

July 7, 1964

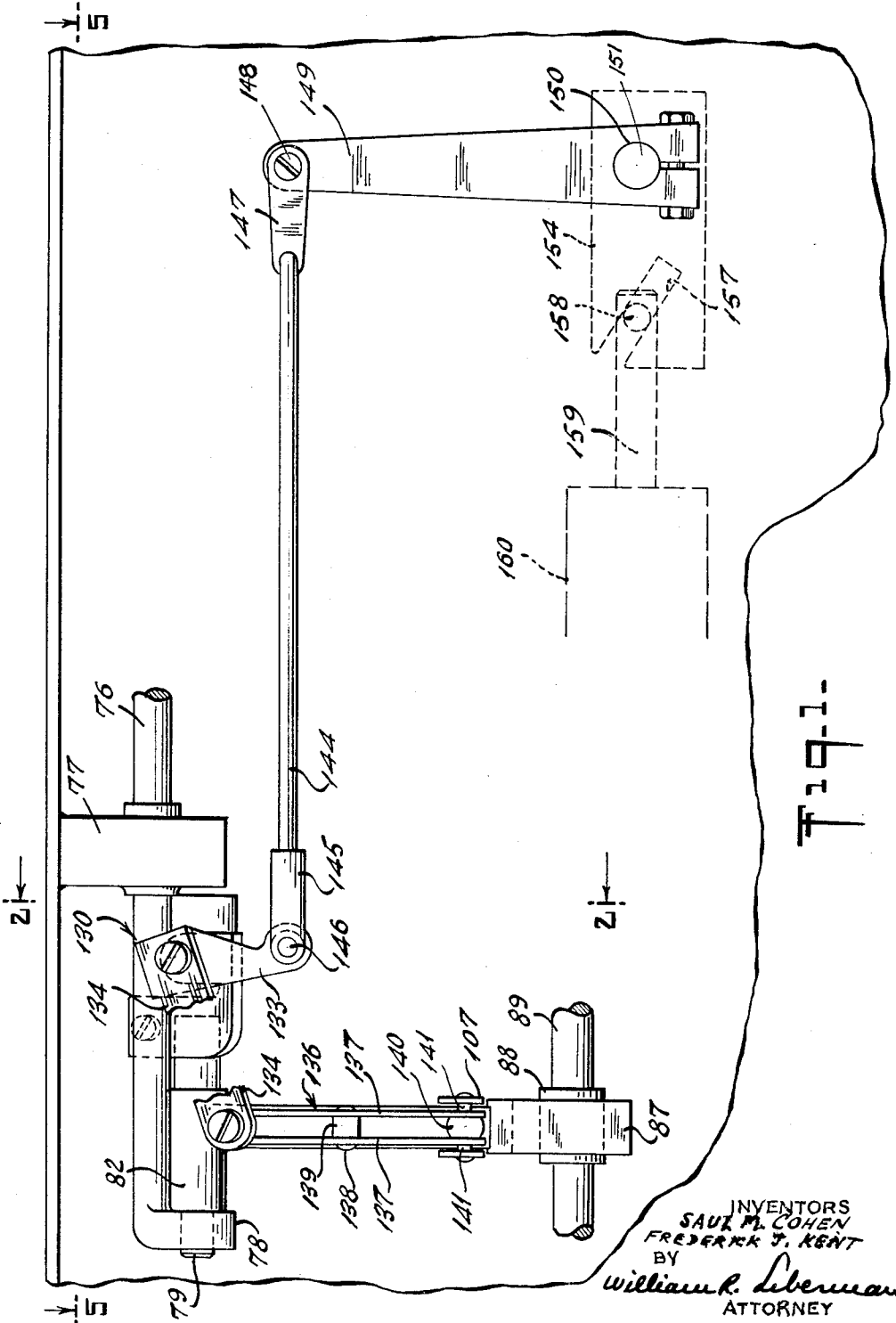
S. M. COHEN ETAL

3,139,849

MULTIPLE NEEDLE THREAD TRIMMER

Filed Aug. 7, 1961

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July 7, 1964

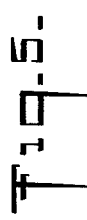
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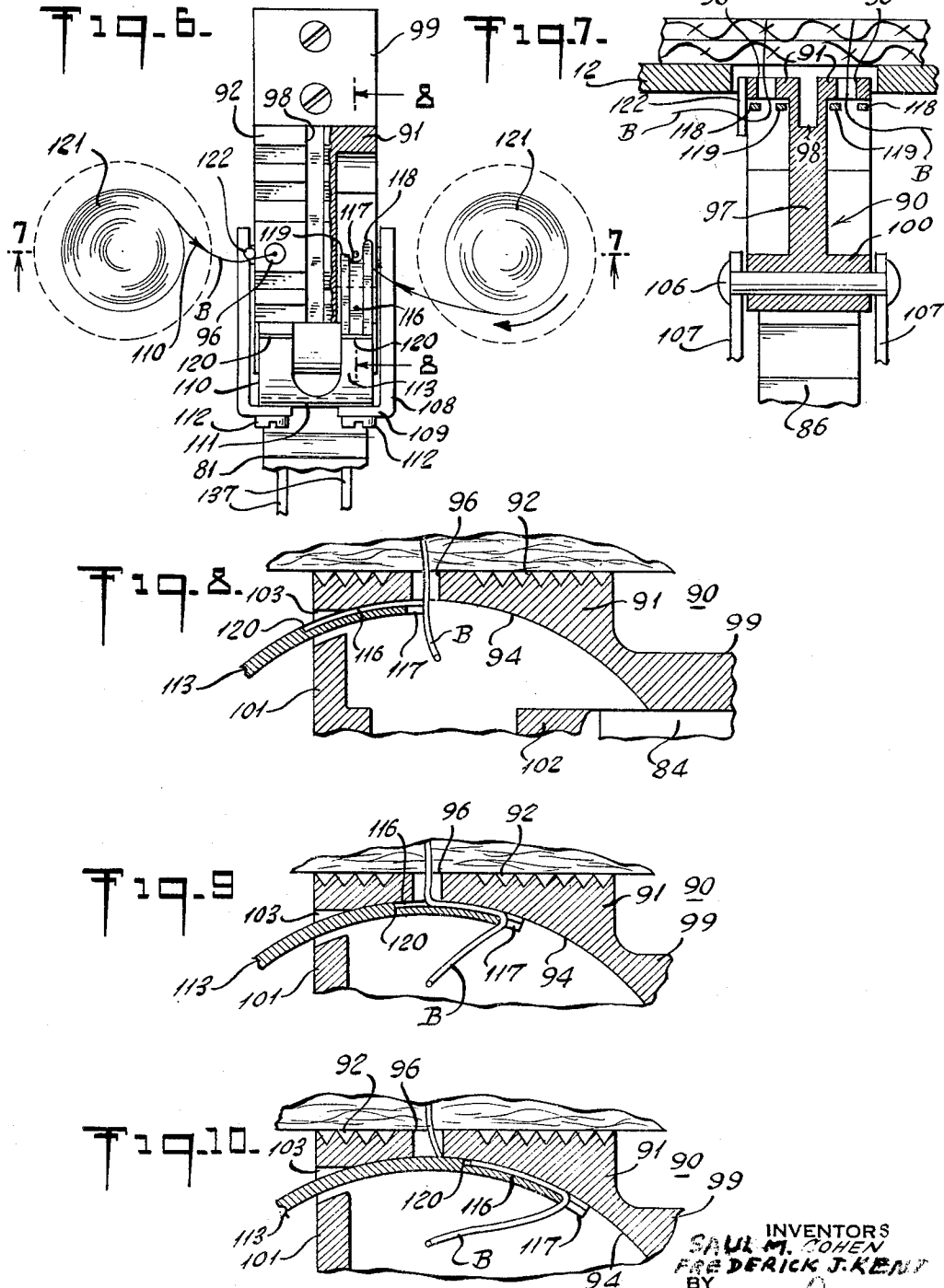
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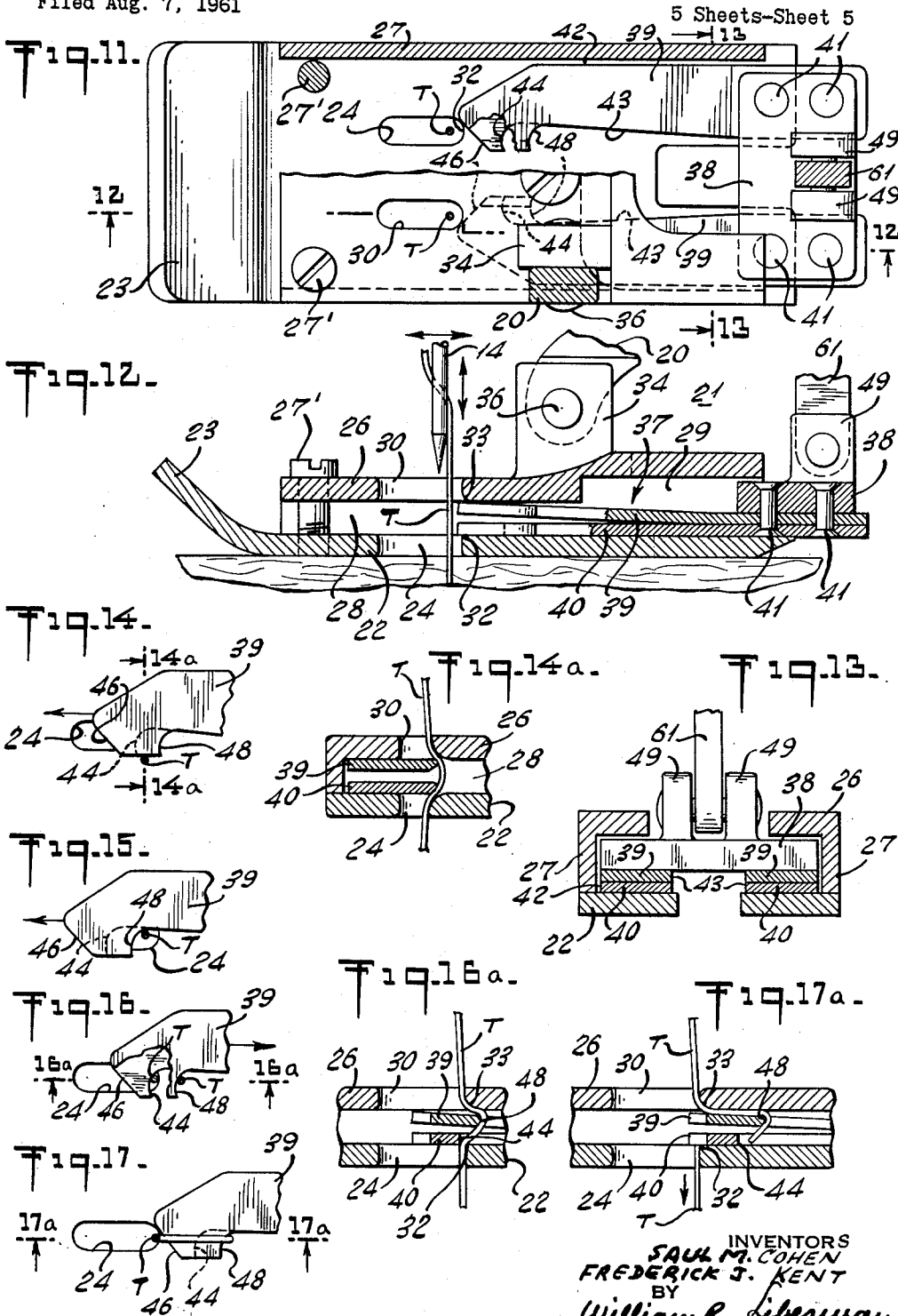
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1

3,139,849

MULTIPLE NEEDLE THREAD TRIMMER

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11 Claims. (Cl. 112-252)

The present invention relates generally to improvements in sewing machines, and it relates particularly to an improved automatic thread cutting mechanism.

In commercial sewing operations employing conventional sewing machines of various types, frequent severing of sewing threads attendant the sewing sequences is necessary but is highly time consuming and thereby contributes appreciably to the cost of the end product. Many forms of thread cutting devices have been suggested and used, but these have possessed numerous drawbacks and disadvantages. Among the drawbacks of the automatic thread cutting mechanisms heretofore employed is their limited application and adaptability. For example, these cutting mechanisms cannot be used with needle feed, lock-stitch sewing machines and for practical reasons cannot be used with multiple needle machines.

It is, therefore, a principal object of the present invention to provide a sewing machine with an improved automatic thread cutting mechanism.

Another object of the present invention is to provide an improved automatic thread cutting mechanism in a needle feed, lock-stitch sewing machine.

Still another object of the present invention is to provide an improved automatic thread cutting mechanism in a multiple needle sewing machine.

A further object of the present invention is to provide an improved sewing machine, automatic thread cutting mechanism of the above nature characterized by its versatility, adaptability, ruggedness, simplicity and ease of application.

The above and other objects of the present invention will become apparent from a reading of the following description, taken in conjunction with the accompanying drawings, wherein

FIGURE 1 is a fragmentary bottom plan view of a two-needle, needle feed, lock stitch sewing machine constructed according to and embodying the present invention;

FIGURE 2 is an enlarged sectional view taken along line 2-2 in FIGURE 1;

FIGURE 3 is a sectional view taken along line 3-3 in FIGURE 2;

FIGURE 4 is a sectional view taken along line 4-4 in FIGURE 2;

FIGURE 5 is a sectional view taken along line 5-5 in FIGURES 1 and 2;

FIGURE 6 is a sectional view, partially broken away, taken along line 6-6 in FIGURE 5;

FIGURE 7 is a sectional view taken along line 7-7 in FIGURE 6;

FIGURES 8 to 10 inclusive are sectional views taken along line 8-8 of FIGURE 6 at different stages of the machine operating cycle;

FIGURE 11 is a top plan fragmentary view of a sewing machine foot piece and upper thread cutting assembly;

FIGURE 12 is a sectional view taken along line 12-12 of FIGURE 11;

FIGURE 13 is a sectional view taken along line 13-13 of FIGURE 11;

FIGURE 14 is a fragmentary top plan view of a top thread cutting element during its advance stroke;

FIGURE 14a is a sectional view taken along line 14a-14a of FIGURE 14;

2

FIGURES 15, 16 and 17 are views similar to FIGURE 14, illustrating the cutter element in successive stages of the cutting stroke;

FIGURE 16a is a sectional view taken along line 16a-16a of FIGURE 16; and

FIGURE 17a is a sectional view taken along line 17a-17a of FIGURE 17.

While the mechanism of the present invention is advantageously employed in a sewing machine of the two needle, lock stitch, needle feed type and is so illustrated and described herein, it may be used to great advantage in other types of sewing machines, of the single or multiple needle type and of different stitch and feed types.

A feature of the present invention resides in the provision of a thread cutting device in a sewing machine including a reciprocating needle, comprising a cutter element longitudinally movable along a path intersecting the path of said needle and including a front section having a leading side edge inclined to the longitudinal path of said cutter element and a rearwardly directed cutter-defining trailing edge, and means for reciprocating said cutter element along said longitudinal path. Another feature of the present invention is achieved by providing, in a sewing machine including a reciprocating work advancing feed dog, a thread cutting member movable with said dog and means for moving said thread cutting member relative to said feed dog.

According to a preferred form of the present invention, as embodied in a two needle, needle feed, lock stitch sewing machine, there are provided a foot piece which defines a bottom guide plate and a top guide plate mounted on and above the bottom guide plate, the guide plates having laterally spaced pairs of vertically aligned slots formed therein to accommodate the conventionally reciprocated, laterally spaced needles. A cutter assembly is longitudinally slidably located between the guide plates and includes a rear cross bar to which is secured a pair of laterally spaced, longitudinally extending thread engaging and cutting members. Each thread cutting and thread engaging member has a lower cutter element resting on the bottom guide plate and provided with a front section having a leading side edge inclined to the longitudinal axis of the cutter element and a trailing rearwardly directed cutting edge, and an upper thread engaging element provided with a front section which is resiliently urged upwardly into engagement with the top guide plate and has a leading inclined side edge aligned with the cutter element side edge and a rearwardly directed hook shaped edge trailing the cutting edge of the lower cutter element. Means are provided to reciprocate the cutter assembly so that the cutter and thread engaging element front sections move across the needle registering apertures formed in the guide plates.

The sewing machine is provided with a pair of coupled feed dogs driven in a conventional manner and each having a serrated upper face and a concave cylindrical bottom face. A first bell crank is supported below and movable with the feed dogs and includes a depending first leg and a longitudinally extending second leg and is pivoted about a horizontal axis. An arcuate cutter element is mounted on the second leg and is swingable along the feed dog cylindrical underface and across the needle aperture formed therein. The cutter element is provided with a leading section having a recess at its leading end and having formed in its upper surface a longitudinal groove with a base disposed below the feed dog cylindrical surface. Trailing the leading section of the cutter element is a cutting edge which defines the trailing end of the groove and surface of the feed dog. A second bell crank is pivoted about a vertical axis movable with the feed dog and includes a laterally extending leg connected to the depending leg of the first bell crank

and a longitudinally extending leg connected to a motivating means. The cutting members are simultaneously selectively activated when the needles are in their raised position by any suitable mechanism. One such mechanism, which may be advantageously employed, is described in U.S. Patent No. 2,914,010, granted November 24, 1959, to Saul M. Cohen.

Referring now to the drawings, which illustrate a preferred embodiment of the present invention, reference numeral 10 designates generally the bed plate of a two needle, needle feed, lock stitch sewing machine which, except as hereinafter described, may be of conventional construction. An insert plate 11 is located in bed plate 10 at the throat of the machine, and has an opening 12 formed therein in alignment with the sewing machine feed dogs and needles. The sewing machine includes a needle bar 13 which is vertically and longitudinally reciprocated in the usual manner and releasably carries a pair of laterally spaced needles 14. A vertical foot piece support bar 16 slidably registers with a bushing 17 carried by the sewing machine and may be selectively manipulated, as is well known, to a raised position and a work-engaging depressed position. Mounted on bar 16 is a bracket 18 which includes an upright leg locked in a vertical slot in bar 16 and a pair of forwardly projecting, laterally spaced arms terminating in dependent and transversely apertured fingers, indicated at 20.

Rockably supported by bracket 18 above plate opening 12 is the upper thread cutting assembly 21 which is movable with bar 16 to a raised position above plate 11 and to a depressed position spring-urged toward plate 11. Assembly 21 includes a longitudinally extending bottom guide plate or foot piece 22 which is upwardly forwardly inclined at its leading end 23 and has formed therein a pair of laterally spaced needle slots 24 extending longitudinally a distance slightly in excess of the full longitudinal stroke of needles 14. Mounted on bottom guide plate 22 and spaced vertically therefrom is a top guide plate 26 provided with depending side flanges 27 which rest on the top face of bottom plate 22, plates 22 and 26 being secured by screws 27'. The underface of the rear section of the plate 26 is vertically upwardly offset relative to the underface of the front section thereof to delineate with the plate 22 front and rear longitudinally extending communicating passageways 28 and 29 of smaller and greater heights respectively. A pair of needle slots 30 are formed in top plate 26 coextensive and in alignment with needle slots 24. As seen in FIGURE 12, the upper trailing edges 32 of needle slots 24 are sharp to define cutting edges, whereas the lower trailing edges 33 of slots 30 are rounded to define non-abrading thread guide edges. A pair of laterally spaced transversely apertured lugs 34 project upwardly from plate 26 and are pivoted to bracket fingers 20 by headed pins 36 to permit the rocking of assembly 21.

An upper thread engaging and cutting member 37, located and longitudinally slidable in passageways 28 and 29, includes a rear cross-bar 38 which registers with trailing passageway 29. A pair of laterally spaced complementary pairs of upper and lower thread engaging and thread cutting elements 39 and 40 respectively extend forwardly from cross-bar 38 and have their coinciding superimposed trailing ends secured to the underface of the cross-bar 38 by countersunk rivets 41. Each of the thread cutting elements rests on lower plate 22, and is provided with a longitudinally extending outer edge 42 which is closely spaced from the corresponding flange 27 to restrict cutter member 37 to free longitudinal movement. The inner edges 43 of the cutter elements 40 are forwardly outwardly inclined and terminate in rearwardly directed hook shaped edges 44 which define the trailing parts of the front sections of said elements 40. The leading edge 46 of each element 40, in longitudinal alignment with the corresponding needle slot 24, is forwardly outwardly inclined. As illustrated in FIGURE 16, the

bottom corner of the rearwardly directed hook shaped edge 44 is sharp and cooperates with the sharp needle slot edge 32 to provide a cutting system. The other edges of cutter 40 which engage the thread are rounded.

Each thread engaging element 39 is of substantially the same configuration as the corresponding underlying cutter element 40 except that the rearwardly directed hooked edge 48 trails the hooked edge 44 of cutter element 40. The other edges of thread engaging element 39 are in substantially vertical alignment with the corresponding edges of the underlying cutter elements 40. The trailing sections of cutter elements 39 and 40 are in abutting engagement while the leading section of each cutter 39 is upwardly sprung and disposed above the leading section of cutter 40, the front edge of cutter 39 bearing against the underface of the top guide plate 26. A yoke member 49 defined by a pair of transversely apertured upright lugs is medially located along the rear edge of cross bar 38.

The mechanism for actuating cutter assembly 37 includes a split collar block 50 registering with and locked about bar 16 by a shouldered screw 51 engaging a corresponding shoulder and tapped bore formed in block 50. Swingably supported by block 50 is a rockable yoke 52 which consists of vertically extending, laterally spaced arms 53, pivoted at their upper ends to block 50 by shouldered screw 51 and an opposite shouldered screw 54, and terminating at their lower ends in rearwardly directed legs 56 bridged by a cross piece 57. Integral with cross piece 57 and medially depending therefrom is an arm 58 having a forwardly projecting finger 59, the extremity of which is folded rearwardly, as indicated at 60. A vertical bore is formed in finger 59 and section 60, slidably engaging a pin 61, the lower end of which is pivoted to yoke 49.

Formed integrally with the upper end of one yoke arm 53 is a rearwardly directed bar 63 having an aperture 64 formed adjacent the end thereof. A bell crank 65 has an opening formed in its knee portion which engages the outer reduced section of a stepped collar spacer member 66 mounted on block 50 by a shoulder screw 67. Bell crank 65 includes a laterally projecting leg 68 terminating in a coupling ball 69 which registers with aperture 64 in bar 63, and a vertically projecting longer leg 70 carrying adjacent its upper end a rearwardly directed pin defining threaded bolt 71. A vertically slotted yoke 72 engages and straddles pin 71 and is mounted at the end of a slide rod 73 reciprocated by a solenoid 74 when the needle bar is in its raised position, as described in the above referred to Patent No. 2,914,010.

The feed dog actuating mechanism includes a laterally extending shaft (FIGURES 1 and 2) journaled in a depending bracket 77, and rocked in the conventional manner in synchronism with the longitudinal reciprocation of needle bar 13. Shaft 76 carries a pair of laterally spaced, upwardly directed rocker arms 78 which support between them a laterally extending axle 79. A feed dog supported bracket 80 comprises a longitudinally extending arm 81 terminating at its forward end in laterally extending sleeve 82 rockably engaging axle 79, and having an end section 83 of reduced outside diameter (FIGURE 5). An upright support block 84 is formed at the trailing end of bracket arm 81. Depending from bracket arm 81 forward of its rear end is a leg 86 on which is mounted a rearwardly directed yoke member 87 having upper and lower parallel arms. Registering with yoke member 87 is an eccentric wheel 88 rotated by a shaft 89, in conventional manner, in synchronism with the vertical movement of needle bar 13. Thus, a vertically and longitudinally reciprocating movement is imparted to the bracket 80.

Feed member 90 is mounted on support block 84 in alignment with plate opening 12, and consists of a pair of laterally spaced, longitudinally extending feed dogs 91 having serrated upper faces 92 and arcuately shaped

5

concave underfaces 94, a vertical aperture 96 being formed in each feed dog 91 in vertical alignment with corresponding needles 14 and extending between the feed dog upper and lower faces 92, 94. Feed dogs 91 are mounted atop a vertical medial web 97 and separated by an intermediate longitudinally extending groove 98. Projecting rearwardly from web 97 and feed dogs 91, and downwardly offset relative to dogs 91, is an arm 99 disposed atop block 84 and secured thereto by suitable screws. The lower, front and rear edges of web 97 are provided with oppositely directed peripheral flanges 100, 101 and 102 respectively, front flanges 101 terminating at a point below underface 94 of the feed dogs to delineate passageways 103 on opposite sides of the web 97.

A pair of laterally spaced parallel bell cranks 104 are disposed on opposite sides of lower flange 100 and are pivoted thereto by a pin 106 extending through the knee portion thereof. Each bell crank 104 includes a depending arm 107 and a forwardly projecting shorter arm 108 terminating in an inwardly directed lug 109 (FIGURE 6). A dual lower thread engaging and cutting member 110 is of arcuate configuration corresponding to the curvature of feed dog underface 94, and includes a front cross piece 111 extending between the rear faces of lugs 109 and secured thereto by suitable screws 112. Projecting rearwardly from the cross piece 111 are a pair of laterally spaced cutter or finger elements 113 each of which engages feed dog arcuate underface 94 on opposite sides of web 97 which registers with the space separating the cutter elements 113. Each cutter element 113 includes a leading section having a longitudinal medial groove 116 formed therein which extends to the front end of the cutter element 113 into registry with a rearwardly directed recess 117 which is formed in the leading end of cutter element 113 and is flanked by an outer long finger 118 and an inner shorter finger 119. Groove 116 terminates at its trailing end in an upwardly projecting cross shoulder 120 having an upper sharp edge which engages underface 94 of the feed dogs and cooperates with the sharp rear bottom edge of needle aperture 96 to define a thread cutting system therewith. Conventional bobbin devices 121 are associated with feed dogs 91, and a guide pin 122 depends from the outer edge of one of the feed dogs 91 to direct the corresponding bobbin thread properly.

A vertical rocker arm 123 is provided at its upper end with a split collar 126 engaging sleeve section 83 and locked thereto by a suitable screw 127 which engages both elements of collar 126. Arm 123 carries at its lower end a laterally projecting leg 128 terminating in a forwardly projecting lug 129 (FIGURE 5). A bell crank 130 comprises a U-shaped knee section 131 which is pivoted to the lug 129 by a substantially vertical pin 132 and includes an arm 133 projecting rearwardly from the upper leg of knee section 131 and having an aperture formed therein adjacent its free end, and an arm 134 projecting laterally from the lower leg of the knee section 131. The ends of the bell crank arms 107 and 134 are connected by a coupling member 136 (FIGURE 1) which includes a pair of laterally spaced longitudinally extending parallel links 137 joined by a rivet 138 which carries a spacer collar 139 separating links 137. The rear ends of links 137 have laterally aligned apertures formed therein which engage a coupling ball 140 provided with outwardly directed opposite pins 141 registering with apertures formed in the ends of bell crank arms 107. A coupling ball 142 is mounted atop a shank 143 supported by and projecting upwardly from the free end of bell crank arm 134 and registers with apertures formed in the corresponding free ends of links 137.

A connecting rod 144 is provided at one end thereof with a yoke member 145 having aligned apertures or seats formed in the arms thereof which engage a coupling ball 146. Coupling ball 146 registers with an aperture formed in the free end of bell crank arm 136. The opposite end of the connecting rod 144 is flattened, as at 147, and is

6

pivotally connected by a shoulder screw 148 to the underface of the free end of a rocker arm 149. The other end of rocker arm 149 terminates in a split collar 150 which engages the lower end of a vertical shaft 151 and is contracted and tightened by a cooperating screw registering with the split collar arms. The upper section of the shaft 151 projects through and is journaled in a bushing 152 formed in bed plate 10 and is restrained against axial movement by a pair of positioning collars 153 affixed by lock screws on shaft 151 at opposite ends of bushing 152. A cam plate 154 is provided with a depending hub 156 also affixed to the upper end of the shaft 151. Cam plate 154 has formed therein a diagonal slot 157 slidably engaged by a vertical follower pin 158 depending from the free end of a reciprocating rod 159 motivated by a solenoid 160. Solenoids 74 and 160 are simultaneously energized and deenergized to advance and retract rods 73 and 159 respectively to effect the upper and lower thread cutting strokes, rods 73 and 159 being retracted by springs or other means, such as a cooperating solenoid. It should be noted that a single solenoid system may be employed to motivate both the upper and lower thread cutting mechanisms. The system employed in the above-identified Cohen patent may be employed to advantage in this connection.

Considering now the operation of the above described thread cutting mechanism, the cutting stroke is effected automatically when needle bar 13 and needles 14 are in their fully raised position and feed dogs 91 are in their depressed positions, by the momentary energization of the solenoids 74 and 160. Energization of solenoid 74 advances rod 73 and yoke 72 to the right, as seen in FIGURE 3 of the drawings, to swing bell crank 70 clockwise which, in turn, swings yoke 52 clockwise, as seen in FIGURE 2. Yoke 52, by way of arm 58, advances cutter member 37 forwardly along the passageways 28 and 29. During the initial part of the advance stroke of cutter 37, the leading inclined edges of the upper and lower cutter elements 39 and 40 pass across openings 30 and 24 and engage the corresponding upper threads T to urge them laterally inwardly against the side edges of openings 24 and 30 (FIGURES 14 and 14a). When cutter 37 reaches the end of its advance stroke, the cutter hook edges 44 and 48 pass beyond threads T which spring back into longitudinal and confronting alignment with threads T (FIGURE 15). Cutter 17 is then retracted, and during the initial part of its return stroke, threads T are engaged by hook edges 48 of the upper cutter 39 and are drawn rearwardly into passageway 28 (FIGURES 16 and 16a). As the return stroke continues, the hook cutting edges 44 of lower cutter 40 pass across the corresponding aperture, cutting edges 32, to effect a severing of threads T, the lower ends of the upper sections of which are engaged between the confronting walls of upper cutter element 39 and plate 26 (FIGURES 17 and 17a). The cutter member 37 then returns to its fully retracted position (FIGURES 11 and 12) to complete the upper thread cutting stroke.

The cutting of the bobbin threads B is effected by the energization of solenoid 160 which advances rod 159 to the left, as seen in FIGURE 1, and rocks cam plate 154 and arm 149 counterclockwise. Arm 149, by way of connecting rod 144, rocks bell crank 130 clockwise which, in turn, by way of coupling member 136, rocks bell crank 104 clockwise as seen in FIGURE 2, to advance cutter member 110 along its stroke from its retracted position (FIGURE 8). During the initial part of the cutting stroke, the leading section 114 of each of cutter element 113 passes across the needle aperture 96, the cutter element end recess 117 engaging the corresponding thread B to draw thread B in registry with groove 116 in the cutter element along the confronting feed dog underface 94 (FIGURE 9). Upon further advance of cutter member 110, the cutting edges 120 pass across needle apertures 96 to sever threads B against the trail-

ing lower sharp edges of apertures 96 (FIGURE 10). Upon de-energization of solenoid 160, cutter member 110 is withdrawn by the motivating linkage to its retracted position to complete the cutting cycle.

It is important to note that the rod 144 is substantially perpendicular to the plane of movement of the feed dogs 91. As a consequence, the normal movement of feed dogs 91 during the normal sewing operation imparts insignificant longitudinal movement to rod 144 and hence does not affect the movement of cutting element 113 in relation to the feed dogs 91 during the normal sewing operation.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

We claim:

1. A sewing machine comprising a reciprocating needle, a feed dog reciprocating across the path of said needle, a thread cutting member, means moving said thread cutting member in synchronism with said feed dog, and remotely actuatable means for selectively moving said thread cutting member relative to said feed dog independently of the movement thereof.

2. A sewing machine comprising a reciprocating needle, a work advancing feed dog synchronously reciprocating across the path of said needle and having upper and lower faces and an opening formed therein between said upper and lower surfaces, a thread cutting member mounted on and synchronously movable with said feed dog, and means for selectively reciprocating said thread cutting member in a path along said feed dog lower face and across said opening.

3. A lock stitch sewing machine comprising a vertically reciprocating needle, a feed dog reciprocating in synchronism with said needle and having top and bottom faces and a vertical aperture in alignment with said needle, a thread cutting element mounted on and synchronously driven with said feed dog and movable relative to said feed dog in a path along said feed dog bottom face and across said aperture, and means for selectively reciprocating said cutting element along said path.

4. A sewing machine according to claim 3, wherein said feed dog bottom face and said cutting element are of substantially complementary arcuate configuration.

5. A sewing machine according to claim 3, wherein said cutting element includes a leading section having a longitudinally extending surface disposed below said feed dog bottom face and a cutting edge trailing said leading section and substantially abutting said feed dog bottom face.

6. A sewing machine according to claim 3, wherein said cutting element has a recess formed in its leading end.

7. A sewing machine according to claim 6, wherein said recess is flanked by a pair of forwardly directed legs of different lengths.

8. A lock stitch sewing machine comprising a vertically reciprocating needle, a feed dog having a serrated top face and a cylindrical bottom face and a vertical aperture formed therein communicating with said top and bottom faces, means for imparting vertical and longitudinal reciprocating motion to said feed dog in synchronism with said needle, a support arm swingably mounted relative to and movable with said feed dog, an arcuate cutting element mounted on and circumferentially extending from said support arm and engaging said feed dog bottom face, and means for rocking said support arm to selectively reciprocate said cutting element across said aperture.

9. A sewing machine according to claim 8, including a bracket depending from said feed dog, said support arm being pivoted to said bracket.

10. A lock stitch sewing machine comprising a bracket, a feed dog mounted on said bracket and having top and bottom faces and an aperture communicating with said faces, means for imparting a longitudinally reciprocating motion to said bracket, a first bell crank pivoted about a horizontal axis to said bracket and including a depending first leg and a longitudinally projecting second leg, a cutter element mounted on said second leg and engaging said feed dog bottom face and movable across said aperture upon the rocking of said first bell crank, a second bell crank supported by said bracket and pivoted about a vertical axis and including a laterally extending third leg and a longitudinally extending fourth leg, a link connecting said first and fourth legs, and means connected to said third leg for rocking said second bell crank.

11. A sewing machine according to claim 10, wherein said means for rocking said second bell crank includes a connecting rod reciprocable along the length thereof in a direction substantially perpendicular to the plane of motion of said bracket.

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