Jan. 2, 1934. F. B. KEALL 1,941,942

SEWING MACHINE

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Fig. 1

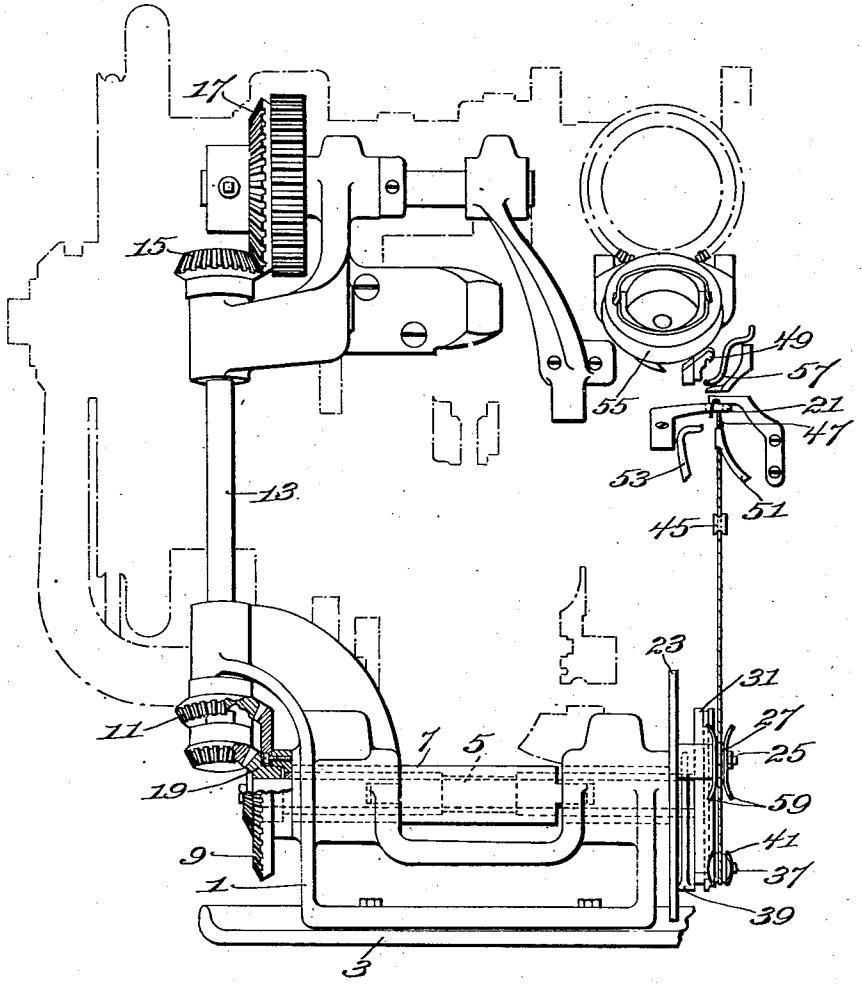

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Fig. 2

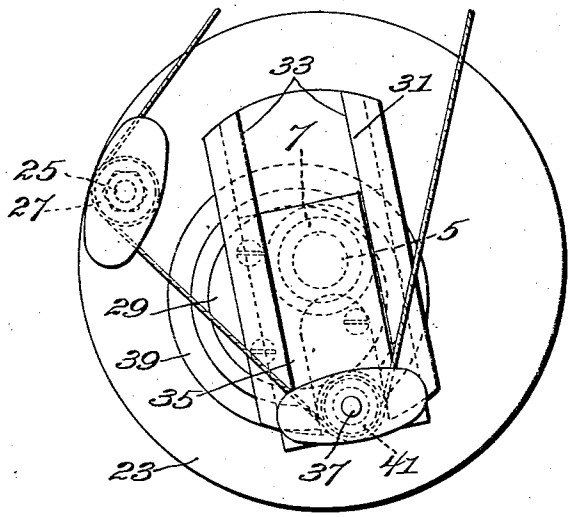
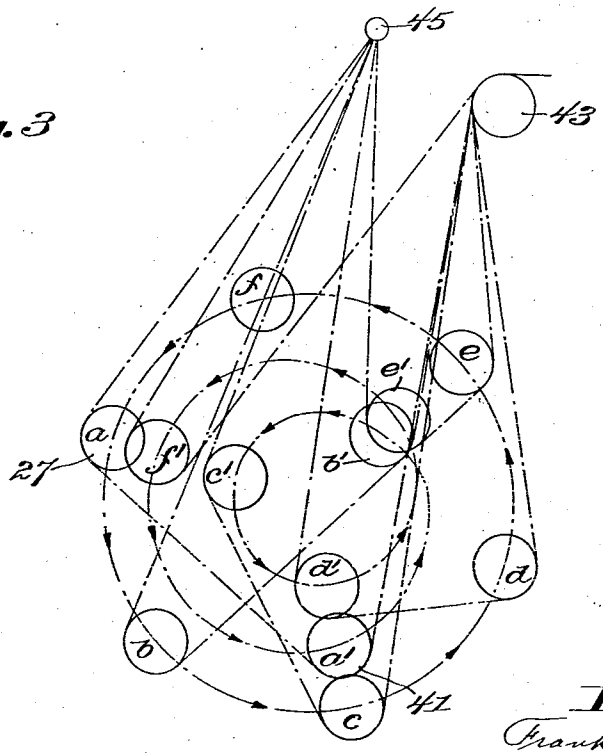


Fig. 3



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UNITED STATES PATENT OFFICE

1,941,942

SEWING MACHINE

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11 Claims. (Cl. 112—57)

This invention is concerned with improvements in or relating to sewing machines and is more particularly concerned with machines for sewing leather. Such sewing machines are used, for example, in the boot and shoe industry for sewing shoe soles to shoes. A machine of a kind commonly used for sewing an outsole for a welted shoe to the shoe has a curved hooked needle which cooperates with a curved awl and thread handling instrumentalities to sew the sole to the welt of the shoe by a lockstitch seam. The mode of operation of such a machine and the general principles of its construction are similar to those of the machine disclosed in U. S. Patent to Ashworth No. 1,169,909, dated February 1, 1916.

In a machine designed for sewing outsoles to shoes or for sewing together pieces of heavy material it is necessary that the threaded handling and other parts of the machine be strong and robust in order that they may stand up to the strain imposed upon them by the arduous nature of their work. When the parts are made heavy, however, in order to give them strength, there become apparent various factors which militate against the smooth and easy running of the machine.

When sewing around a welted shoe in stitching the outsole to the welt for example, it is at present customary for the machine to run at a relatively high speed, at least when sewing around the sides of the forepart, and in a machine in which the parts are made heavy and strong considerable vibration is set up by the heavy moving parts unless special steps are taken to ensure that the said parts are correctly balanced, a matter of no small difficulty and expense even where rotating parts are concerned, and where heavy oscillating or reciprocating parts moving at high speed are concerned it becomes extremely difficult to obtain even an approximately vibrationless state of motion. The higher the speed at which the machine runs, the more pronounced, of course, becomes the vibration.

The effects of vibration in a machine running at high speed are harmful both to the machine and to the operator and where the machine is a stitching machine through which the work must be guided by the operator, the continued presence of vibration tires the operator, makes it more difficult for him to serve the machine, and reduces his daily output below the amount which a smoothly running machine would enable him to produce.

I have noted that one of the chief sources of vibration in an outsole stitching machine of the general type disclosed in the prior specification aforesaid is the to and fro movement of a relatively heavy thread take-up device, the purpose of which is to control the tension of the thread paid out to the needle, shuttle and other thread handling devices and subsequently drawn down on to and set within the work.

In one of its several aspects, the present invention embodies in a hooked needle sewing machine a novel and smoothly running thread take-up device which rotates constantly while the machine is running and which imparts necessary tension to the thread and operates to pay it out to the sewing instrumentalities and to draw it down on to the work evenly at the necessary times.

In another of its several aspects, the present invention embodies in a hooked needle sewing machine novel rotary thread take-up means which engage the thread continually and have, during a stitch forming cycle, such orbital movement that the thread will be paid out to and withdrawn from the stitch forming instrumentalities in amounts which are substantially those required.

An illustrated form of rotary take-up device according to the present invention is hereinafter described. In this form, two thread take-up rolls around which the thread is arranged to pass on its way to the sewing instrumentalities from a thread supply are mounted upon separate rotary members which rotate at different speeds and one of the said thread take-up rolls is arranged to be moved in a spiral-like path towards and away from the other thread take-up roll as the latter rotates in a purely circular path. Thus, as the two rolls come close together, thread is given up by them to the sewing instrumentalities and, as they separate, the rolls cooperate to draw a stitch formed by the sewing instrumentalities towards the work and to set it within the work. Similarly, as the rolls move towards the work they pay off thread for the formation of a stitch and, as they move away from the work, they draw down on to the work the stitch formed by the sewing instrumentalities.

The objects and the several features of the present invention will become clear from a consideration of the following description with reference to the accompanying drawings of the illustrative form aforementioned.

In the drawings Fig. 1 shows, in front elevation, the form of take-up device mentioned as applied to an outsole stitching machine for boots and shoes; Fig. 2 is an elevation, from the right hand side of Fig. 1, showing certain details of the

take-up device seen in that figure; and Fig. 3 is a diagrammatic view showing the paths moved through by thread take-up rolls of the device seen in Figure 1 during a stitch forming and setting cycle.

In the illustrative form of rotary take-up device there is supported in a bracket 1 secured to the table 3 of a curved hooked needle outsole sewing machine of the kind disclosed in the patent to Ashworth aforesaid, a pair of horizontal rotary shafts. One of these shafts, indicated at 5, (being a solid shaft) is mounted within the other, which is indicated at 7 (the latter being a tubular shaft) and the shaft 7 is driven at the same speed of rotation as the main shaft of the machine and in the opposite direction by a bevel gear 9 on its left hand end which meshes with a similar bevel gear 11 on the lower portion of a shaft 13 driven by gears 15 and 17 from the main shaft of the machine.

The inner shaft 5 is driven at twice that speed by a smaller bevel gear 19 meshing with a bevel gear at the lower end of the shaft 13. The two shafts 5 and 7 are arranged above the work table of the machine and extend from near the left hand side of the machine (when looked at from the front) to just beneath the work-supporting table 21 of the machine. The outer tubular shaft 7 carries at its right hand end a disc 23 about five and a half inches in diameter which has a fixed stud 25 projecting axially from it near its periphery, which stud carries on its outer end a thread take-up roll 27. A cam member, in the present instance, an eccentric 29 is rigidly secured to the front side of the disc 23 as seen in Figure 2. The inner solid shaft 5 projects through the disc 23 and eccentric 29 and has a plate 31 (about four inches in length) on its right hand end, which plate lies close against the eccentric. The said plate has a guideway 33 (see Figure 2) cut diametrically across it in which a slide 35 is received for sliding movement. The slide has a pin 37 projecting through it near one end, the left hand end of said pin (as seen from the front of the machine) being received within a bearing in an eccentric sleeve 39 embracing the eccentric 29 so as to be acted on by said eccentric. The forward end of the pin projects beyond the right hand face of the slide 35 and has a thread take-up roll 41 on it which is similar to the roll 27 on the disc 23, the two thread guiding rolls 27 and 41 lying in the same general plane perpendicular to the axis of the rotary shafts as seen in Figure 1.

As before stated, the inner shaft 5 rotates at twice the speed of the outer shaft 7 and, owing to the fact that the slide 35 which carries the thread guiding roll 41 is coupled to the eccentric sleeve 39, the thread take-up roll 41 is caused to travel, while the thread take-up roll 27 moves once around a circular path roughly five inches in diameter, in a continuous spiral-like path which approximates first of all to a complete circle of approximately two and a quarter inches in diameter and then, to a complete circle of approximately three and three eighths inches in diameter.

I will now describe how the two thread take-up rolls cooperate to take up thread, supplied to them under the influence of a thread pull-off finger of the kind referred to as 153 in the specification of the patent to Ashworth, and to pay it out at the requisite speed to allow of the correct formation of a stitch without causing reeving of the thread through any of the various members which engage it, and without allowing it to become unduly slack while it is being handled by said members.

The thread take-up rolls cooperate for this purpose as follows:—At the beginning of a stitch forming cycle when the needle is raised above the work, the awl is ready to pierce the work and the looper is just starting to move towards the needle, the thread take-up roll 27 on the larger disc 23 will be at the front side of the disc and a little above the horizontal position of its axis and will, when its carrying disc rotates, move downwardly. The position is indicated at *a* in Figure 3. The thread take-up roll 41 will, at this time, be just rearwardly of its lowest point and will be slightly above the latter. The position of this roll at this time is indicated at *a'* in Figure 3. When the two thread take-up rolls are in these positions, the thread passing from a stationary thread guiding roll 43 downwardly round both of the thread take-up rolls 27 and 41 and up again to another thread guiding device 45 just below the sewing point will have almost, but not quite, the maximum length which can be controlled by the take-up device. The portion of thread passing from the roll 41 to the roll 27 at this time will make an angle with the thread passing from the take-up device to the thread guiding device 45 just below the sewing point of roughly ninety-five degrees. After the main shaft of the machine has rotated through some few degrees from the position it occupies at the beginning of a stitch forming cycle the disc 23 will have rotated (in a counter-clockwise direction looked at from the right of the machine) through a corresponding number of degrees to carry its thread take-up roll 27 below the horizontal plane in which its axis lies. Simultaneously the thread take-up roll 41 will have rotated through twice the angle and will have been carried further upwardly (i. e. towards the underface of the work) away from its lowest point.

As the cooperating thread take-up rolls thus move to these positions relatively to the said thread guiding devices 43 and 45, they spread apart a little, causing a small amount of thread to be drawn downwardly through the work to set the stitch previously formed within the work. During rotation of the main shaft of the machine through, say ten more degrees, the thread take-up roll 27 on the disc 23 is carried downwardly through another ten degrees while the thread take-up roll 41 travels upwardly twenty degrees. This re-positioning of the thread take-up rolls pays off or gives a little thread to the looper. The positions of the rolls 27 and 41 after the main shaft of the machine has moved through sixty degrees from the commencement of the stitch forming cycle are indicated respectively at *b* and *b'* in Figure 3. During approximately a further rotation of the main shaft of the machine through approximately sixty degrees the awl 47 (see Fig. 1) completely pierces the work, feeds it towards the needle 49 and retires from the work, the needle descends and enters the hole formed in the work by the awl and continues to descend to its lowest point below the work. As these operations progress, the looper 51 continues a movement across the line of the needle stroke to lay the thread in the hook of the needle and the thread take-up rolls 27 and 41 continue to be carried around, by their respective carriers, the roll 41 moving angularly faster than the roll 27 and being moved diametrically of the plate 31 during rotation of

the latter by the eccentric 29 on the disc 23. During the further movement of the main shaft just mentioned, the rotation of the two thread take-up rolls brings them somewhat closer together into the positions indicated at *c*, *c'* in Figure 3, and thus pays out, as required, the necessary thread to the looper to enable the latter to carry the thread across the needle path without applying extra tension to the thread and without allowing excessive slack to develop in it.

The needle reaches the bottom of its stroke after the main shafts has rotated through about 130 degrees from the position it occupied at the commencement of the cycle and the looper 51 and thread finger 53 combine to pass the thread around it at that time, the thread being held with the requisite tautness by the cooperating movement of the thread guiding rolls. Thereafter the needle commences to rise, taking a loop of thread with it while the looper dwells. As the needle rises, taking the loop of thread with it, the thread take-up rolls are brought closer together still as they rotate and approach nearer to the underside of the work, thus paying out thread as the needle rises. The positions of the rolls after the main shaft has rotated through one hundred and eighty degrees when the needle is still rising upwardly are indicated at *d* and *d'* in Figure 3. As the needle reaches the top of its stroke, the beak of the shuttle 55 passes into the needle loop, which will be held open at that time by a thread lifter 57, and commences to lift it over the body of the shuttle. As the loop is lifted over the body of the shuttle, more and more thread is paid out by the cooperating thread take-up rolls as they rise and approach each other (passing slightly beyond the positions indicated at *e*, *e'* which they occupy when the main shaft has rotated through two hundred and forty degrees) until, when the loop of thread is at its highest point on the shuttle, i. e., when the main shaft has rotated through about two hundred and eighty degrees, the two thread take-up rolls are as close together as they can be and are also at their highest positions relatively to the thread guiding device 45. After the loop has passed over the highest part of the shuttle, the cooperating thread take-up rolls travel downwardly away from the work and separate relatively rapidly (as indicated by the positions *f*, *f'*, which they take up after the main shaft has rotated through three hundred degrees) to draw the thread from over the bobbin down on to and to set the stitch in the work.

Thus, during a stitch forming and setting cycle of the machine, the thread take-up roll 27 on the disc 23 is carried around once in a circle starting from and ending at the position shown at *a* in Fig. 3 just above the height of the shaft 5 and the thread take-up roll 41 will be caused by the rotation of the plate 31, and by the action of the eccentric 29, to which it is coupled, to travel from the position shown at *a'* and at twice the angular speed of rotation of the thread take-up roll 27, in a curved path which describes first an approximate circle (indicated by the letters *b'*, *c'*, *d'* in Figure 3) of less than half the diameter of the path of the thread take-up roll 27 and then an approximate circle (indicated by the letters *e'*, *f'*, *a'*) of just over three fifths of that diameter. It is to be noted that in reality the path of the thread take-up roll 41 is a closed spiral of continually changing curvature and that, as indicated by the positions *a'*, *f'* which the roll takes up after the main shaft has rotated through successive angular movements of sixty degrees, the speed of movement of the roll 41 continually varies.

Such an arrangement can be made to yield up thread for engagement by the needle, to pay it out for passing over the shuttle and to draw it down to set the stitch in the work in a manner closely approximating that which is theoretically necessary. However, an auxiliary take-up device similar to that referred to at 173 in the specification of the patent to Ashworth but the timing of which is modified as desired may be provided to enable the rotary take-up device to set the stitch in the work slightly earlier than it normally would in order to ensure that the stitch shall be completely set before the awl enters the work once more thus avoiding such cramping of the thread during the stitch setting as would be likely to occur by the crowding of the sole material around the thread if the awl were caused to pierce the work once more before the stitch has been set.

In order to ensure that the thread will be properly engaged by the rolls on the rotary take-up device, each of the pivot pins for the said rolls may carry a pair of sector-shaped thread guiding plates indicated at 59 in Figure 1 located one on either side of the roll and having flaring ends between which the thread enters easily and by which it is guided to the roll.

The nature and scope of the invention having been indicated, and a form of the invention having been specifically described, what is claimed is:

1. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising a thread engaging member, a member mounted to rotate about a fixed axis upon which the thread engaging member is carried, and means acting on the thread engaging member to cause it to move in a closed path which is non-symmetrical about the axis of rotation of the said rotating member.

2. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising a thread engaging member, a member mounted to rotate about a fixed axis upon which the thread engaging member is mounted, and means for controlling said thread engaging member to cause it to move in a closed curved path and to approach and recede from the axis of the rotating member.

3. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising a thread engaging member, a rotating member upon which the thread engaging member is movably mounted, a second rotating member, and connections between the thread engaging member and said second rotating member acting to move the thread engaging member on the first mentioned rotating member during its rotation.

4. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members, two rotating members upon which the thread engaging members are respectively mounted, and means for causing one of said thread engaging members to approach

and recede from the other thread engaging member as the two rotary members rotate.

5. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising a thread engaging member, and means for actuating and controlling said thread engaging member to cause it to move in a closed curved path comprising two rotary members rotating at different speeds, and connections from said rotary members to the thread engaging member.

6. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members, two concentric rotary members on which said thread engaging members are respectively mounted, and means for rotating said rotary members at different speeds.

7. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members, two concentric rotary members on which said thread engaging members are respectively mounted, and means for rotating one of said rotary members at twice the speed of the other.

8. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members, two concentric rotary members on which said thread engaging members are respectively mounted, means for rotating one of said rotary members at twice the speed of the other, and means for imparting an inward and outward radial movement to the thread engaging member on the higher speed rotating member during each rotation of the lower speed rotating member.

9. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two concentric rotary members, means for rotating one of said rotary members at twice the speed of the other, a thread engaging member fixedly mounted on the lower speed rotating member, a radially movable slide carried by the higher speed rotary member, a thread engaging member mounted on said slide, and actuating connections between the slide and the lower speed rotary member for imparting a radial inward and outward movement to the slide during each rotation of the lower speed rotary member.

10. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members mounted to move in different closed curved paths, and means for actuating and controlling said thread engaging members to cause one of said members to move in a circular path and the other member to move in a path which approaches and recedes from the center of said circular path.

11. A hooked needle lockstitch shoe sewing machine having, in combination, stitch forming devices including a hooked needle, needle threading mechanism, a shuttle, and a take-up comprising two thread engaging members mounted to move continuously in the same direction in different closed curved paths in constant engagement with the thread, and means for actuating and controlling said members to pull the needle loop from the shuttle and set the stitch and to give up thread in timed relation to the thread handling movements of the needle, shuttle, and needle threading mechanism.

FRANK BYCROFT KEALL.