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		831 Bonnie Brae, River Forest, Ill. 60305	349,844	9/1886	Harlow et al.	112/199
[21]	Appl. No.	792,269	2,778,329	1/1957	Howell et al.	112/199
[22]	Filed	Jan. 21, 1969				
[45]	Patented	July 20, 1971				

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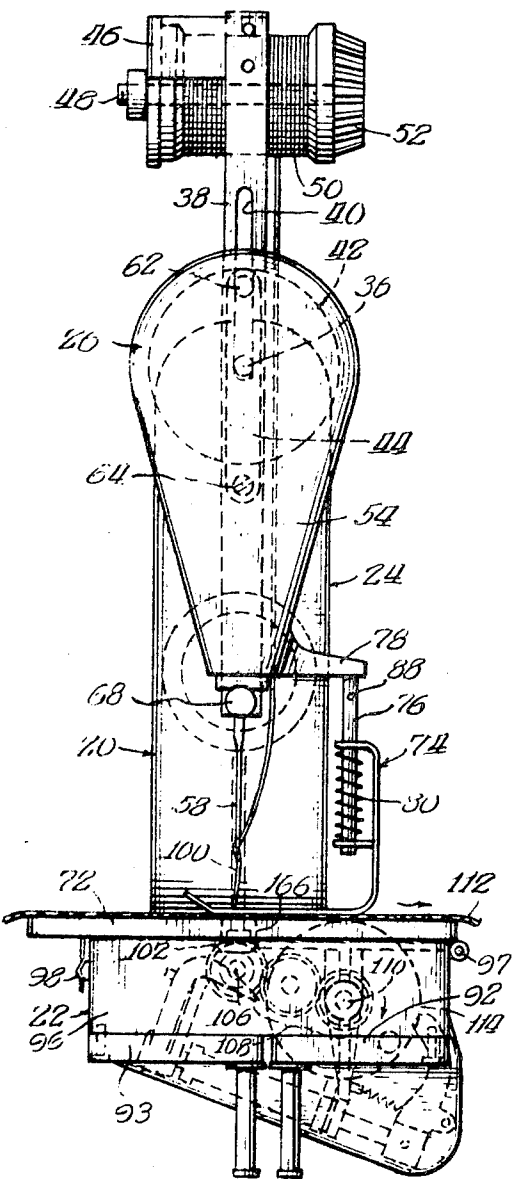
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[54] SEWING MACHINE STITCHING MECHANISM
3 Claims, 18 Drawing Figs.

[52]	U.S. Cl.	112/199
[51]	Int. Cl.	D05b 1/06
[50]	Field of Search	112/119, 21

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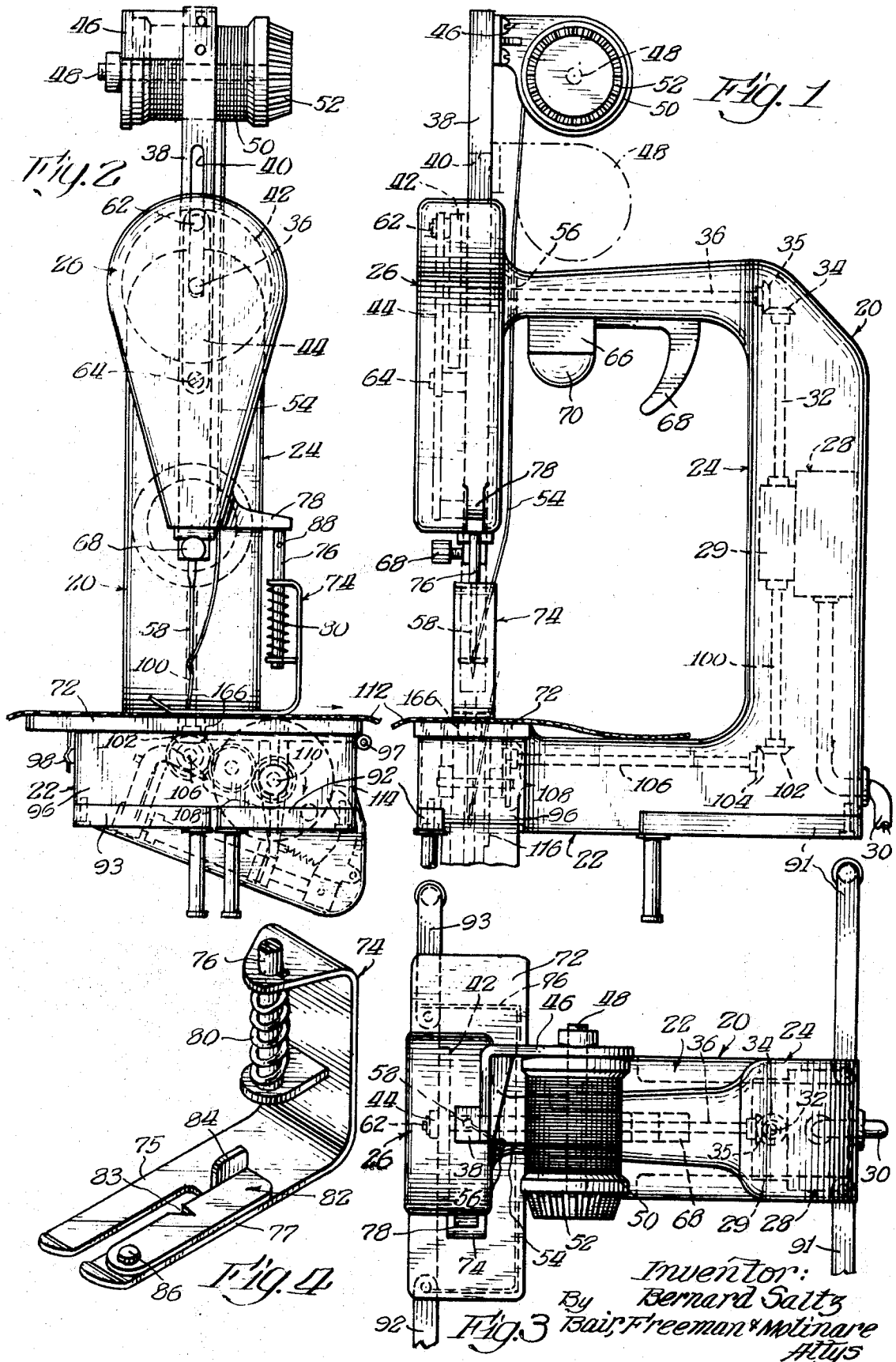
ABSTRACT: A portable electric sewing machine for sewing material, buttons or the like with a chainstitch. The mechanism for looping the thread to form the chain of the stitch includes a reciprocating pair of spreadable, parallel arms positioned beneath the material and work surface. As the needle passes through the material, a loop of thread is retained by the parallel arms. The loop positioned by the arms for passage of the needle through the loop on the next successive stroke of the sewing needle.

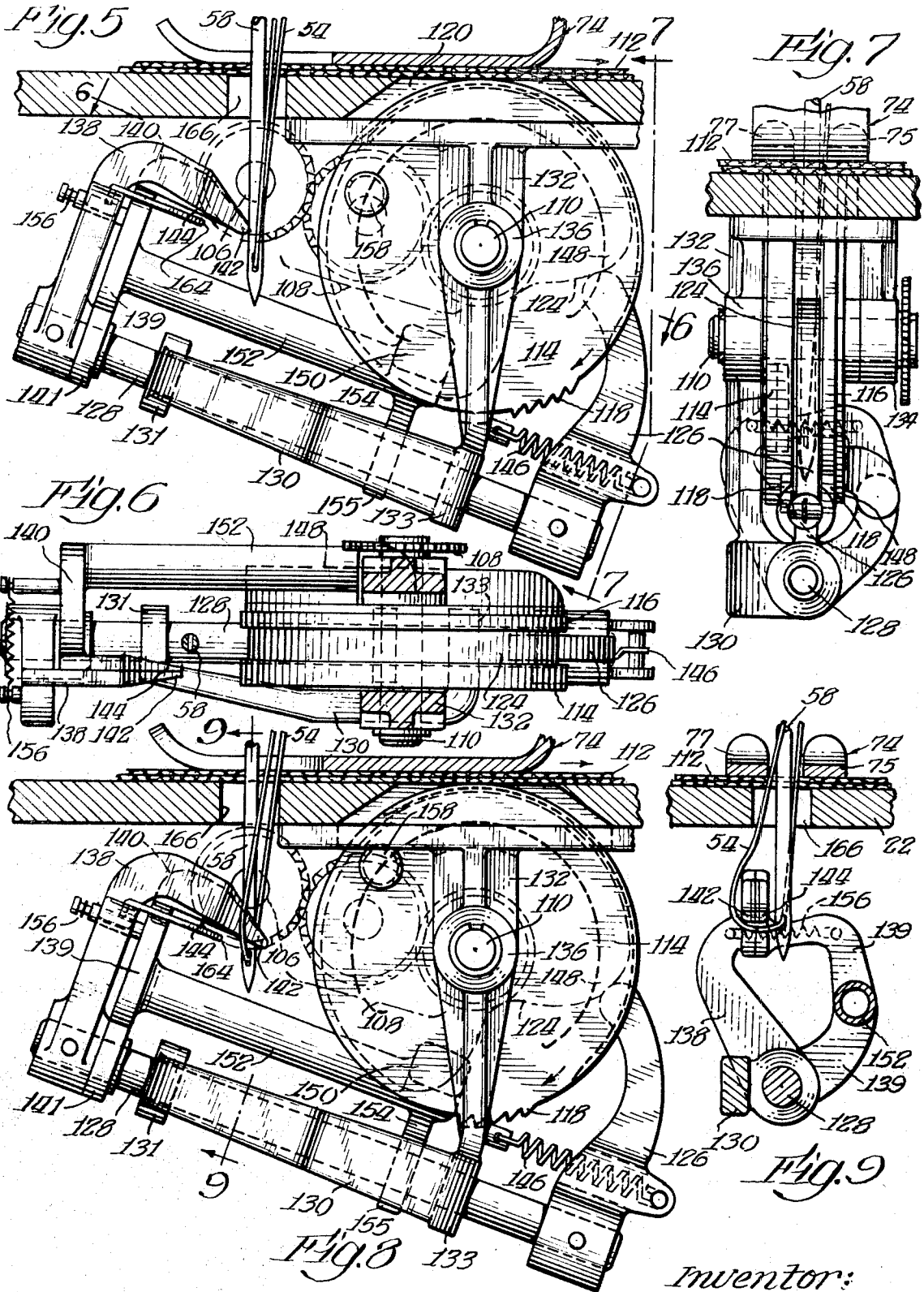


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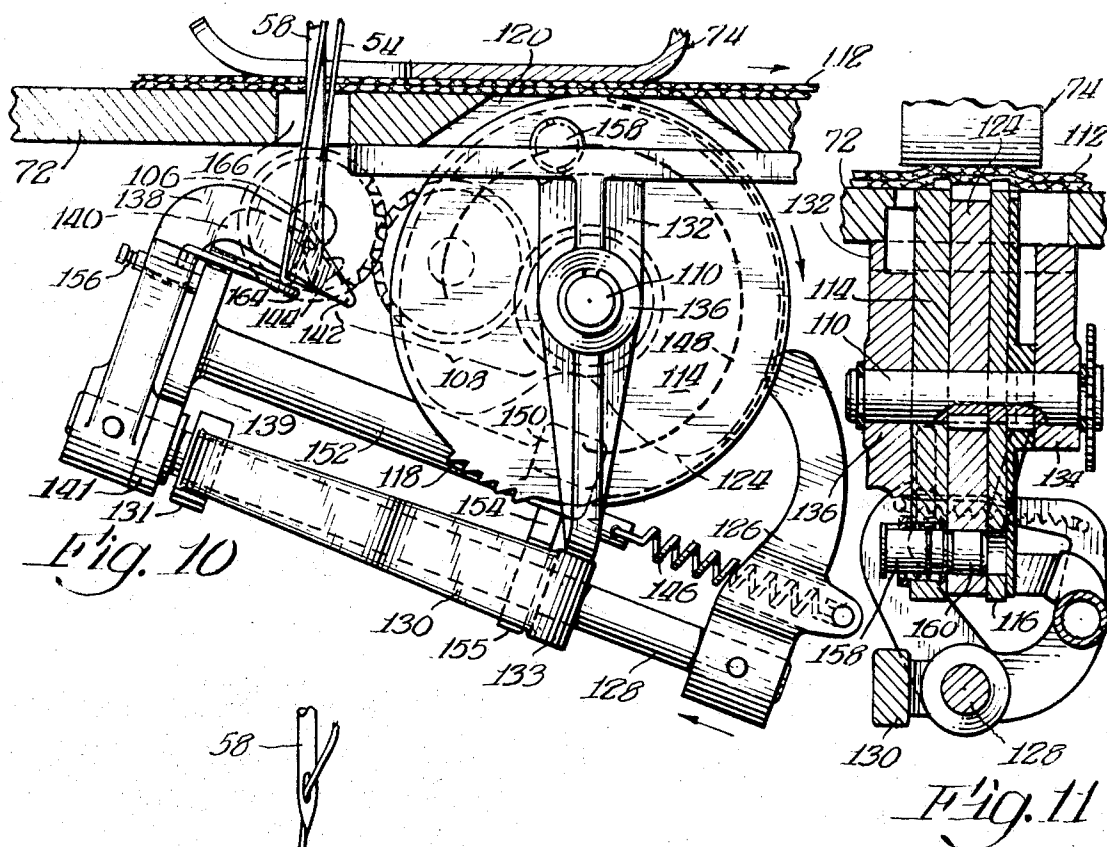
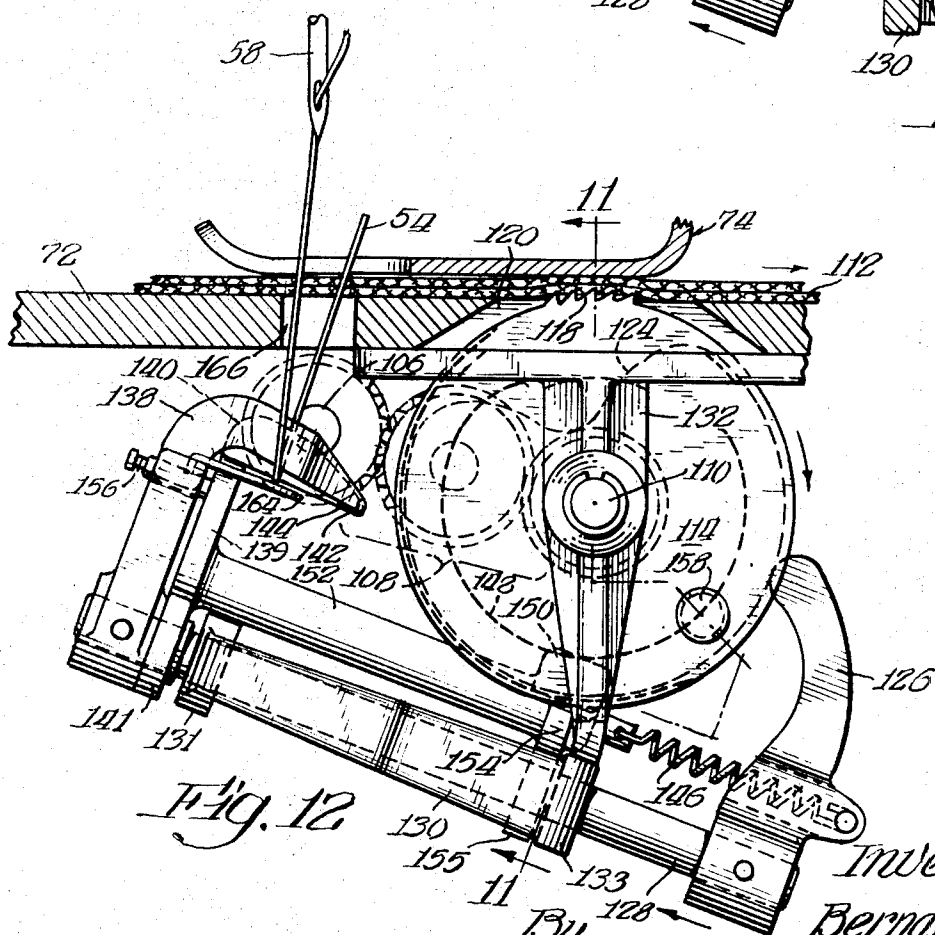
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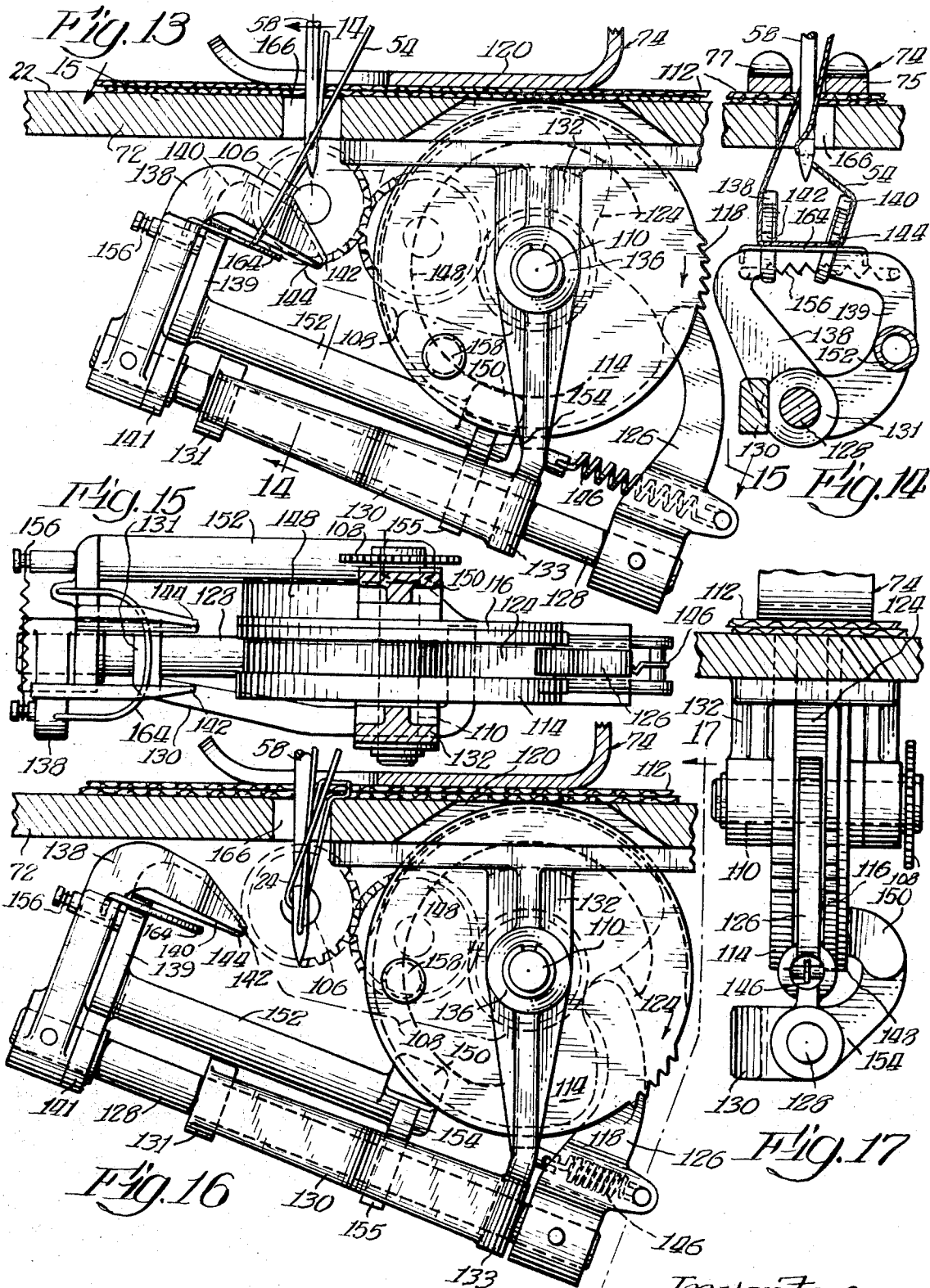




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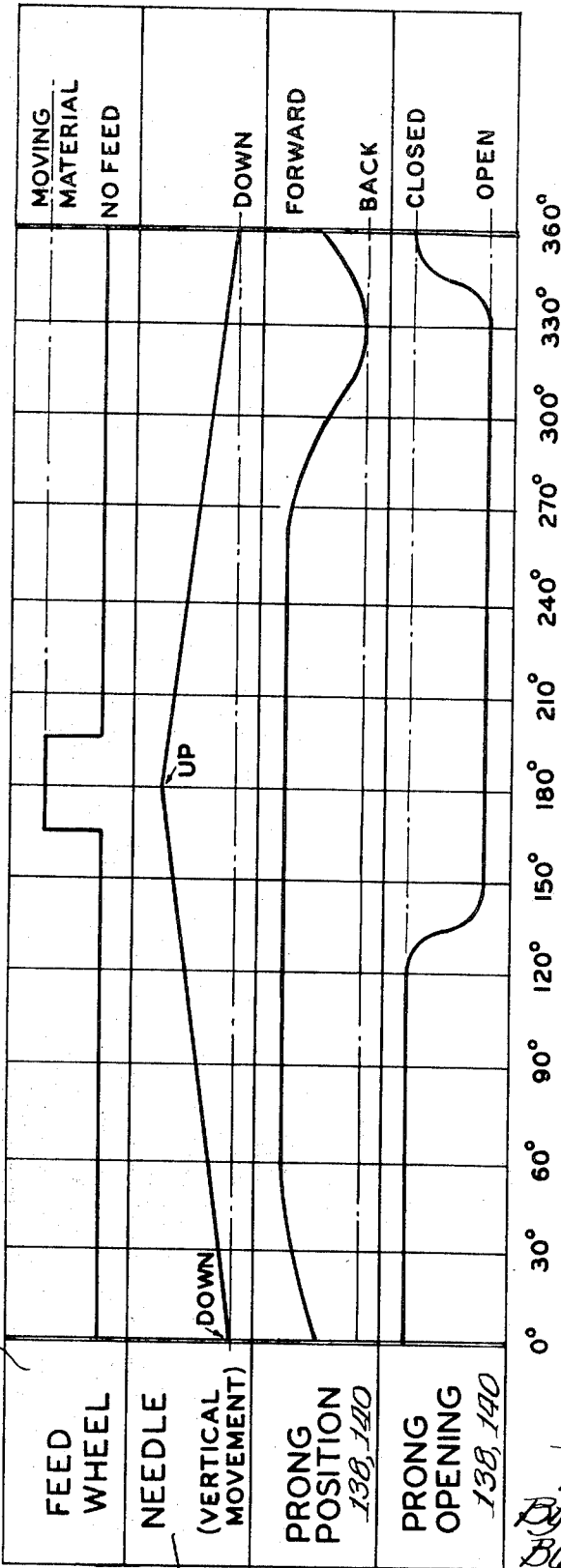
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Fig. 18

114, 116



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SEWING MACHINE STITCHING MECHANISM

BACKGROUND OF THE INVENTION

This invention relates to the sewing mechanism of a sewing machine and, more particularly, to the mechanism for providing a chainstitch for a portable sewing machine.

Portable hand sewing machines have been available for some time. The U.S. Pat. of Saltz et al. No. 2,928,363, for example, discloses such a manually driven, portable sewing machine. While such devices are very useful and operate effectively when manually driven, such devices have been limited to manual operation. Operation by a motor has been impractical or unsatisfactory because the mechanism for forming the chain stitch does not operate efficiently at sewing speeds possible with such a motor. The reason such devices do not operate well at high speeds can be attributed to the relatively great distance mechanical parts comprising the device must move to form each stitch of the chainstitch. To overcome these difficulties, and to provide an efficient and smoothly operating chainstitch sewing machine capable of being driven by an electric motor, the following described invention was conceived.

SUMMARY OF THE INVENTION

In a principal aspect, the present invention of an improved sewing apparatus comprises a reciprocating needle adapted to hold a thread and pass that thread through material on a work surface plate. At the end of the needle stroke which displaces the needle through the material and plate, a pair of parallel, reciprocating, spreadable arms are provided which serve to grasp the thread and form a loop for passage of the needle on the next subsequent needle stroke.

It is thus an object of the present invention to provide an improved chainstitch sewing machine.

A further object of the present invention is to provide a mechanically simple, yet rugged and dependable sewing machine construction.

Still another object is to provide a sewing machine construction which operates efficiently at higher speeds as provided for by electric motors.

One further object of the present invention is to provide an improved sewing machine which includes a novel chainstitch forming mechanism.

These and other objects and advantages and features of the invention will be set forth in greater detail in the description which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

In the description which follows, reference will be made to the drawings comprised of the following figures:

FIG. 1 is an elevational side view of a hand portable electric sewing machine employing the subject matter of the invention;

FIG. 2 is an end view of the sewing machine shown in FIG. 1;

FIG. 3 is a top view of the machine shown in FIG. 1;

FIG. 4 is an enlarged view of the foot of the sewing machine shown in FIG. 1;

FIG. 5 is an enlarged side view of the chainstitch loop-forming mechanism;

FIG. 6 is a cross-sectional view of the loop forming mechanism taken substantially along the line 6-6 in FIG. 5;

FIG. 7 is a cross-sectional view of the loop-forming mechanism taken substantially along the line 7-7 in FIG. 5;

FIG. 8 is a second enlarged side view of the loop-forming mechanism with the needle advanced from the position illustrated in FIG. 5;

FIG. 9 is a cross-sectional view taken substantially along the line 9-9 in FIG. 8;

FIGS. 10, 12, 13, and 16 illustrate further sequential positions of the loop-forming mechanism;

FIGS. 11, 14, 15 and 17 are sectional views taken respectively along the lines 11-11 in FIG. 12, 14-14 in FIG. 13, 15-15 in FIG. 13 and 17-17 in FIG. 16; and

FIG. 18 is a time displacement graph illustrating the relative position of the needle, the loop-forming mechanism and the cloth-feeding wheel of the sewing device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Embodiments utilizing the improvements of the present invention will generally be portable sewing machines of the type adapted to provide a chainstitch. In particular, an electrically driven, portable sewing machine is the type contemplated to use the improvements of the present invention although the invention is not limited to an electrically driven machine.

Referring now to FIGS. 1, 2 and 3, there is shown a typical portable electric sewing machine utilizing the improvements of the present invention. The machine includes a body, or housing, 20 which is divided into a base portion 22, an ascending motor column 24 and a head section 26. Positioned within the motor column 24 is an electric motor 28 which is provided with power through an electric cord 30.

Power provided through the cord 30 is switched on and off to the motor 28 by means of the switch 66 actuated by a trigger 68. A light 70 is positioned beneath the switch 66 and directed toward the work surface of the sewing machine.

The motor 28 provides power to a gear box 29 which, in turn, drives a needle bar drive shaft 32 that is connected by means of bevel gears 34 and 35 to a connecting needle bar drive shaft 36. A needle bar 38 is slidably mounted in the head section 26 and includes a slot 40 through which shaft 36 passes to connect with a flywheel 42. Pivotaly attached to the flywheel 42 is a drive rod 44. The opposite end of the drive rod 44 is connected with the needle bar 38 to reciprocally drive the bar 38 up and down in the head section 26, as the shaft 36 rotates.

A spool-mounting arm 46 is attached to the top of the needle bar 38. A shaft 48 extends from the arm 46 and is adapted to receive a spool 50 of thread. A threadable knob 52 retains the spool 50 on the shaft 48. A length of thread 54 from the spool 50 passes through an opening 56 in the body 20 and is threaded through a hold in a needle 58 attached to the lower end of the needle bar 38. The needle 58 may be removed from an opening in the end of the needle bar 38 by unscrewing a needle clamp screw 60.

As described above the needle bar 38 and attached needle 58 are driven in a vertical reciprocating manner by the drive crank 44 which has one end connected to the flywheel 42 at a pivotal connection 62 and its opposite end attached directly to the needle bar 38 at a pivotal connection 64. Thus, as the flywheel 42 rotates, the needle bar 38 and attachments travel between the extreme positions illustrated by the solid and the phantom lines in FIG. 1.

A work surface plate 72 with a needle opening 166 is attached to the top of the base 22 and provides a surface for material and the like which is being sewn. When in operation, the sewing machine of the invention is adapted for movement of cloth in the direction of the arrow indicated in FIG. 2 on the plate 72. Of course, when sewing on buttons or other stationary sewing operations, the movement of the material being sewn is guided by the operator of the machine.

A foot 74 attached to a rod 76 extending from an arm 78 on the head section 26 is biased by a spring 80 toward the plate 72 to maintain material in a proper position for sewing. The end of the foot 74 adjacent the needle 58 is horseshoe shaped so that the needle may pass between the side members 75 and 77 of the end of the foot 74. The foot 74 may be raised from the plate 72 and held in a raised position by a pin 88.

Attached to one side 77 of the forward end of the foot 74 adjacent the needle 58 is a thread cutter 82. The thread cutter 82 is a flat bar of metal which includes a cutting notch 83 adjacent the needle opening in the foot 74. The notch 83 engages a thread and severs that thread when a tab 84 of the

cutter 82 is grasped to manually rotate the thread cutter 82 about a rivet 86 attaching the cutter 82 to the foot 74. As the cutter 82 is rotated, the notch in the cutter engages and severs the thread 54.

Incorporated as part of the base 22 are extensible braces 91, 92 and 93, as illustrated in FIGS. 1 and 3. The braces 91, 92 and 93 may be extended outwardly from the base 22 to support the sewing machine. Although not shown, there is a brace corresponding to brace 91 on the opposite side of the base 22. The machine is thus portable and to increase the utility of the machine, the braces 91, 92 and 93 make it possible to use it as a stationary machine.

The base 22 also includes a removable cover portion 96 which swings about a hinge 97 and is held in a closed position by a clasp 98. Thus, when necessary to repair the gear train of the sewing machine or otherwise inspect the inner workings, the cover 96 may be swung away.

Referring now to the remaining FIGS. 4 through 18, there is shown the stitching mechanism of the sewing machine. This mechanism is positioned beneath the plate 72 within the region of the cover 96. It cooperates with the thread and the needle 58 to provide a chainstitch. This mechanism is driven by means of a power shaft 100 extending from the gear box 29 associated with motor 28. The shaft 100 is connected through bevel gears 102 and 104 with a drive shaft 106 operable to drive a gear train 108. Gear train 108 provides power to a shaft 110. The various connected shafts and gears provide for a single revolution of the shaft 110 with each single revolution of the flywheel 42 and corresponding complete cycle of motion of the needle 58.

In these Figures, material 112 is feeding in the direction indicated by the arrow between the foot 74 and the plate 72. The shaft 110 is adapted to rotate in the clockwise direction as indicated in the Figures and drive first and second cloth-driving wheels 114 and 116 respectively. The wheels 114 and 116 include teeth 118 which are adapted to engage the material 112 at the appropriate moment during the sequence of operation to move the material forward between the foot 74 and the plate 72. When the teeth 118 are not in position to engage the material 112 the wheels 114 and 116 rotate through the opening 120 in the plate 72 and do not engage the material 112.

Also connected to the shaft 110 is a cam 124. A follower 126 rides on cam 124 and operates to move a shaft 128 slidably mounted in first and second bearings 131 and 133 rigidly fixed to a bearing mounting bar 130. The bearing bar 130 is rigidly attached to the plate 72 by means of a support arm 132 which also includes shaft bearings 134 and 136 for the shaft 110.

Attached at the opposite end of the shaft 128 is a pair of prongs 138 and 140. Thus, as the follower 136 moves in response to the cam 124, the prongs 138 and 140, which each include a tip end 142 and 144 respectively, reciprocate back and forth into and out of a position which intersects the path of travel of the needle 58. Reciprocation is assured by a spring 146 attached between the bearing sleeve 130 and the follower 126.

Prong 138 is a fixed prong rigidly attached to the shaft 128. However, prong 140 is adapted to rotate about the shaft 128 as an axis. Thus, prong 140 may be in contact with prong 138 or it may swing away from prong 138 as indicated in FIG. 14. Prong 138 moves in response to a rotating cam 148 also mounted on shaft 110. A follower 150 attached at the end of a connection bar 152 affixed between the prong 140 and the follower 150 causes the prong 140 to move in response to the motion of the follower 150. To maintain stability of the follower mechanism, a support bearing arm 154 connects the follower 150 and shaft 128. The prong 140 which is connected to an arm 139, thus rotates about shaft 128 on bearings 141 at the end of arms 139 and 155 at the end of arm 154. A spring 156 connected between the prongs 138 and 140 maintains the follower 150 in contact with the cam 148 and also drives the prongs 138 and 140 into engagement with one another.

When the prongs 138 and 140 are mated against each other, and shaft 128 is positioned toward the far right-hand position by means of the cam 124, the prongs 138 and 140 pass on the outside or one side of the lowered needle 58. This is indicated in FIG. 9. On the other hand, when the prongs are spaced from one another, the needle 58 passes between the prongs 138 and 140, as indicated in FIG. 14.

As an additional feature of the invention, the cloth-driving wheels 114 and 116 may be disconnected from the driving shaft 110 by pulling the lock pins 158 and 160 out of engagement with the cam 124, as illustrated in FIG. 11. Thus, the wheels 114 and 116 will not rotate in response to motion of the shaft 110, whereas the cam 124 and 148 will continue to be driven by the shaft 110 and operate the stitch forming mechanism. Disengagement of the wheels 114 and 116 is desirable for sewing buttons with the sewing machine. In such a case, one does not desire to have the cloth moved forward with each stitch of the sewing machine. Rather, one desires to manually position the needle over successive holes in the button. The magnetized lock pins 158 and 160 are so adapted that they may be disengaged from the cam 124. Thus, pin 158 may be pulled to the left in FIG. 11 and twisted for a half turn to remain disengaged from the cam 124. The adjacent pin 160, being magnetized, is also pulled to the left by the magnetized pin 158. To reengage the lock pins 158 and 160, one merely reverses the process, thus allowing the cam 124 to rotate, whereupon the lock pins 158 and 160 will seek the opening the cam 124 and wheel 116 respectively.

Referring now to the sequence of FIGS. 5, 8, 10, 12, 13 and 16, and the accompanying section views, FIGS. 6, 7, 9, 11, 14, 15 and 17, there is disclosed the sequence of operation, or movement of the stitch-forming mechanism. Beginning with FIG. 5, the needle 58 is at the lowest point of its path of travel. The tips 142 and 144 of the prongs 138 and 140 are positioned slightly to the left of the needle 58, the thread 54 passes lightly along the side of the needle 58 adjacent the tips 142 and 144. In the next step shown in FIG. 8, the needle 58 is rising through the material 112. As the needle 58 rises through the material 112, a loop is formed by the thread 54 adjacent the needle 58. This loop results because the friction of the material maintains the thread in a substantially fixed position in the material 112 as the needle 58 rises.

The prongs 138 and 140, and in particular, the tips 142 and 144 pass through the loop formed by the thread 54 and the needle 58. The prongs 138 and 140, of course, are in a closed position adjacent one another. The loop of thread passes under the tips 142 and 144, and slides on the inclined underside of the tips underneath a cantilever spring 164. The thread is held by the spring 164 against the prongs 138 and 140. One of the important features of the invention is that the prongs 138 and 140 are inclined downwardly or at an acute angle in relation to the direction of needle travel so that the lower surface of the prongs 138 and 140, that surface against which the spring 164 is positioned, will tend to cause the thread to slip under the spring 164.

Referring now to FIG. 10, the needle continues on its path up through the material 112, and the thread 54 is now positioned completely underneath the spring 164. The prongs are maintained in a substantially stable position as the needle 58 rises, that position being to the right, as illustrated in the Figures.

In FIG. 12, the needle 58 reaches its uppermost position, while the prongs 138 and 140 remain in a substantially fixed position. At this point, the teeth 118 of the wheels 114 and 116 engage the material 112 causing the material 112 to advance in the direction indicated by the arrow. As the material 112 advances, the thread at 54 passing through the material 112 is drawn to the right-hand side of the needle opening 166 in the plate 72, as indicated in FIG. 12. The thread is thus slightly inclined toward the direction of material travel as indicated in FIG. 12. Simultaneously, the prongs 138 and 140 begin to open in response to the interaction of the follower 150 with the cam 148.

Referring now to FIG. 13, the needle 58 begins to descend through the material 112. The teeth 118 of the wheels 114 and 116 are no longer in driving contact with the material 112. The prongs 138 and 140 are now completely opened by the cam 148 coacting with the follower 150, as is illustrated in FIG. 14. The needle 58 passes through the loop formed by the thread 54.

Almost simultaneous but momentarily after the passage of the needle 58 through the loop of the thread 54, the opened prongs 138 and 140 retract to the left of the position shown in FIG. 13 causing the thread 54 to slip from the spring 164 off of the tips 142 and 144 of the prongs 138 and 140. The thread 54 loop is grasped onto the needle 58 and tends to "climb" the needle 58 to engage the material 112. Thus, as the needle continues to descend, the prongs reach their most rearward, or furthestmost, position to the left, shown in FIGS. 13 and 16. As the prongs 138 and 140 reach the position illustrated in FIG. 16, they close. Then as the needle 58 approaches its lower position in its cycle, the position illustrated in the FIG. 5, the cycle will again repeat.

As can be appreciated, the shape of the cam 124 controls the relative position of the shaft 128 and attached prongs 138 and 140 in relation to the portion of the needle 58. As can also be appreciated, the motion of the prongs 138 and 140 may be changed by changing the shape of the cam 124. Thus, it may be desirable for certain operations to amend the sequence of operation in some manner by changing the shape of cam 124. Likewise, by changing the shape of the cam 148, the opening and closing sequence of the prongs 138 and 140 can be altered.

This mechanism as specifically described forms the well-known chainstitch. The sequence of operations of the described mechanism is presented as a graph in FIG. 18. There the abscissa is divided into the degrees of rotation of the needle bar drive shaft 32.

The feed wheels 114 and 116, as indicated at the upper portion of the graph, feed material only when the needle 58 is in the uppermost vertical position. The looper, which comprises the prongs 138 and 140 and the supporting mechanism, is graphed to indicate (1) the position of the prongs 138 and 140 in the horizontal plane as driven by cam 124 and (2) whether the prongs 138 and 140 are spread apart or together. Again, the shape of the cam 124 can be altered to vary the response characteristics of the prongs 138 and 148 and the invention is not limited to the specific embodiment shown nor to a cam-type mechanism for positioning the prongs 138 and 140 and spring 164 in relation to the needle.

I claim:

1. In a sewing machine of the type having a thread supply, a reciprocating needle with an opening through the pointed end of said needle for thread, and a work surface plate which includes a needle passage therethrough for receiving said reciprocating needle and thread, the improvement comprising, in combination: thread-looping means positioned beneath said work surface plate adapted to engage a loop formed by said thread when said needle is extended through said plate and hold said loop in position to form a chain stitch as said needle reciprocates through said plate and material on said work surface plate, said looping means including first and second parallel adjacent arms adapted to move toward and away from the loop formed by thread through said opening in said needle and thread-retaining means cooperating with said arms, said parallel arms also adapted to spread and come together in a direction substantially perpendicular to the direction of needle travel and said thread-retaining means being adapted to provide retention of a loop of thread between said retaining means and said arms.

2. In a sewing machine as described in claim 1, wherein said arms are inclined downwardly with respect to the direction of needle travel and said retaining means comprises a member underlying the arms for cooperation therewith.

3. A method for sewing a chain stitch in material using a sewing machine of the type having a thread supply, a reciprocating needle with an opening through the pointed end of said needle for thread, and work surface plate which includes a needle passage therethrough for receiving said reciprocating needle and thread, which comprises the steps of moving said needle and thread passing through said needle passage through said material and said opening in said work surface plate to a first extreme position; retracting said needle from said first extreme position and simultaneously positioning a pair of arms through a loop formed by said thread and said needle; retaining said loop between retaining means and said pair of arms; further retracting said needle through said work surface plate and said material to a second extreme position and simultaneously maintaining said pair of arms in substantially the position of intersection with said loop; advancing said material on said work surface plate; spreading said pair of arms to open said loop; moving said needle again from second extreme position towards said first extreme position through said material and said work surface plate, said needle passing through said loop; retracting said arms from said position of intersection thereby causing said loop to be disengaged from said spread arms and said retaining means, said thread passing over said moving needle; and rejoining said spread arms.

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