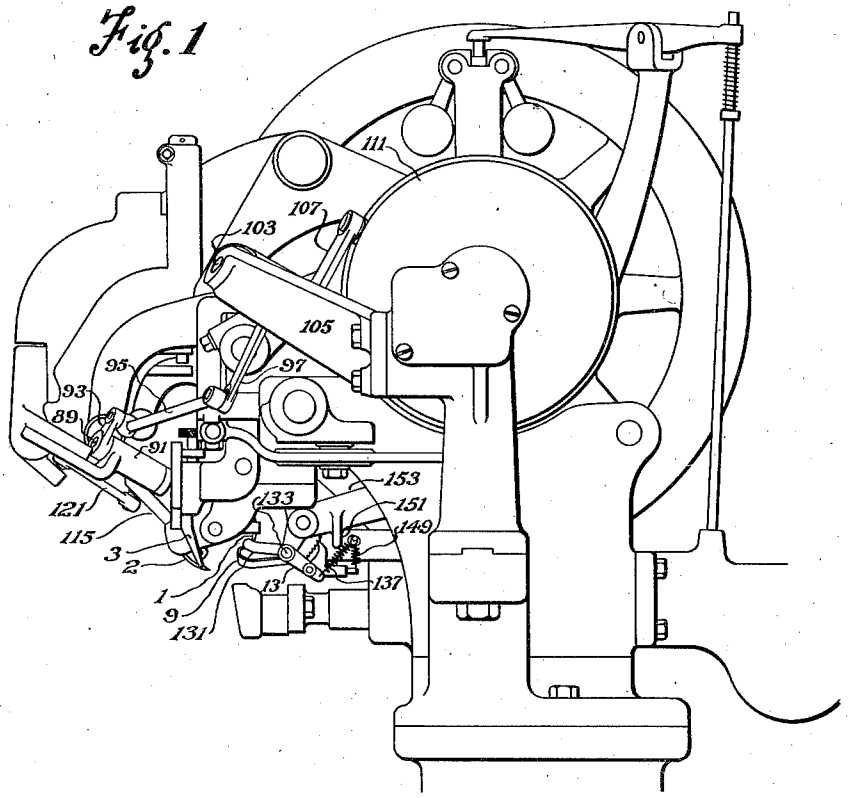
Aug. 8, 1939. J. GOULDBOURN ET AL 2,168,568

SEWING MACHINE

Filed June 28, 1937 4 Sheets-Sheet 1

Fig. 1



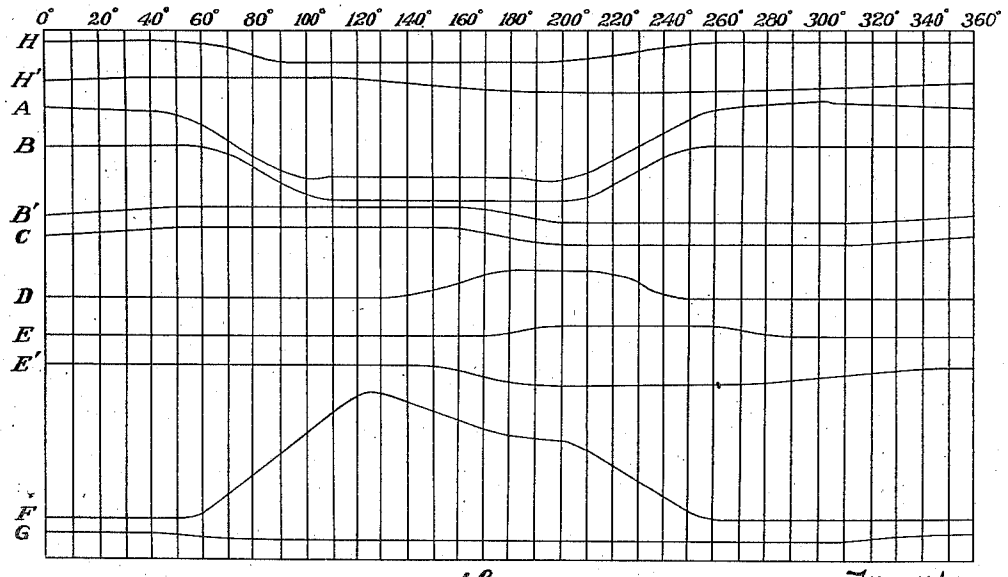




Fig. 2

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SEWING MACHINE

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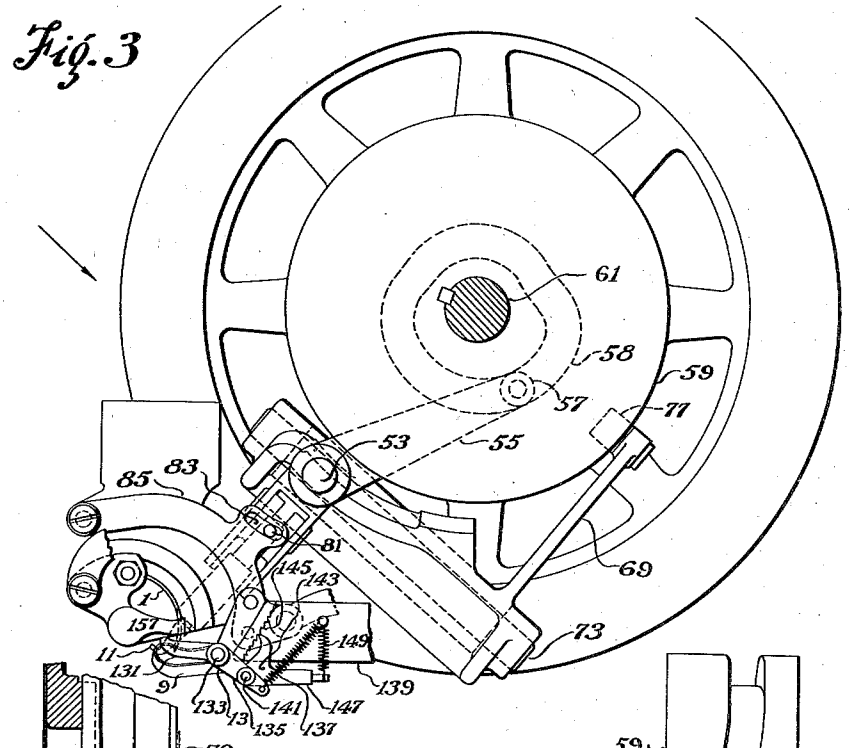
Fig. 3



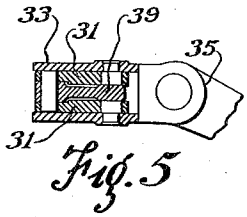




Fig. 5




Fig. 4

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SEWING MACHINE

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Fig. 6

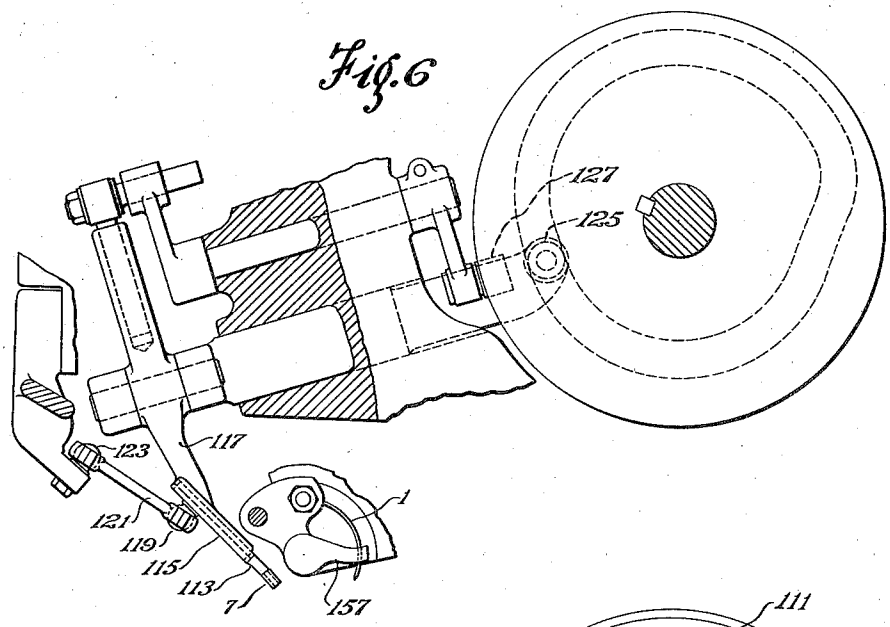


Fig. 7

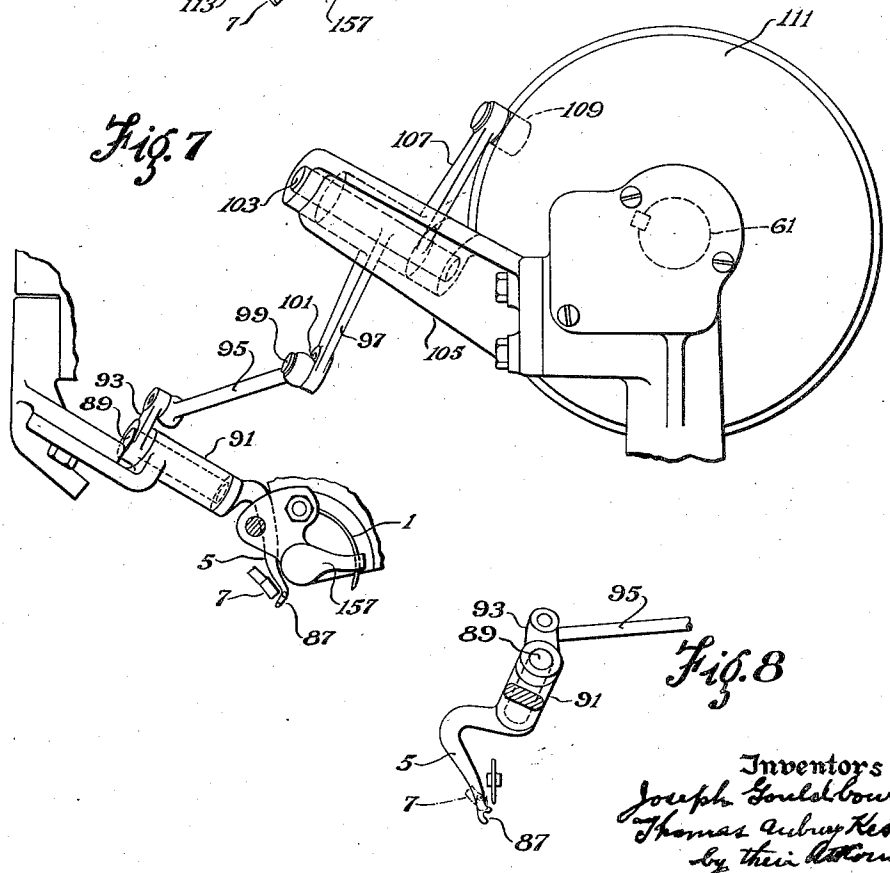


Fig. 8




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SEWING MACHINE

Filed June 28, 1937 4 Sheets-Sheet 4

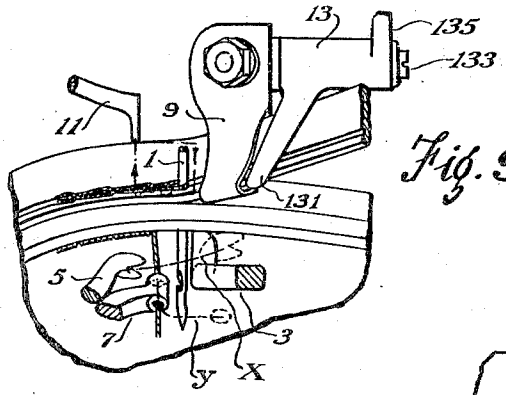


Fig. 9

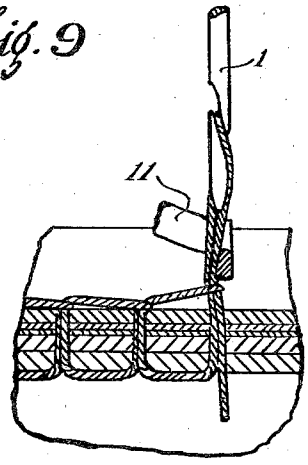


Fig. 10

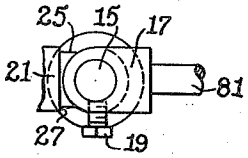


Fig. 15.




Fig. 11

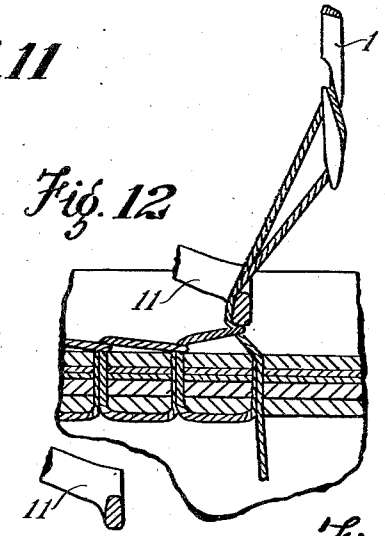


Fig. 12

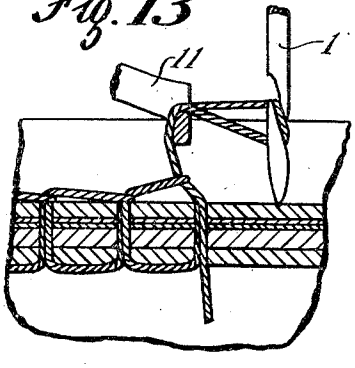


Fig. 13

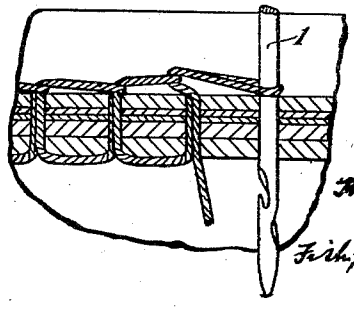


Fig. 14

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Patented Aug. 8, 1939 2,168,568

# UNITED STATES PATENT OFFICE

2,168,568

## SEWING MACHINE

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Application June 28, 1937, Serial No. 150,728
In Great Britain August 27, 1936

20 Claims. (Cl. 112—35)

This invention is concerned with improvements in or relating to sewing machines, and is particularly, but by no means exclusively, concerned with curved hook needle chain-stitch sewing machines for sewing the uppers and welts of boots or shoes to lips or ribs of insoles secured on the bottoms of lasts within the uppers.

Examples of such machines are disclosed in the United States Letters Patent to Eppler No. 1,108,560 of August 25, 1914, and No. 1,003,175 of September 12, 1911.

Although machines of the nature indicated in the patents referred to have proved in practice to be capable of sewing uppers, welts and insole lips together satisfactorily, and are in fact in very general use at the present time, we have observed that, under some circumstances at least, the sewing together of the materials may not produce quite the results desired around all parts of the shoe.

For example, when sewing around the toe portion of a shoe by a machine of the type disclosed in Patent No. 1,108,560 which makes use of a work feeding member or feed point which digs into the work and then moves laterally to effect the feeding of the work, the manner in which the operator controls the shoe to cause the sewing operation to proceed around the toe portion and the non-positive manner in which the feeding member acts on the work tend to produce the result that the stitches are not drawn so tightly against the work around the toe portion as at other parts of the shoe, this tendency being particularly marked on shoes which have sharply pointed toes.

Also the manner in which tension is applied to the thread to cause the stitches to be drawn tightly against the work sometimes causes the thread to cut into the insole lip along the sides of the shoe or to strain it out of its correct upstanding position, towards the edge of the insole. This tendency is particularly noticeable on shoes the insoles of which have relatively soft or weak lips thereon.

Among the several objects of the present invention are to improve so-called "welt-sewing" machines of the kind referred to, by the provision of novel and convenient means which will assist in ensuring that the stitches will be set with substantially uniform tightness against the work at all parts around a shoe and by the provision of novel and convenient means which will assist in reducing any tendency for the setting of the stitches to mutilate the insole lip or to deflect it out of its correct position.

With the above objects in view a particular illustrative embodiment hereinafter described according to the present invention includes a thread-deflector consisting of a finger which lies somewhat close to that face of the work which the needle first penetrates in its work piercing movement and moves, at the same time as the needle is retiring from the work to draw a loop of thread through the work and through a thread loop passing through the needle hole last made in the work, to urge both limbs of the loop of thread then being drawn through the work away from the plane of the needle in the direction of work feed towards the needle hole last formed in the work. The fact that the deflecting finger engages the needle thread loop and bows it laterally at the same time as the needle is continuing its rearward movement, allows the thread easily to be deflected without causing it to reeve in a severe manner through the barb of the needle, and without straining or bending the needle, advantages which could hardly be expected where the deflecting finger only caused the thread to bow after the needle has come to rest while in its rearmost position and while therefore the thread extending between it and the work is stationary and is held relatively taut by the take-up device. The thread-deflecting finger holds the thread loop in its deflected position substantially until the needle has once more commenced to pierce the work, after the work has been fed forward a stitch length, for the formation of the next stitch, it actually bowing the loop still more as the needle advances towards the work, and then retires, out of engagement with the loop laterally of the needle plane, to its original position in readiness to engage and deflect the loop of needle thread next to be drawn through the work by the needle. When therefore a stitch setting tension is exerted on the thread loop passing around the needle by the take-up device when the needle has again penetrated into the work, the tension on the thread is transmitted along the latter to the place where the thread loop passing around the needle passes through the previous loop in that position between the two needle holes last formed in the work to which it was deflected by the deflecting finger. The consequent tension on the thread therefore causes the needle loop both to pull the looped end of the previous loop along the surface of the work towards the needle hole last formed and to move through this loop along the surface of the work as it does so. The fact that the tension on the thread, in the setting of the stitch, causes the inter-

engaging looped portions to move along the surface of the work towards the last needle hole results in those portions of the two interengaging loops which are actually passing through the needle holes being urged somewhat towards each other and thus effecting the tightening and setting of the stitches by compression of the insole lip in a direction extending lengthwise thereof rather than by an outward pressure such as would be obtained by straining the thread lying against the inner face of the lip against the latter. With such an arrangement there is, therefore little tendency for the insole lip to be strained outwardly or bent towards the edge of the sole. The fact that the interengaging looper portions lie on the surface of the work between two needle holes makes it easier for the thread passing between the needle holes to be tightened and set by a tension exerted on the thread and therefore reduces the pull which it is necessary to apply to the thread by the take-up to set the stitches against the work.

Another feature of the invention is to provide a welt sewing machine with thread handling instrumentalities well suited for operation at a higher speed than has hitherto been usual.

Further features of the invention consist of certain constructions, arrangements, and combinations of parts, the advantages of which will be obvious to one skilled in the art from the following detailed description.

In the accompanying drawings illustrating the preferred form of the invention Figure 1 is a right hand side elevation of a machine embodying the invention; Figure 2 is a chart indicating the relative times in the machine cycle when the movements of some of the parts of the illustrated embodiment commence and end; Figure 3 is a right hand side elevation of a part of a thread deflecting mechanism and a welt pressing member of the said machine; Figure 4 is a detail view of the same parts as shown in Figure 3, when viewed in the direction indicated by the arrow in Figure 3; Figure 5 is a sectional view on the line 5—5 of Figure 4; Figure 6 is a view in right hand side elevation, and partly in section, of the looper mechanism of the machine; Figure 7 is a view in right hand side elevation of the thread finger mechanism of the machine; Figure 8 is a front elevation of part of said thread finger mechanism; Figure 9 is a plan view illustrating the general relation of the needle, thread deflector, looper, thread finger, welt guide and channel guide of the machine at one particular stage in a machine cycle; Figures 10 to 14 inclusive are sectional plan views illustrating particularly the relations of the thread deflector and needle at different operating positions; and Figure 15 is a detail plan view on an enlarged scale showing a portion of the thread deflector supporting sleeve.

The illustrated machine includes a curved hooked needle 1 which moves forwardly in passing through the welt, upper and insole lip and a feed point or awl 2 which is moved rearwardly to dig into the insole in the inner channel formed therein and is then moved towards the left to feed the shoe. The needle 1 and feed point 2 and their operating mechanisms are substantially the same, except as hereinafter described, as those disclosed in the patents above referred to. The machine also includes a channel guide 3, a thread finger 5, a looper 7, and welt guide 9 similar to and operating towards and from the work in the same manner as disclosed in Patent No. 1,108,560.

In the embodiment of the invention a thread loop deflector 11 is actuated during the loop drawing or retracting stroke of the needle to engage the right hand sides of the lengths of thread extending through the work between the needle and the work so as to deflect the thread in the direction of work feed. The deflector has formed on it a stem 15 from which the deflector extends upwardly and rearwardly at an angle of about 45 degrees to the horizontal. During each sewing cycle of the machine the deflector 11 is moved on parallel linkage in the line of feed to deflect the needle loop, and is rocked slightly towards and away from the seam and axially of the stem 15 to engage and disengage the threads at the proper time. The result of these movements of the deflector is a motion in a rectangular path in the forward portion of which the deflector engages the thread, and in the rearward portion of which the deflector is disengaged from the thread, the disengagement occurring after the needle has substantially reached the work in its advancing stroke.

To permit the deflector 11 to move in the manner outlined, the stem 15 is secured in a tube or sleeve 17 (see Figure 4), by a screw 19, which tube is slidingly mounted, for movement axially thereof, in a guiding member 21 which has an arm 23 extending towards the left from it. The sleeve 17 has formed on it a flat face 25 which engages a flat face 27 on the guiding member 21 to prevent the sleeve from rotary movement in the member. The arm 23 has pivotally connected to it at 29, just at the left of the stem 15, the forward ends of a pair of parallel links 31, 31, forming the linkage on which the deflector is mounted. The links 31, 31 extend into a recess formed in an arm 33 of a cam lever 35 and at their rear ends are pivoted in the recess at 37 to the arm of the cam lever. The recess affords support to the links 31, 31 and guiding member 21 by reason of its upper and lower walls engaging the outer faces of the links, and by reason of an arm 39 on the member 21 which extends between the links.

For actuating the deflector 11 in proper timed relation to the other stitch forming devices, the arm 23 on the stem guiding member 21 is pivoted at its left hand end at 41 to the forward end of an arm 43 of a bell-crank lever 45 which from its forward end extends rearwardly and upwardly and is pivoted on a stud 49 secured in a second arm 51 extending forwardly and downwardly from the hub of the cam lever 35, the arm 51 of the cam lever 35 lying a little to the left of the arm 33 on the cam lever. The cam lever 35 is pivoted on a horizontal shaft 53 extending laterally of the machine and secured in the machine frame and has a rearwardly and upwardly extending arm 55 which at its upper end carries a cam roll 57 which engages in a cam groove 58 formed in the left-hand side face of a cam 59 on the cam shaft 61 of the machine. As the cam shaft 61 rotates, the cam imparts a slight up and down movement to the deflector 11, the guiding member 21 and the parallel linkage moving bodily about the axis of the shaft 53 on which the cam lever 35 is pivoted.

The arm 63 of the bell-crank lever 45 extends from the hub of the lever rearwardly and upwardly and has pivotally connected to its upper end the right hand end of a link 65 which extends towards the left and at its left hand end

is pivoted on a ball-ended stud adjustably secured in a curved slot 67 formed in the forward end of one arm 69 of cam lever 71 pivoted between its ends on an upwardly and forwardly extending shaft 73 secured in the machine frame. Another arm 75 of the bell-crank lever 71 extends upwardly and rearwardly and carries a cam roll 77 which enters a cam groove formed in the peripheral face of a cam 79 on the cam shaft 61 of the machine.

To move the deflector 11 up and down in the guiding member the tube 17 has extending from it towards the right a horizontal pin 81 which passes through a slot 83 formed in a welt guide carrier 85. The carrier 85 is pivoted to the machine and is rocked, in a path extending rearwardly and upwardly, during each cycle of the machine so as to carry the welt guide 9 towards and from the work, the guiding member being moved by the engagement of the pin 81 on the said tube 17 in the slot 83 in the welt guide carrier. The slot in the welt guide carrier 85 is substantially concentric to the axis of the shaft 53 on which the cam lever 35 is pivoted when the welt guide is in its forward position so that when the deflector 11 is moved up and down about the axis on which its cam lever 35 swings, the deflector 11 is not moved up and down in the guiding member 21.

The thread finger 5 which cooperates with the looper hereinafter more fully described in laying the thread in the needle barb and which, therefore, may be assumed to be similar in purpose to that referred to as 17 in Patent No. 1,108,560 is moved during its thread pulling and giving up movements to and fro laterally of the machine instead of rearwardly and forwardly, as is usual in sewing machines with which the invention is particularly concerned, and also dips into the channel of the insole. The thread finger (see Figs. 7 and 8) has a lower forked end 87 for engaging the thread which, when the thread is being laid in the needle barb or hook, moves from left to right of the machine and slightly rearwardly (i. e. more or less in the direction of work feed) behind the forward end of the needle then projecting forwardly through the work. From its lower forked end 87 the thread finger extends upwardly and forwardly and then slightly downwardly towards the right. From the upper end of the thread finger there extends a stem 89. The stem 89 is inclined upwardly and forwardly at an angle of about thirty degrees to the horizontal when the machine is viewed from the side (Fig. 7) and is inclined upwardly and to the right at an angle of about sixty-five degrees to the horizontal when the machine is viewed from the front (Fig. 8). The stem 89 of the thread finger passes upwardly through a bearing 91 secured on the machine frame. The upper end of the stem 91 has secured on it a short arm 93 which extends rearwardly from the stem and is pivotally connected at one end to the left hand end of a link 95. The link 95 extends from its left hand end towards the right and its right hand end is pivotally connected to the lower end of one arm 97 of a cam lever by a stud 99 secured in a slot 101 in the arm 97. The arm 97 of the cam lever extends upwardly from its lower end and the hub of the cam lever is secured on a shaft 103 which is parallel to the stem 89 of the thread finger and which is rotatably mounted in bearings on a bracket 105 secured on the machine frame. Another arm 107 of the cam lever extends upwardly and has rotatably mounted on its upper end a cam roll 109 which enters a cam groove in the peripheral face of a cam 111 secured on the cam shaft 61. Owing to the inclination of the stem 89 of the thread finger 5 the lower forked end 87 of the finger, as it is moved from left to right to assist in laying the thread in the needle hook, swings downwardly and slightly rearwardly about the stem. During this movement of the thread finger the forked end of the finger engages the thread extending from the work to the looper 7 and carries the thread behind the needle, the looper 7 then acting to carry the thread in front of the needle to lay the thread in the hook of the latter. The downward swinging movement of the thread finger causes the lower end of the finger to dip down between the channel lips at each side of the shoe when sewing round the toe and thus enables the thread finger to clear the lips as it moves into engagement with the thread and as it carries the thread behind the pointed end of the needle.

The slight rearward movement of the lower end of the thread finger 5 prevents the finger from engaging the usual channel guide 3 of the machine as the lower end of the finger moves towards the right. The lower end of the thread finger 5, as it swings from left to right, moves in a direction more or less parallel to the channel lip through which the seam is being formed and inside the channel lip, i. e. on that side of the lip which lies nearer the middle of the insole. This direction of movement of the lower end of the thread finger prevents the thread finger from engaging the channel lip during its movement and since the tension exerted by the thread finger on the thread extending from the last formed needle hole to the looper 7 is in a direction more or less parallel to the channel lip, there is little, if any, tendency for the channel lip to be forced towards the edge of the insole by the pull on the thread.

The looper 7 when laying the thread in the hook of the needle is moved from a position at the left hand side of the needle and somewhat rearwardly of the point of the needle when the latter is fully advanced through the work, in a bent path extending from a position at the left hand side and rearward of the needle forwardly and towards the right so that the looper passes from its position at the left hand side and somewhat rearwardly of the needle in front of and towards the right of the needle and during this movement of the looper, the looper in conjunction with the thread finger lays the thread around the shank of the needle so that the hook of the needle may receive the thread. The looper carries a length of thread in front of the needle towards the right and the thread finger carries a length of thread behind the needle towards the right, thus forming a loop of thread which passes round the left hand side of the needle, and is engaged by the hook of the needle as the needle moves back through the work. As the looper 7 moves in passing the thread around the needle it, therefore, moves first forwardly and then towards the right across the front of the needle and, later returns along the same path without having completely passed around the needle.

The lower thread guiding end of the looper 7 is formed on a slide 113 (see Fig. 6) mounted in a guideway 115 provided at the forward side of the lower end of a looper lever 117, corresponding to the looper lever 22 of the Patent No. 1,108,560. The guideway in the arm extends upwardly and forwardly at an angle of about 45 degrees to the

horizontal so that the looper can move in the same direction as the point of the needle while laying the thread in the needle hook. At the forward side of the slide 113 is a ball-ended stud 119 to which is pivotally connected a link 121 which in turn is pivotally connected to a stud 123 secured in the machine frame. The looper lever 117 is actuated forwardly and rearwardly and left and right to lay the thread in the needle hook in the same manner as in the patent referred to, through suitable connections to the cam followers 125 and 127 cooperating with a cam on the sewing shaft 61. As the lever 117 is moved forwardly, the forward swinging movement of the link 121 about its stationary pivot 123 causes the slide 113 on which the looper is formed to move downwardly on the looper lever, and as the lower end of the looper lever swings towards the right in front of the needle, the swinging movement of the lower end of the link 121 also causes downward movement of the slide 113 on the lever 117. The arrangement is such that as the looper 7 moves forwardly and toward the right it also moves somewhat downwardly, this downward movement being in addition to that given the looper by reason of the slight downward movement of the looper lever 117 and its actuating connections.

Means is also provided in the present machine for placing a tension on the welt during the formation of each stitch to prevent the welt from being drawn lengthwise relatively to the shoe by the thread during the setting of the stitches. This means includes a presser member 13 pivoted on the welt guide 9 (Figs. 1, 3 and 4), having a forwardly extending arm 131 arranged to bear against the upper face of the welt and to press the welt against the lower face of the welt guide 9. The presser member 13 is pivoted to the welt guide on a horizontal pivot 133 extending laterally of the machine behind the welt-guiding portion of the welt guide. The presser member 13 has a rearwardly and somewhat downwardly extending arm 135 to the rear end of which there is connected one end of a tension spring 137 the other end of which is connected to a plate 139 secured on the machine frame. The spring 137 causes the arm 131 of the presser member 13 to press against the welt. The rearwardly extending arm 135 of the presser member 13 has pivoted to it near its rear end on a horizontal pivot 141 extending laterally of the machine a pawl 143. The pawl 143 has an upwardly extending arm which has formed on its upper end a tooth arranged to engage one of a series of ratchet teeth 145 formed one above the other on the plate 139. The pawl 143 has a rearwardly extending arm 147 to which is connected one end of a tension spring 149, the other end of which is connected to the plate 139 and the spring 149 normally holds the pawl in engagement with one of the ratchet teeth 145. The rearwardly extending arm 147 of the pawl is, during each sewing cycle, engaged by a finger 151 (Fig. 1) secured or formed on the usual needle actuating cam lever, part of which is shown at 153, to cause the toothed end of the pawl to be withdrawn from the ratchet teeth 145. When, during the operation of the machine, the welt guide 9 is swung upwardly and rearwardly away from the work while the work is being fed, the pivot 133 of the presser member moves with it but since the pawl 143 is at this time in engagement with one of the ratchet teeth 145 the rear arm 135 of the presser member is prevented from moving upwardly with the welt guide and the front arm 131 of the presser member is moved upwardly away from the welt so as to release the welt during the feeding of the work. When the welt guide 9 is moved downwardly and forwardly into engagement with the work at the conclusion of the work feed, the rear arm 135 of the presser member 13 is held inoperative by the pawl 143 which is held in engagement by its spring 149 with the ratchet teeth 145 so that the front arm 131 of the presser member is moved towards the welt.

When the needle is passing forwardly through the work and is approaching the end of its forward movement, the pawl 143 is withdrawn from the ratchet teeth 145 by the aforesaid finger 151 (Fig. 1) on the needle actuating cam lever 153 and the presser member is thus rendered operative.

The manner in which the various instrumentalities of the present illustrative embodiment cooperate in a machine cycle will now be described with reference to Figures 2 and 9 to 14 of the drawings.

In Figure 2 the movements of the needle are indicated at A, the in and out movements of the feed point at B, the feeding movements of the feed point at B', the movements of the channel guide at C, the movements of the thread finger at D, the movements of the looper from left to right at E, the movements of the looper forwardly and rearwardly at E', the movements of the take-up at F, the movements of the welt guide at G, the movements of the thread deflector forwardly and rearwardly at H, and the movements of the thread deflector from left to right at H'.

In the stopped position of the machine shown in Figures 1 and 3 to 7 inclusive, the needle 1 occupies substantially its rearmost and retracted position, a needle guide 157 of usual form occupies its rearmost position along the shank of the needle, the feed point 2 is projecting into the work and has moved about half way towards the left along a feeding movement, the channel guide 3 will be pressing firmly against the work and will have moved along the feed line with the feed point. The thread finger 5 which cooperates with the looper 7 to lay the thread around the needle at that time occupies its left hand position out of engagement with the thread extending from the work to the looper and the looper occupies its most rearward and leftward position at the left hand side of the needle. The thread take-up device occupies a lowered position in which it lies relatively close to the work. The welt guide 9, which at a chosen time in the machine cycle is locked against movement, is unlocked in the stopped position of the machine and occupies a rearward and upward position. The thread deflector 11, when the machine is in the stopped position, occupies a position in which it has moved towards the left almost as far as it can across the plane of the needle in deflecting and exerting a tension on the last needle loop and occupies almost the highest position it reaches in applying tension on the loop. The needle commences to advance towards the work when the main shaft of the machine has rotated through about 50 degrees from its stopped position and the thread finger, looper, take-up, and thread deflector all remain substantially stationary during this portion of the cycle, the welt guide and the thread deflector advancing somewhat when the mainshaft has rotated through some 30 degrees to 40 degrees. The advancing movement of the needle continues until the main shaft has rotated through about 100

degrees from its stopped position and in the interval which occurs while the main shaft is rotating through this further 50 degrees, the thread finger 5, looper 7 and welt guide 9 still remains stationary while the take-up rises to impart a stitch setting tension to the previous stitch. When the main shaft has rotated through about 65 degrees, at which time the needle will only have advanced slightly from its rearward position, the thread deflector 11 commences to swing downwardly and rearwardly out of contact with the needle loop of the last stitch while remaining at the left hand extremity of its movement, the deflector having its right hand end bent forwardly and upwardly however to maintain the loop in its deflected position substantially until the deflector is approaching its extreme rearward and downward position, i. e., until the main shaft has rotated through some 100 degrees. By the time the main shaft has rotated through this angle the needle will have commenced to pierce the work and the fact that the deflector retains its engagement with the thread loop until this time ensures that the loop of thread will be supported against falling off the needle shank as the needle advances to pierce the work. The deflector, having moved out of engagement with the thread by the time the main shaft has rotated through about 120 degrees, commences to move idly across towards the right, below the needle, it actually continuing this movement until the shaft has rotated through about 190 degrees.

The needle actually reaches its full advanced position indicated in Figure 9 with its hooked end projecting through the work when the main shaft has rotated some 110 degrees and dwells in that position until the main shaft has rotated through some 200 degrees. The take-up completes the setting of the previous stitch when the main shaft has rotated some 130 degrees. About the same time as the take-up completes the setting of the stitch, the thread finger 5 commences to move across towards the right, more or less parallel to the direction of work feed, between the needle and the inner face of the insole lip. The thread finger actually comes into engagement with the thread when the main shaft has rotated through about 140 degrees. The thread finger concludes its movement towards the right in the path indicated at X in Figure 9, having urged the thread behind and against the left hand side of the needle, when the main shaft has rotated through some 180 degrees and at approximately the same time the looper starts to move towards the right from a position in which it then lies in front of and slightly to the left of the needle. The thread finger dwells in its right hand position until the main shaft has rotated through some 220 degrees and during the time it dwells in that position, the looper continues its movement towards the right in the path indicated at Y in Figure 6 and wraps the thread around the forward side of the needle so that when the latter retires, its barb will engage the thread to draw a loop rearwardly through the work. When the needle retires to its rearward position, which it does while the main shaft is rotating from about 200 degrees to 300 degrees, the thread finger moves back towards the left (it actually moving thus while the main shaft rotates from 220 degrees to 250 degrees) and during rotation of the main shaft from about 240 degrees to 330 degrees the looper returns to its original left and rearward position along the same path as it followed in laying the thread around the front of the needle. The fact that the thread finger and looper cooperate to lay the thread around the needle shank in the manner indicated and that the looper does not completely encircle the needle shank in laying the thread against the latter results in the advantage that the two limbs of the thread loop taken back through the work by the needle will not be caused to cross over each other when the loop is later pulled down on to the work by the take-up, but will lie in a side by side elevation.

The fact that the thread finger 5 moves a constant distance in a direction more or less parallel to, and opposite to the direction in which the work is fed through the machine as it assists the looper to lay the thread around the needle gives the advantage that the length of thread extending from the last needle hole to the thread finger, when the latter is at the right hand end of its movement, around the needle shank and then to the looper, will be dependent on the distance towards the left from the thread finger which the last needle hole occupies and, since the position of the last needle hole will be determined by the distance the work was fed by the last operative movement of the feed point and channel guide, the result is achieved that the lengths of thread presented to the needle for drawing back through the work will be dependent upon and proportional to the length of work feed. Therefore, since less thread will be paid out to the needle for the formation of the shorter stitches usually sewn around the toe of a shoe, the stitches formed around the toe will be more likely to be set as firmly against the work as the stitches sewn along the sides than would be the case if the amounts of thread paid off to the needle by the thread finger and looper were substantially constant irrespective of the distance the work is fed between successive stitches.

It will be understood that as the needle retires to draw the loop of thread through the work, the take-up descends at an appropriate speed to pay off sufficient thread to the needle to provide for the backward movement of the needle loop.

Slightly before the needle commences to retire from its most forward position to draw the needle loop back through the work (i. e., when the main shaft has rotated through some 190 degrees) the thread deflector, which is then idle in a lowered and rearward position at the right hand end of its travel, commences to swing forwardly and upwardly, towards the position indicated in Figure 10 but slightly to the right of that position, ready to engage the needle loop, the forwardly and upwardly bent right hand end of the deflector then lying close by the right hand side of the needle shank. The deflector reaches an appropriate forward and raised position, still more or less at the right hand extremity of its movement, when the main shaft has rotated through some 250 degrees and by this time the point of the retiring needle will have moved just sufficiently rearwardly as not to obstruct movement of the thread deflector towards the left which movement then immediately commences. Almost as soon as the deflector commences to move towards the left and while the needle continues its retreating movement, the bent end of the deflector engages the right hand sides of both limbs of the needle loop just below the point of the needle as indicated in Figure 10, and commences to bow or deflect the loop towards the left out of the needle plane. By the time the main shaft has rotated through 300

degrees, by which time the needle will have reached its fully retracted position, indicated in Figure 11, after which it immediately starts to advance slowly once more, the deflector will have moved sufficiently far over towards the left to produce an appreciable bowing or deflection in the needle loop and after this time the deflector both continues to move towards the left, during the time the feeding of the work takes place, and is moved upwardly, towards the position indicated in Figure 13, and forwardly slightly so as to exert an upward and forward tension on the loop as the needle moves towards the work again to prevent the loop from falling downwardly off the needle. The combined movements of the deflector towards the left and upwardly and forwardly continue until the end of the cycle, the deflector being given a slight upward and rearward sliding movement, due to its connection with the welt guide, as the welt guide moves backwardly which it does while the main shaft is rotated from about 310 degrees to the end of the cycle. At the commencement of the next cycle the deflector is moved a little further towards the left and is raised a little further while still in engagement with the needle loop and continues to deflect the loop and to exert an upward tension on it until the needle has advanced slightly towards the work as indicated in Figure 12. The deflector then commences to swing downwardly and rearwardly while still however engaging the loop by means of its bent end.

The deflector actually retains the thread loop in its deflected condition until the needle once more commences to pierce the work, as indicated in Figure 13, after which it immediately retires out of engagement with the thread. When the setting of the stitch is being completed by the take-up, the deflector will no longer be engaging the loop and the needle will have penetrated, completely through the work, as indicated in Figure 14. The tension exerted on the thread passing through the looper and the work and around the needle by the take-up will, therefore, tighten the thread loop around the needle shank and will consequently pull the looper end of the previous stitch loop through which the needle passes along the surface of the work. As the deflector acts in the manner described to bow the needle loop, it exerts a tension on that limb of the previous loop which passes through the next to last needle hole and which extends upwardly through the next to last needle hole and around the needle so that it assists the take-up in setting the stitch. The fact that the deflector exerts a tension on this limb causes the looped end of the previous loop to be pulled somewhat towards the left, i. e., towards the next to last needle hole. Therefore when the deflector retires from engagement with the thread, the interengaging portions of the two loops will remain on the surface of the work at a position between the last needle hole and the previous needle hole, as indicated in Figure 14. When, therefore, the take-up again exerts its stitch setting tension on the thread, the tension acts to draw the interengaging portions of the two loops along the surface of the work towards the needle about which the last loop passes, and causes the last loop to slide through the previous loop. Thus by the shortening of the loop passing around the needle, the previous loop is drawn towards the needle until it lies more or less in line with the last needle hole and that portion of the insole lip lying between the last needle hole and the next to last needle hole is compressed lengthwise thereof by reason of the position which the interengaging portions of the two loops occupy on the surface of the work when the stitch setting tension is applied to the thread. Owing to the fact that the deflector progressively deflects the needle loop while the needle is actually moving rearwardly it is able to pull one limb of the previous loop through the work and to deflect the needle loop more easily and with less possibility of causing straining or chafing of the thread than would be the case if the deflector were only caused to act on the thread while it is stationary and under appreciable tension. The channel guide and feed point, then in engagement with the work, commence to move towards the left to feed the shoe through the machine a stitch length when the main shaft has rotated through substantially 320 degrees, as indicated in Figure 11, and their feeding movement continues substantially until the main shaft has rotated through 50 degrees in the next cycle. While the work is being fed, the needle is out of the work moving slowly forward from its most rearward position, the looper remains practically stationary in its rearward position to the left of the needle, the thread finger also is stationary to the left of the needle, the welt guide 9 is moved upwardly and rearwardly out of engagement with the work to facilitate the feed of the latter, it actually moving downwardly and forwardly again to rest on the work just after the work feed has concluded, and the thread deflector 11 moves towards the left and upwardly and rearwardly somewhat so as to maintain the thread loop in its deflected or bowed condition during the work feed, thus exerting some upward and rearward lifting action on the loop. The feed point digs into the work substantially when the main shaft has rotated through some 260 degrees and remains in its work penetrating position until the main shaft has rotated through 60 degrees in the next cycle of the machine. By reason of this fact the feed point will remain in the work throughout the whole of the time the deflector is acting to deflect the thread towards the left and will, therefore, afford effective support to the work against being moved through the machine by the deflector.

The welt presser member 13 which acts to press the welt against the lower portion of the welt guide 9 is, by reason of its mounting on the welt guide and its connection at its rear end to the pawl 143 lifted so as to release its pressure on the welt when the welt guide is moved rearwardly so that the welt may easily move through the guide when the shoe is being fed. The presser is lowered against the welt when the welt guide is moved forwardly at the conclusion of feed. If the guide should not then engage the welt by reason of being stopped by the work before it reaches its original position, the projection 169 acts as the needle is approaching the forward extremity of its advancing movement to release the pawl from the ratchet teeth and allow the presser to swing against the welt. By the provision of the welt presser 13 which grips the welt against the guide during the formation and setting of each stitch, any tendency for the thread to draw the welt through the welt guide, either during the formation of a stitch or during the setting thereof, will be resisted and therefore there will be little likelihood that a strip of welt which, in its loose state, is long enough to extend around a shoe substantially from the heel breast line at one side of the waist to the other will be contracted or puckered to such an extent that

it is no longer able to reach entirely around the shoe.

The relatively simple mechanisms above described for actuating the thread deflector, thread finger and looper are such as will readily lend themselves to incorporation in a machine designed to run at a relatively high speed and will not be likely to develop excessive wear or to give rise to undue vibration when operated at high speed.

The nature and scope of the invention having been indicated, and a machine embodying the several features having been specifically described, what is claimed is:

1. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, and means for actuating the deflector before the needle has reached the end of its loop drawing stroke to deflect both sides of the loop carried by the needle between the needle and the previously formed loop in the direction of work feed.

2. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, and means for actuating the deflector in the direction of work feed to deflect the loop carried by the needle between the needle and the previously formed loop and to hold the loop deflected until the needle engages the work during the formation of a new stitch.

3. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, and means for actuating the deflector in a rectangular path, along one portion of which the thread carried by the needle between the needle and the previously formed loop is engaged by the deflector, and along another portion of which the thread is disengaged from the deflector.

4. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector arranged to be actuated in a rectangular path, along one portion of which the thread carried by the needle between the needle and the previously formed loop is engaged by the deflector and along another portion of which the thread is disengaged from the deflector, and means for actuating the deflector to hold the thread until the needle has substantially reached the work in its advancing stroke.

5. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, means for actuating the deflector to deflect both sides of the loop carried by the needle between the needle and the previously formed loop, and parallel motion linkage on which the deflector is movable along the direction of work feed during deflection of the needle loop.

6. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, means for actuating the deflector in the direction of work feed to deflect both sides of the loop carried by the needle between the needle and the previously formed loop, and means for actuating the deflector towards and away from the seam to engage and disengage the needle loop.

7. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, means for actuating the deflector to deflect both sides of the loop carried by the needle between the needle and the previously formed loop, parallel motion linkage on which the deflector is movable along the direction of work feed during deflection of the needle loop, and means for moving the parallel motion linkage bodily to actuate the deflector towards and away from engagement with the needle loop.

8. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a take-up, a loop deflector, and means for actuating the deflector to deflect both sides of the loop carried by the needle between the needle and the previously formed loop and while thread is being given up by the take-up.

9. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, and means for actuating the deflector to deflect both sides of the loop carried by the needle between the needle and the previously formed loop, said means beginning its operative movement before the needle has reached the end of its loop drawing stroke and continuing such movement during a portion of the succeeding needle advancing stroke.

10. A chainstitch inseam shoe sewing machine having, in combination, stitch forming mechanism including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, and a loop deflector arranged when actuated to deflect both sides of the loop carried by the needle between the needle and the work, and means for actuating the needle to draw thread from the previously formed loop while the deflector is acting to deflect the last formed loop.

11. A chainstitch inseam shoe sewing machine having, in combination, stitch forming mechanism including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector and means for actuating the deflector in the direction of work feed to deflect both sides of the loop between the needle and the previously formed loop during the loop drawing stroke of the needle and for actuating the deflector away from the seam during the next succeeding advancing stroke of the needle.

12. A chainstitch inseam sewing machine for forming an inseam within the channel of an insole having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, and a thread finger acting in a direction opposite to that in which the work is fed to measure thread

from the needle loop and to dip into the channel of the insole in measuring the thread.

13. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a loop deflector, means for actuating the deflector in the direction of work feed to deflect the loop carried by the needle between the needle and the previously formed loop, and a thread finger acting in a direction opposite to the direction of feed to measure thread for the needle loop.

14. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a welt guide movable towards and from the work, a loop deflector, and means for actuating the deflector including a connection operatively connected to the welt guide.

15. A chainstitch inseam-shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a welt guide movable towards and from the work, a loop deflector arranged to deflect the thread carried by the needle between the needle and the work in the direction of work feed, and means on the welt guide for gripping and releasing the welt during each sewing cycle.

16. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a welt guide movable towards and from the work, a loop deflector arranged to deflect the thread carried by the needle between the needle and the work in the direction of work feed, and means for actuating the welt guide to grip the welt while a stitch is being set and to release the welt during work feed.

17. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a welt guide movable towards and from the work, a presser member, yielding means for actuating the presser member to grip the welt, and a pawl actuated by movement of the welt guide away from the work to release the presser member from the welt.

18. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle, mechanism operating to cause the needle to draw a loop of thread through the work and through a previously formed loop of thread, a welt guide movable towards and from the work, a presser member for gripping the welt to prevent its movement through the welt guide, yielding means for actuating the presser member to grip the welt, a pawl for holding the presser member from gripping relation with the welt, and means including the needle actuating mechanism for moving the pawl into inoperative position to permit the presser member again to grip the welt.

19. A chainstitch inseam shoe sewing machine having, in combination, stitch forming devices including a curved hook needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a looper, mechanism for actuating the looper to lay the thread in the needle hook, a slide on which the looper is mounted, and means for actuating the slide in the direction of movement of the point of the needle as the thread is laid in the needle hook comprising a link pivotally connected at one end to the looper and at the other end to a stationary part of the machine.

20. A chainstitch sewing machine having, in combination, a hooked needle operating to draw a loop of thread through the work and through a previously formed loop of thread, a thread deflector arranged to displace, along the surface of the work, those portions of the needle loop and the previous loop which are then in engagement with each other, a stitch setting device for drawing the inter-engaging loop portions along the surface of the work towards their original positions during the setting of a stitch, and a thread finger acting to draw off, for successive stitches, amounts of thread proportionate to the extent of work feed which takes place between said stitches.

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