted about its pivot 36 by means of a stitch length adjusting lever 43 secured at one end by a shouldered set screw 45 in a bore formed in a boss 46 of a segmental member 44, which is operatively associated with the feed regulator block 35 by a clutch pin 60 whose function subsequently is to be discussed in detail. The free or readily accessible end of the lever 43 extends through an opening 46 in the standard 11, the opening being partially closed by a stitch length indicating plate 48 secured to the standard by screws 49 and having an elongated opening 50 to adjustably receive the lever 43. The segmental member 44 pivotally is mounted on the same mounting stud 36 as the feed regulator block 35 as best illustrated in FIG. 3. As shown in FIGS. 3 and 4, the pin 60 is T-shaped having laterally extending arms 58 and 59. The pin 60 is carried by a bore 61 (FIG. 5) formed in the regulator block 35 being biased outwardly by a spring 52 secured at one end to the pin and at the other end by suitable securing means to the stud 36. The arm 58 of the pin 60 normally is disposed in a recess 51 of the segmental member 44 due to the outward bias exerted on the pin 60 by the spring 52. Thus, the pin 60 connects member 44 to the feed regulator block 35 so that movement of the lever 43 will adjust the tilt of the regulator block 35, thereby varying the amount of endwise movement imparted to the pitman 27 upon oscillation thereof with a corresponding variation in the feed stroke.

In the standard stitch length adjusting mechanism, such as disclosed by the Johnson Patent No. 2,970,556, the feed regulator lever 43 ordinarily is attached directly to the feed regulator block, which in the present preferred embodiment is referred to be feed regulator block 35. However, in the present embodiment the lever 43, when the arm 58 of the pin 60 is disposed as discussed above, performs the same function as the corresponding lever in the standard mechanism.

The pin 60 forms part of a backup stitch mechanism, comprising the present invention which produces a reverse stitch substantially at the rate of 18 stitches per inch. This mechanism is operative when the operator of the machine selectively couples by means of the pin 60, a feed regulating mechanism including a three cornered cam 70 driven from the machine actuating mechanism
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separately from the cam stack and at a speed of half that of the main arm shaft 12 to a feed adjustment drive lever 63. The drive lever is oscillated by the three cornered cam 70, the kinematics being so oriented as to alter the normal conventional feed produced by the feed advance pin 27 to produce feeding alternately in forward and reverse directions with the forward feeding steps preferably being substantially three times longer than those in the reverse direction. Thus, since the preferred reverse stitch rate is 18 stitches per inch the forward stitch is produced at a rate of six stitches per inch. More specifically as to the operation of the preferred embodiment of the invention, gear 53 is meshed on the vertical hook drive shaft 17 (see FIG. 1) for drivingly engaging a gear wheel 54 mounted on a shaft 55 by means of a set screw 56. The worm gear 53 drives the gear 54 and consequently the mounting shaft 55 at a ratio of 2:1 relative to the arm shaft 12. As best shown in FIG. 3, the shaft 55 is supported by a portion 57 of the frame of the swing machine. Also mounted on the shaft 55 is the three cornered cam 70, which registers with a slideway 71 of a slide block 72 and moves the block in a vertical up and down direction, as shown by the arrow in FIG. 1, by virtue of an elongated opening 73 cut in the wall of the slideway 71. A shoulder 74 or finger 74 integrally formed at the upper end of the slide block 72 has an opening therein for receiving an eccentric shoulder screw 64 which mounts in a hole 65 of the drive lever 63 thereby connecting the feed adjustment drive lever 63 to the slide block 72. A set screw 65 holds the eccentric screw 64 in position in the shoulder 74 of the slide block 72. This arrangement provides an operative arrangement whereby the drive lever 63 is rocked on the axis of the mounting stud 36 in conformance with the motion of the cam 76, when machine is in operation. As best shown in FIGS. 3 and 5, transmission of the motion of the cam 70 by means of the drive lever 63 to the feed advance pin 27 is precluded when the right lateral arm 58 of the pin 60 vertically moves up and down in a vertical slot 66 formed in the drive lever 63. This arcuate slot 66 has a center of curvature coincident with the axis of oscillation of the lever 63. Under these circumstances the backup stitch mechanism is uncoupled (FIGS. 3 and 5) and the stitch length adjustment lever carried by the member 44 is operative as it normally would be in the case of a sewing machine absent the present invention. As discussed above, in this latter arrangement the arm of the pin 60 engages the feed regulator block 35 housing the pin 60 from the lever 43 for adjusting the stitch length. Thus, with the lateral arm 58 of the pin 60 engaging the slot 67 in the driven lever 63, movement of the lever will be transmitted to the feed regulator block. With the pin disengaged from the slot 67, the member 44 by means of the lever 43 can be manually adjusted for the desired stitch length. From the foregoing description it is seen that the present invention provides a backup stitch mechanism designed in a novel, yet relatively simple manner, to produce a reverse stitch which provides a lockstitch with the highest desirably characterizing the reverse feeding and thereby the disclosure that when the pin 60 engages the drive lever 63 to produce the alternate reverse stitch, the lever 43 is disengaged so that it does not move and thereby present a danger and possible annoyance to the operator. The resulting stitch formation produced by the present invention when the lateral arm 58 of the pin 60 engages the slot 67 is illustrated in FIG. 7. The sequence of needle penetrations in FIG. 7 is A, B, C and D, the feeding being in a forward direction at needle penetrations A and C and in a rearward direction at needle penetrations B and D. When the direction of feed is opposite that shown by the arrow, a reverse or backward stitch A-B or C-D will be made whose length is substantially one-third of the forward stitches B-C, etc. The elasticity or resiliency of the seam illustrated arises from the fact that backward stitches A-B, C-D, etc., can shorten when the work piece is elongated. For example, elongation of the seam would involve the shift of point B toward A, D toward C, etc. Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of our invention which is for purposes of illustration only and not to be construed as a limitation of the invention.

6. A pair of outward facing shelf-like shoulders 85 are formed on the button for preventing outward movement thereof once the button has been depressed. These shoulders, as best shown in FIG. 6, are adapted to abut against the inner surface of either side defining the opening 82 in the plate 78. The spring mounting arrangement of the button allows it to be laterally shiftable in order to bring one of the button shoulders 85 into abutting relationship with one side of the opening 82 in the button mounting plate. Preferably, as shown in FIG. 6, the button is shifted to the left to avoid any possible interference by the button with the oscillating movement of the drive lever 63. Depressing the button 75 causes a corresponding movement of the pin 60 from an outermost position (FIG. 3) to its innermost position (FIG. 6) whereupon the lateral extending arm 58 is urged into a substantially horizontal or radial slot 67 formed in the drive lever 63 between the extremities of the vertical slot 66. This slot 67 is disposed on the lever 63 so that the desired reverse stitch rate of 18 stitches per inch may be produced by movement of the stitch length adjustment lever 43 to a position aligning the recess 51 and the slot 67 in substantially the same planes to enable the lateral arm 58 to register with the slot 67 upon depression of the button 75. The structure is designed so that the reverse stitch pin engaging position of the lever 43 substantially is located at the 8 marking (not shown) on the stitch indicator plate 48. It is to be understood that the position of the slot 67 is located in accordance with the desired reverse stitch rate and therefore, could be positioned other than as illustrated in the drawings and may include a series of such slots, each one producing a different reverse stitch rate. As illustrated in FIG. 6, the lateral arm 58 of the pin 60, which normally is disposed in the recess 51 of the member 44, is urged forward away from the operator upon depression of the button 75 thereby moving the arm out of the recess 51 and consequently engaging the feed regulator block 35 housing the pin 60 from the lever 43 for adjusting the stitch length. Thus, with the lateral arm 58 of the pin 60 engaging the slot 67 in the driven lever 63, movement of the lever will be transmitted to the feed regulator block. With the pin disengaged from the slot 67, the member 44 by means of the lever 43 can be manually adjusted for the desired stitch length.
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Having thus described the nature of the invention, what I claim herein is:

1. A sewing machine having a frame, an actuating mechanism comprising a main shaft journaled in said frame, a work feeding mechanism effective to transport work fabrics relative to said sewing machine frame, means driven by said actuating mechanism for operating said work feeding mechanism, said operating means including a regulating member pivotally mounted on said frame and arranged to control the stitch length and direction of said work feeding mechanism, said sewing machine including a backup stitch mechanism including a cam controlled feed regulating means driven by said actuating mechanism in timed relation to said main shaft, and operator influenced control means carried by said frame for selectively coupling said cam controlled feed regulating means to said regulating member thereby to permit work feeding having a predetermined, alternating sequence in forward and reverse directions.

2. A sewing machine as claimed in claim 1 wherein said cam controlled feed regulating means is organized to produce forward feeding steps substantially longer than those in the reverse direction.

3. A sewing machine as claimed in claim 1 wherein said operator influenced control means comprises a button accessible exteriorly of said frame, a clutch pin influenced by said button to selectively couple said cam controlled feed regulating means to said regulating member for providing feed alternately in forward and reverse directions.

4. A sewing machine as claimed in claim 3 wherein said clutch pin is carried by said regulating member, said cam controlled feed regulating means including a lever oscillatable about an axis fixed in said frame, said lever being formed with an arcuate clutch pin accommodating slot having a center of curvature coincident with said axis of oscillation and with a radial clutch pin accommodating slot joining said arcuate slot, means biasing said clutch pin into said arcuate slot to uncouple said regulating member from said cam controlled feed regulating means, and means effective upon depression of said button for shifting said clutch pin into said radial slot to couple said regulating member with said cam controlled feed regulating means.

5. A sewing machine having a frame including an opening, a block pivotally mounted on said frame, a pivotally mounted stitch length adjusting lever extending through said opening and being received in said block an oscillating feed advancing pitman, said block imparting endwise motion to said pitman with the motion being variable between predetermined limits depending upon the location of said adjusting lever, an actuating mechanism including a main arm shaft journaled in said frame imparting motion to said pitman by means of a linkage arrangement, said sewing machine further including a backup stitch mechanism including a cam controlled feed regulating mechanism, said mechanism comprising a feed adjustment drive lever disposed adjacent to said pivotally mounted block, a cam driven by said actuating mechanism, a slide block carried by said drive lever, said slide block operatively driven by said last mentioned cam, said drive lever having formed therein an opening comprising a vertically disposed slot and an offset pin receiving horizontal slot extending rearward from and located centrally of the extremities of said vertical slot, operator influenced control means including a button formed on a pin controlling shoe for selectively coupling or uncoupling said feed adjustment drive lever to said first mentioned block, a feed regulator block operatively associated with said pitman and disposed rearward of said button, said pin having lateral extending arm portions, one of said arm portions normally being disengaged from the drive lever and freely movable in said vertical slot, said drive lever oscillating in conformance with said cam when said button is depressed so that said one of said arm portions is urged into the pin receiving slot, whereupon the motion of the cam is transmitted to the pitman for providing feeding alternately in forward and reverse directions.

References Cited

UNITED STATES PATENTS
2,970,556 2/1961 Johnson 112—210
3,363,594 1/1968 Kosrow 112—210
2,052,896 9/1936 Roseman 112—203 X

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