Jan. 2, 1934. F. B. KEALL ET AL 1,941,943

SEWING MACHINE

Filed July 19, 1932 2 Sheets-Sheet 1

Fig. 1

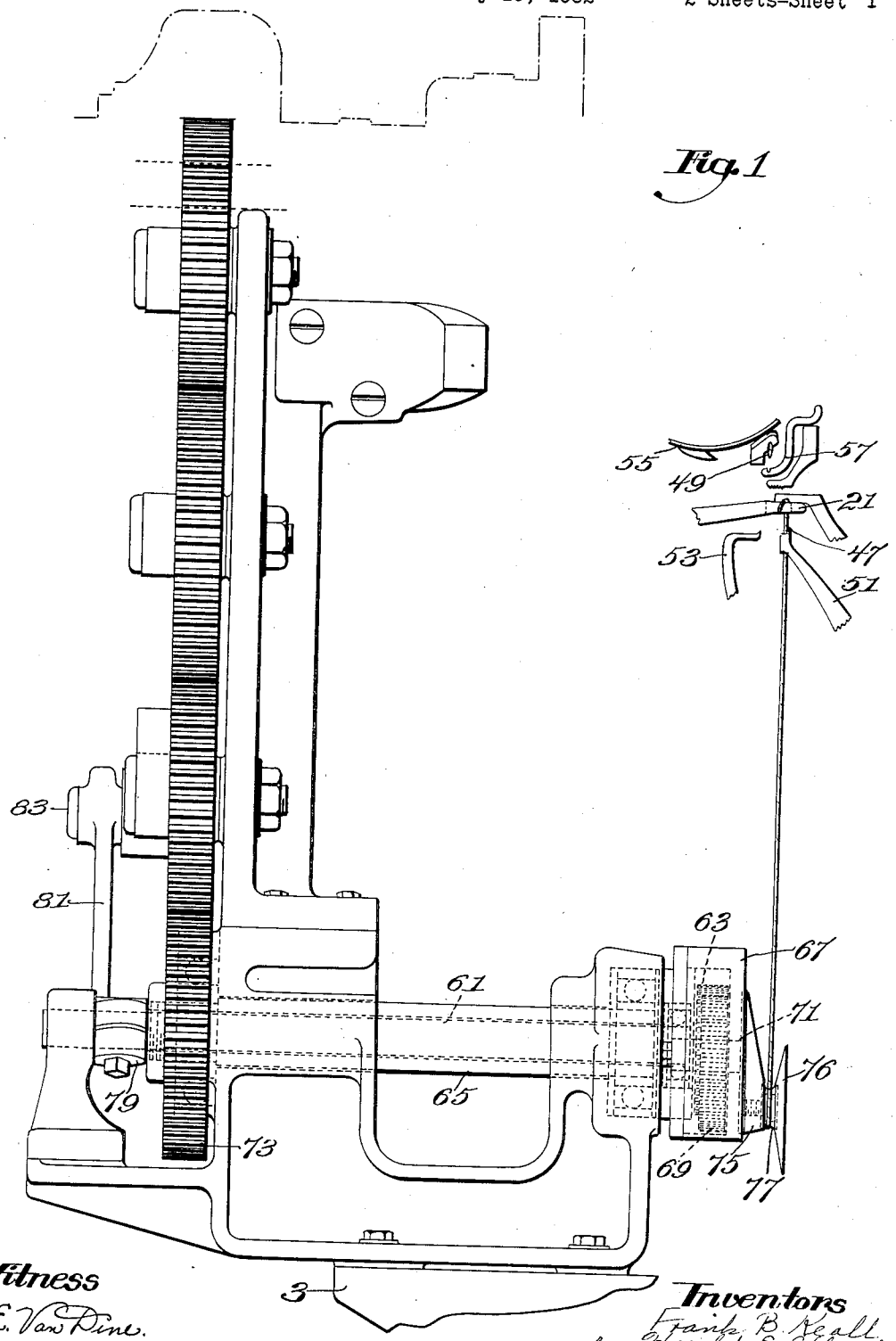

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Fig. 2

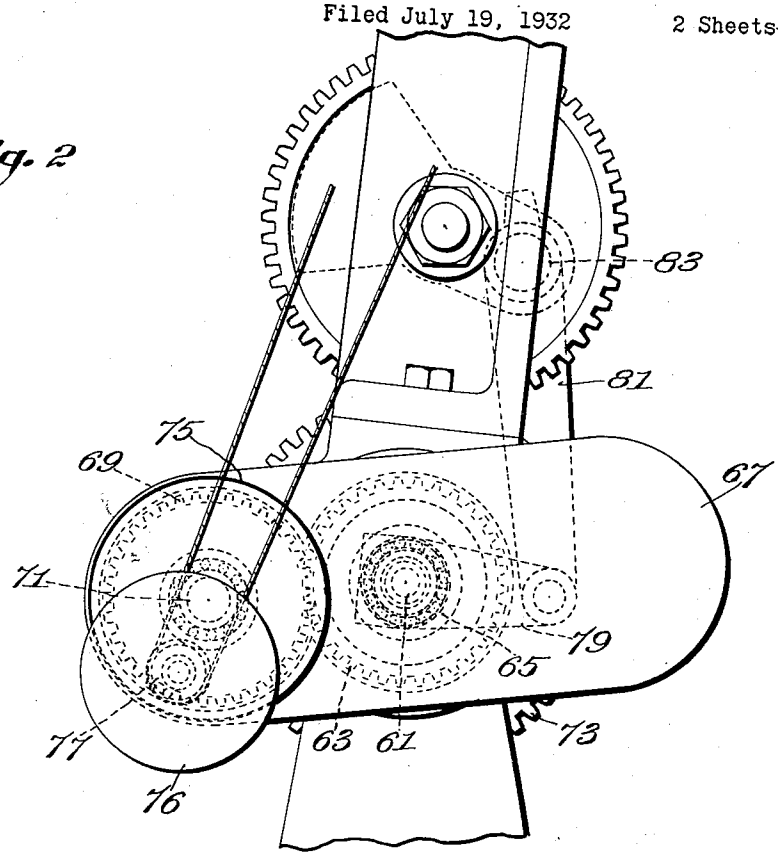
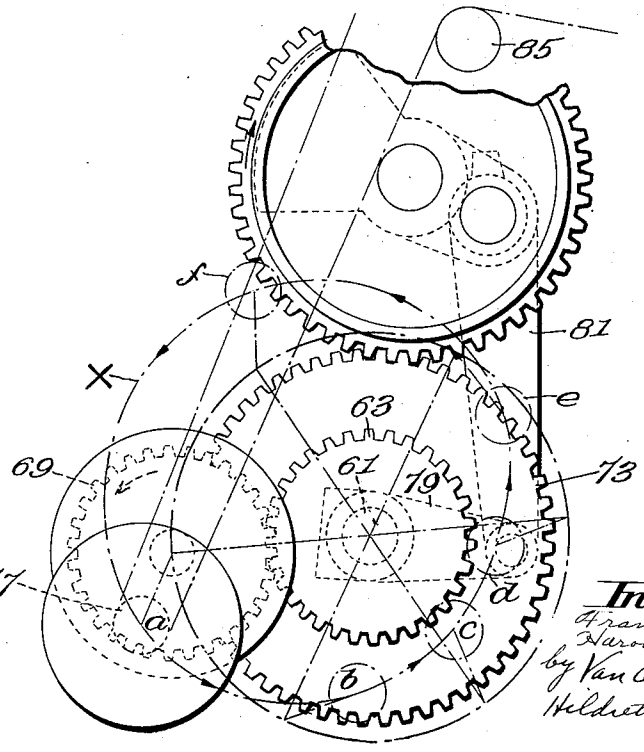


Fig. 3



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Patented Jan. 2, 1934 1,941,943

UNITED STATES PATENT OFFICE

1,941,943

SEWING MACHINE

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Application July 19, 1932, Serial No. 623,378, and in Great Britain December 18, 1931

5 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, for instance, as are used in the boot and shoe industry for sewing shoe soles to shoes. Such machines are usually provided with 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. An example of such a machine is disclosed in the United States patent to Ashworth No. 1,169,909 dated February 1, 1916.

In machines designed for sewing outsoles to shoes or for sewing together pieces of heavy material, it is necessary that the thread 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.

In sewing around a welted shoe in stitching the outsole to the welt, for example, it is customary to run the machine at a relatively high speed at least when sewing around the sides of the forepart and, by reason of the fact that the moving parts of the machine are strong and heavy, a considerable amount of vibration is apt to be set up in the machine which is not only harmful to the machine, but which interferes with the manipulation of the work by the operator, making it more difficult for him to serve the machine and reducing his daily output below the amount which a smoothly running machine would enable him to produce.

One of the chief sources of vibration in an outsole stitching machine of the general type disclosed in the patent to Ashworth hereinbefore referred to is the to and fro movement of a relatively heavy thread take-up device, the purpose of which, during its movement in one direction, is to pull the needle loop from the shuttle and set the stitch, and during its movement in the opposite direction, to supply the thread which is taken up by the thread handling movements of the needle, shuttle, and needle threading mechanism.

An object of the present invention is to provide a take-up device which will be free from any harmful vibration-producing tendency and which will operate smoothly and evenly to control the thread in the desired manner during each stitch forming cycle.

With the above object in view, the invention contemplates the provision in a hooked needle lockstitch shoe sewing machine of a rotary take-up device comprising a single thread engaging member which is mounted to move continuously in constant engagement with the thread and which is actuated at the necessary speed during a stitch forming cycle to pull the needle loop from the shuttle and set the stitch and give up thread in timed relation to the thread handling movements of the needle, shuttle, and needle threading mechanism. In the illustrated form of rotary take-up device hereinafter described as embodying the invention, a single thread take-up roll is secured eccentrically to a pinion which is rotated around the periphery of a second pinion which itself is oscillated to and fro about its axis at a relatively slow speed, the result of the combined rotary and oscillating movements of the two pinions causing the take-up roll to move towards and away from the work at a varying speed in an orbital path so as to control the thread throughout the sitch forming cycle without undue slackness or tension.

Another object of the invention is to provide a rotary take-up mechanism of novel and improved construction and, with these objects in view, the invention also consists in the devices, combinations and arrangements of parts hereinafter described and claimed, the advantages of which will be apparent to those skilled in the art from the following description taken in connection with the accompanying drawings in which Figure 1 shows, in front elevation, a form of take-up device embodying the present invention as applied to an outsole stitching machine for boots and shoes; Figure 2 is a view, from the right hand side of Figure 1, showing certain details of the take-up device seen in that figure; and Figure 3 is a view showing the path through which the thread take-up roll of the device moves during a stich forming and setting cycle.

The form of rotary take-up device illustrated in the drawings will be described as applied to an outsole stitching machine which can be assumed to be generally similar in operation to the machine described in the patent to Ashworth hereinbefore referred to. Referring first to Figure 1, there is fitted to a bracket on the tray or table 3 on the machine column a horizontal shaft 61 arranged parallel to the main shaft of the machine, the right hand end of the shaft lying more or less below the work supporting table 21 of the machine. This shaft 61 carries a pinion 63 at its right hand end (looking at the machine from the front) and has a sleeve 65 surrounding it, which sleeve has an elongated closed casing 67 secured to its right hand end to receive within it the pinion 63 on the shaft 61 and the

casing houses a second pinion 69 secured to a pin 71 freely rotatable on ball bearings in the casing, which pinion is of the same size as the pinion 63 on the shaft 61 and meshes with this pinion. The left hand end of the sleeve 65 has a gear wheel 73 secured to it, which gear wheel is coupled by a train of gears to the main shaft of the machine so that the sleeve is rotated once for every rotation of the main shaft and in the opposite direction to the latter, i. e., it rotates in an anti-clockwise direction looked at from the right, as seen in Fig. 2. The pinion 69 has secured as a unit with it a disc 75 which is secured to the pin 71 of the pinion (which pin rotates with the pinion) and carries a thread take-up roll 77, the axis of which extends parallel to the axis of the pinion 69 and is so positioned eccentrically of the pinion that it lies more or less opposite the teeth of the pinion, as indicated in Fig. 2. The shaft 61 on which the pinion 63 is secured has a short crank arm 79 secured to its left hand end (which projects beyond the sleeve 65) which arm is connected by a crank 81 with an eccentric pin 83 projecting from that gear wheel of the train of gears aforementioned which engages with the gear 73 on the left hand end of the sleeve 65. The eccentricity of the eccentric pin 83 and the length of the short crank arm 81 are such that as the gear wheel carrying the eccentric pin 83 makes a complete rotation, the shaft 61 and therefore the pinion 63 at its right hand end oscillates to and fro relatively slowly through about seventy degrees. Thus, for each rotation of the main shaft of the machine, the pinion 69 carrying the thread take-up roll 77 is carried bodily once around the pinion 63 on the shaft 61 and the shaft itself is oscillated once backwards and forwards at a slower speed than the speed of rotation of the pinion 69, thus giving an additional rotary movement to the pinion 69 about its own axis and causing the take-up roll 77 carried on it to travel at a continually varying speed, during each rotation of the main shaft of the machine, in a closed path indicated at X in Fig. 3 which is somewhat oval in shape and is non-symmetrical about the axis of the shaft 61.

The thread passes upwardly and forwardly from thread locking devices and a thread measuring or pull off device which are similar in function to those described in the prior specification aforementioned, over a stationary guide roll indicated at 85 in Fig. 3, directly downwardly around the take-up roll 77, upwardly around a second stationary guide roll (not shown) and thence directly to the looper 51.

The rotary take-up device cooperates with the thread handling instrumentalities during the working of the machine as follows:—

Assuming the machine to be at the instant of starting a new cycle after the completion of a stitch forming cycle, the needle 49 will be raised nearly to the top of its stroke, the awl 47 will be ready to pierce the work, the looper 51 will just have started to move towards the left ready to lay the thread in the barb of the needle when the needle descends and the thread hook 53 and thread lifter 57 will lie away from contact with the thread. At this time the take-up roll 77 will be in the position shown at *a* in Fig. 3, i. e. nearly in its lowest position away from the work and will, in fact, have commenced to set the stitch previously formed within the work. Immediately the machine has started the new cycle the awl will start to pierce the work and the take-up roll 77 will descend a little further to apply a further pull to the thread to complete the setting of the previous stitch within the work and will thereafter (under the combined actions of the bodily rotary movement of the pinion 69 which carries it and of the oscillatory movement of the shaft 61 carrying the pinion 63) start to rise along a flattened path directed first upwardly and rearwardly and then upwardly and forwardly of the machine. The take-up roll continues to move relatively slowly upwardly towards the work along this path (thus paying out thread relatively slowly to the looper) during the whole of the time that the needle pierces the work and descends to its lowest position and during the time that the looper and thread finger 53 cooperate to lay the thread in the hook or barb of the needle and retire after having effected this, during the time that the needle rises with the thread loop in its barb nearly to the top of its stroke and during the time that the thread lifter engages with the thread loop to hold it in a position to be easily engaged by the shuttle beak. These operations take place while the main shaft of the machine and the rotary take-up device are rotating through about two hundred and ten degrees and at the end of the first sixty degrees of rotation of the main shaft of the machine (and therefore also of the take-up device) the take-up roll 77 will have reached the position indicated at *b* in Fig. 3, at the end of one hundred and twenty degrees of rotation of the main shaft the roll will have reached the position indicated at *c*, and at the end of one hundred and eighty degrees of rotation of the main shaft, the roll will have reached the position indicated at *d*. From a consideration of these positions it will be seen that the roll is moving more slowly during the latter part of its movement during this time than during the earlier part of the movement. Soon after this time the beak of the shuttle 55 engages the loop of thread held open for it by the needle and thread lifter and commences to lift it over the shuttle, the needle, having had the thread loop removed from it, rises to the top of its stroke and the thread lifter retires from engagement with the thread. These operations take place while the main shaft of the machine is rotating through a further forty degrees. While this rotation of the main shaft is taking place, the take-up roll will pass through the position indicated at *e* in Fig. 3 (which position the roll takes up when the main shaft has rotated through two hundred and forty degrees) and will be ready to deviate from the flattened path into a steeply rising and forwardly curved path and during the said further forty degree movement the roll will commence to move quicker than it was moving along the lower side of the flattened path thereby paying out thread at a comparatively rapid speed to allow of the lifting of the thread through the work by the needle without reeving and to allow of the engagement of the loop by the shuttle beak and the taking up of the loop by the beak. During the next thirty degrees of revolution of the main shaft of the machine, the loop of thread is lifted over the top of the shuttle and this calls for a rapid paying out of thread in order that the loop may be carried over the shuttle without undue tension on the thread. During this thirty degree movement, the take-up roll will move still more quickly upwardly and forward and will approach the position indicated at *f* (this being the position it reaches when the main shaft has rotated through three hundred degrees) paying out

thread as quickly as required and when, at the end of the thirty degree movement the loop is passing over the highest part of the shuttle, the take-up roll will have reached its highest point in the path shown and will, having approached as close as possible to the work, have paid out as much thread as possible. Once the loop of thread has passed over the highest part of the shuttle it is required to be drawn down on to the work rapidly and this is effected by the take-up roll, which, after the loop has passed over the highest part of the shuttle, starts to move rapidly downwards through the position shown at *f* along a curved path which first leads forwardly and then rearwardly again after it has reached its most forward point and this movement of the take-up roll will, though gradually slackening in speed, as it approaches the lowest point of its travel, have drawn the stitch just formed tightly down on to the work and will have drawn the thread-lock partly into the needle hole by the time that the roll reaches once more the position *a* it occupied at the commencement of the cycle under consideration. While the take-up is operating to pull the thread loop from the shuttle on to the work, the looper will be moved forward gradually, as is usual in outsole stitching machines of the kind in question, preparatory to moving to the left ready to lay the thread once more in the needle barb when the latter descends for the formation of another stitch and the speed of the thread-drawing-down movement of the take-up roll is arranged not to take place so excessively fast as to cause severe tension to be exerted on the thread due to the combined movements of the looper and take-up roll.

Thus it will be understood that when using the illustrative form of take-up device described, the thread passes from pull-off and locking means of known type around the stationary guide roll 85, round the take-up roll 77 and thence directly to the looper and it will be understood that the thread will be paid out to enable the looper and thread hook to lay the thread in the barb of the needle and to enable the needle to rise through the work taking the loop of thread with it by relatively slow movement of the take-up roll along an upwardly inclined and flattened path. It will further be understood that as the thread lifter and needle cooperate to present the loop of thread in position to be seized by the shuttle beak the take-up roll will move quicker towards the work along a path directed forwardly (i. e. so as to be more directly beneath the looper through which the thread passes) and upwardly. During the time that the thread loop is being lifted over the shuttle body, the take-up roll, it will be understood, moves upwardly towards the work still more quickly paying out thread at the requisite speed and thereafter moves downwardly away from the work at a gradually decreasing speed along a path which curves rearwardly to join the upwardly inclined flattened path to draw the formed stitch down on to the work and ready when the machine starts a new cycle, to complete the setting of the lock within the work.

It is found that for a particular type of machine of the general kind disclosed in the patent to Ashworth hereinbefore referred to in general use at the present time and known commercially as the Goodyear outsole rapid lockstitch machine, model O, efficient thread control is effected by a rotary take-up device of the kind described if the pinion 63 on the right hand end of the shaft 61 and the pinion 69 which meshes with it both have a pitch diameter of two and a quarter inches and have thirty six teeth and if the shaft 61 is swung backwards and forwards once through an angle of about seventy degrees during one complete rotation of the sleeve 65 (i. e. during one rotation of the main shaft of the machine). When these proportions obtain it is found satisfactory if the axis of the take-up roll 77 be offset seven eighths of an inch from the axis of the pinion 69 to which it is secured. Further when such proportions obtain it is found satisfactory that the eccentric pin 83 on the gear wheel which drives the sleeve 65 (to which the crank 81 which rocks the shaft 61 is connected) should be offset one inch from the axis of the said gear wheel, that the length of the crank 81 be about three and three quarters inches and that the length of the short crank arm 79 on the shaft to which the crank is connected be one and five eighths inches.

With the above conditions, the take-up roll will follow the path described in the manner set forth if the pinion 69 carrying the take-up roll is so assembled into the device relatively to the pinion 63 on the shaft 61 that when the short crank arm 79 projects as shown in Fig. 3 downwardly and rearwardly at an angle of about five degrees to the horizontal the pinion 69 lies on the forward side of the pinion 63 and at such a position below the axis of the latter that a line joining the axes of the pinion 69 and the pinion 63 is inclined forwardly and downwardly at an angle of approximately six degrees to the horizontal and a line passing through the axis of the take-up roll 77 and the axis of the pinion 69 which carries it extends downwardly and forwardly at an angle of approximately twenty degrees to the vertical.

The thread measuring or pull-off device of the above machine is, as above indicated, similar to that referred to as 153 in the Ashworth patent hereinbefore referred to, and cooperates to measure the length of thread to be pulled off from the supply with a pair of thread-guiding eyes similar to those referred to as 159, 160 in that specification. Further and also as indicated above, the machine has a thread locking device positioned between the thread supply and the pull-off and another between the pull-off and the work which cooperates as indicated in the said prior specification to lock the thread between the pull-off and the supply and between the pull-off and the take-up at the usual times in the cycle of the machine. As the rotary take-up roll 77 above described is acting to pull the thread down on to the work after the loop has passed over the shuttle but before it actually commences to set the stitch within the work, the desired amount of thread for the next stitch will already have been pulled from the supply by the pull-off, the thread lock between the pull-off and the supply will have been closed and the thread lock between the pull-off and the take-up will have been opened.

It is particularly desirable, especially if the machine is to run at a high speed, that the thread be held under appreciable tension as the looper moves across towards the right of the operator in front of the needle to lay the thread within the barb of the needle in order to ensure that the thread will be taut at that time and will be engaged firmly by the needle barb. In order to ensure that the tension in the thread will be adequate during this time, use is made of the thread hook 53 which, as is usual in the particular type

of machine being considered, moves rearwardly after engaging the thread and before the looper starts to lay the thread in the needle barb to facilitate the placing of the thread in the barb and remains in its rear position engaging the thread until the needle has properly engaged the thread and is starting to rise, at which time the thread hook commences to come forward once more and release the thread. To this end the thread hook has secured to it a downwardly extending leaf spring (not shown) which passes in front of the thread and acts, as the thread hook moves rearwardly before the looper starts to lay the thread in the needle barb, to grip the thread against a stationary roll behind the thread thus imparting extra tension to the latter. The spring retains its grip on the thread while the looper moves across in front of the needle and lays the thread in its barb and until the needle has commenced to draw the thread within the work, at which time the grip is released by reason of the thread hook moving to its forward position once more than carrying the spring out of contact with the thread.

The disc 75 which carries the take-up roll is bevelled off on its outer face as shown in Fig. 1 to prevent the thread from catching on any projecting corners and cooperates with a disc 76 secured to the outer end of the pin on which the roll 77 is mounted to guide the thread on to the roll 77. The disc 75 fits into a recess in the cover of the casing 67 in order to prevent the thread from passing between the disc and the casing.

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 rotary member arranged to move bodily in a circular path, a thread engaging member mounted eccentrically on said rotary member, and means for rotating the rotary member at varying speeds and for moving it bodily in said circular path to cause said member 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.

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 rotary member arranged to move bodily in a circular path, a thread engaging member mounted eccentrically on said rotary member, and means for rotating the rotary member and for moving it bodily in said circular path to cause the thread engaging member to travel in a path having the form of a non-circular curve.

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 rotary member arranged to move bodily in a circular path, a thread engaging member mounted eccentrically on said rotary member, and means for moving the rotary member bodily in said circular path, and for rotating it at varying speeds to cause the thread engaging member to travel at varying speeds in a path having the form of a non-circular curve.

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 a rotary member, a thread engaging member mounted eccentrically on said rotary member, a carrier in which the rotary member is mounted, means for rotating the carrier to cause the rotary member to move bodily in a circular path, a gear concentric with the axis of said carrier, and a gear connection between said gear and said rotary member for rotating the rotary member during its bodily circular movement.

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 rotary member, a thread engaging member mounted eccentrically on said rotary member, a carrier in which the rotary member is mounted, means for rotating the carrier to cause the rotary member to move bodily in a circular path, a gear concentric with the axis of said carrier, a gear connection between said gear and said rotary member for rotating the rotary member during its bodily circular movement, and means for oscillating said concentric gear to vary the speed of rotation of said rotary member.

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