July 25, 1933. A. BATES 1,919,410

SEWING MACHINE

Filed April 27, 1931

Fig. 1

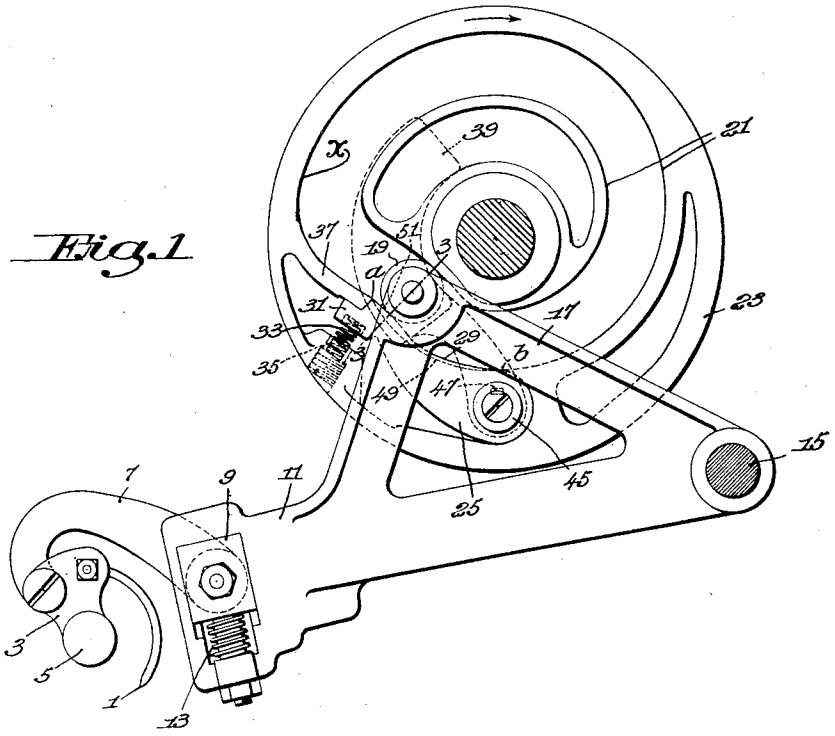


Fig. 2

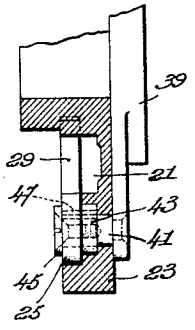
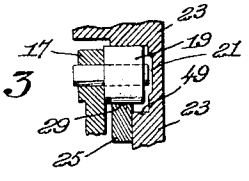


Fig. 3



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UNITED STATES PATENT OFFICE

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SEWING MACHINE

Application filed April 27, 1931, Serial No. 533,096, and in Great Britain May 6, 1930.

This invention is concerned with improvements in or relating to sewing machines and is particularly, but by no means exclusively, concerned with sewing machines suitable for use in the manufacturing of boots and shoes. For the sake of brevity the term shoes will hereinafter be used as including both boots and shoes.

Of the various types of sewing machines used in the boot and shoe industry, some make use of a curved hooked needle around which a loop of thread is laid at a certain stage in the operation of forming a stitch and which thereafter retires away from the work to pull the stitch firmly against the work.

Machines of the type just referred to are frequently used for example for sewing the inseams of welted shoes. It is desirable, in sewing machines generally, (in order to minimize the danger of breaking the thread) to reduce to a minimum the rendering of the thread through the needle which occurs as the needle retires from the work. It is also desirable (particularly when sewing an inseam) to reduce the strain on the thread at this time to the minimum compatible with efficient sewing. When sewing an inseam on a welted shoe, the strains on the thread are resisted principally by the "between substance" provided by the raised lip of the insole and as this "between substance" is sometimes soft or spongy it is liable to be cut through or distorted by the thread if the strain on the latter is excessive.

I have observed that the tendency of the thread to break and of the "between substance" to be distorted or cut into by the thread is more apparent when the sewing is being carried out in a sewing machine which is running at a high speed than it is when the operation is being carried out in a machine which is running at but a low speed. This is apparently due, at least in a large measure, to the fact that the needle of a machine running at a high speed is withdrawn from the work during a sewing operation at a faster rate than the needle of a machine running at a low speed would be. This brings about severe rendering or reeving of the thread through the needle as the latter is retracted and also applies excessive tension to the thread at the same time, tending to bury the stitches in the "between substance" and to mutilate the latter as above described. These objectionable effects become increasingly apparent as the speed of the sewing operation increases. Inseam sewing machines of the type described in U. S. patent to Eppler No. 1,108,560, dated August 25, 1914 are commonly used in the shoe industry at the present time and such machines are provided with a friction clutch by manipulation of which the operator can cause the machine to run at varying speeds (between say three hundred and six hundred revolutions per minute) according as to whether he is sewing around sharp curves such as exist in the waist or at the toe of a shoe or whether he is running along the sides. Thus if the machine runs at three hundred revolutions say when operating on one part of a shoe and at six hundred when operating on another part, the speed with which the needle is withdrawn from the work and the tension applied to the thread by the needle as it withdraws will vary in different places as the operation proceeds around a shoe.

In the result either the quality of the sewing at different parts of the shoe is manifestly different or a compromise in the condition of the settings of the machine has to be made to average the sewing results around the shoe.

The object of the present invention is to overcome these drawbacks and, with this object in view, a feature of the invention contemplates the provision in a hooked needle sewing machine, of means for changing the relation between the speed of rotation of the cam shaft of the machine and the speed of operation of the means for actuating the needle, whereby, regardless of the speed at which the machine is operated in forming stitches, the needle may be retracted at such a speed as to avoid severe rendering or reeving of the thread through the needle or the application of an excessive tension to the thread. Broadly considered, this change of relationship may be effected in any suitable manner upon a change in the speed of the cam shaft, but preferably this result is accomplished by means controlled by the speed of the machine,

which alters the speed of movement of the needle so that the change is effected automatically and may be proportional to the change in the speed of the machine. As a simple and efficient means for accomplishing this result, a centrifugally operable member may be provided arranged to vary the speed of operation of the needle actuating means. In the embodiment of the invention hereinafter specifically described, this centrifugally operable member takes the form of a radially movable centrifugally controlled section of the rotary cam member from which the needle is actuated.

In addition to the features of invention above referred to, the present invention also consists in the novel constructions 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 Fig. 1 is a side view showing the needle operating mechanism of an inseam sewing machine of the type described in U. S. Patent No. 1,108,560 above referred to as modified in one way in accordance with the present invention; Fig. 2 is a sectional view partly broken away and at right angles to Figure 1 showing certain of the parts seen therein; and Fig. 3 is a section on the line 3—3 of Fig. 1 illustrating clearly the relation of certain parts seen in that figure.

As shown in Figure 1 a curved hooked needle 1 is mounted in a carrier 3 which is mounted to oscillate about an axis 5 during the sewing operation in a manner well understood in the art. The mechanism for oscillating the needle comprises a curved link 7 pivoted at one end to the carrier 3 and at the other end to a block 9 mounted in a slot at the end of a lever 11. A spring 13 urges the block 9 towards the top of the said slot and provides a yielding device for the retraction of the needle from the work.

The lever 11 is freely mounted at its right hand end as seen in Figure 1 on a fixed rod 15 and has a web 17 extending upwardly therefrom which carries a cam roll 19 running in a track 21 cut in a cam member 23 fast on the main cam shaft of the machine. The said track is so designed as to give to the needle the necessary oscillating movements at the correct times in the cycle of operations of the machine. Part of the said track however (considered about the axis of the cam) is formed on two members situate side by side axially of the cam shaft, one of the members being part of the cam member itself and the other being a separate member which at certain times shrouds the former but may be withdrawn so that the cam roll may then run on said former member. The said part of the cam track is that shorter part of the track lying between the points *a* and *b* shown on Figure 1. The member which carries part of the cam track, and which may be withdrawn from a position in which it shrouds the other, is indicated at 25. This member comprises an arm pivoted to the cam 23 (it being fast on a stud 41 hereinafter described) and having a cam face 29 cut on its inner face. The member 25 has a nose 31 provided at its free end and the member is urged upwardly by a spring 33 (which bears at one end against the member and is received at its other end in a closed hole 35 in the cam) so that the inner face of the nose bears against the outer face of a rib 37 formed on the cam member. The arm 39 (see Figure 2) has riveted thereto the aforesaid stud 41 which projects through a bearing in the cam-member running axially of the latter. The arm 25 has, on the side nearer the cam, a short sleeve 43 which extends into a cut-out portion surrounding the stud 41. The said stud 41 passes through the sleeve 43 and to the outer face of the arm 25. A washer 45 having a conical hole centrally thereof is arranged against the outer face of the arm 25 and a conical headed screw passes through the washer and screws the arm 25 to the stud 41. A key 47 is also provided to hold the arms 25 and 39 against relative rotation.

The other member of the two members aforesaid which also carries part of the track is as previously indicated merely one section of the main track itself i. e. that section which has formed upon it the cam face lying between the points *a* and *b* and shown in dotted lines in Figure 1 at 49. The cam roll 19 is of such a length as to extend across both the cam faces 29 and 49, as seen in Figure 3, the width of the cam face 29 (and of the cam face 49) being equal approximately to half of that of the cam track 21. It will be observed from a consideration of Figure 1 that the cam face 29 on the member 25 has a hump 51 provided on it and the top of this hump is, when the cam face is in its limiting inward position, the highest part of the cam track 21 (i. e. is nearer to the axis of the cam than any other part of the track). The cam portion 49 has no hump but, after falling away from the point where the left hand end of the cam face 29 comes into alignment with the fixed cam track, rises gradually to the point *b* which point becomes the highest part of the cam track when the arm 25 is swung downwardly completely out of shrouding position.

The operation is as follows:—

Assuming the machine to be running at a low speed and the needle to have pierced the work, a loop of thread will be laid in the barb of the needle and as the cam 23 continues to rotate (its rotation being in a direction of the arrow shown in Figure 1) the point on the cam track indicated at *x* will reach the cam roll 19. As the point *x* passes beneath the

cam roll the latter will start to climb inwardly towards the axis of the cam and towards the point *a* and the needle retracts with the loop in its barb. The cam roll will thereafter run up the hump 51 and will in doing so cause the needle to complete its retracting stroke. The needle will thereafter remain stationary for a short period until it is again advanced to the work by the cam roll reaching a point in the cam track beyond the point *b*. If the speed of the machine is allowed to increase however, the weighted arm 39 will fly outwardly about the axis of the stud 41 and will lower the arm 25 against the compression of the spring 33. Assume now that the machine be running at such a high speed that the cam face 29 on the member 25 is completely withdrawn below the cam face 49. In such a case after the needle has received its loop of thread the point *x* on the cam track will pass beneath the cam roll as before and the roll will commence to climb inwardly towards the point *a*. After it has reached that point, however, it continues to rise only very gradually along the cam face 49 until it reaches the point *b* by which time only will it in this case have caused the needle to reach the same fully retracted position as in the case above considered. At any intermediate speed between the particular low speed and high speed which have been considered (that is at any speed at which the member 25 is partially withdrawn from shrouding position) the cam roll 19 will run along the cam track 21 until it reaches the point *a* after which time it will commence to run along the cam face 49 until it contacts with the cam face 29 on the partially retracted arm 25. The extent to which the arm 25 has been retracted from maximum shrouding position will determine how much of its cam face 29 projects beyond the cam face 49 and which part of the cam face 29 stands most proud of the cam face 49 and forms therefore the highest part of the cam track 21. It is clear therefore that if the machine starts at a low speed and gradually accelerates to a high speed the arm 25 will be swung more and more outwardly thus causing the highest effective part of the cam track 21 to move progressively along the cam track in a direction from the point *a* towards the point *b*, the said highest effective point actually coinciding with the point *b* when the arm is fully retracted from shrouding position. Considering the two extreme cases in which the arm 25 is respectively in maximum and minimum shrouding positions it will be noted that with the arm in former position (and the machine therefore running at a relatively low speed) the part of the cam track along which the cam roll 19 travels to withdraw the needle to its highest position away from the work is that part lying between the point *x* and the highest point of the hump 51 on the arm 25.

When the machine is running fast and the arm 25 is entirely withdrawn from shrouding position the part of the cam along which the roll travels during the withdrawal of the needle extends from the point *x* to the point *b*. It will be seen therefore that a greater angular movement is required to retract the needle completely when the machine is running at high speed than is the case when the machine is running at low speed. Thus although the angular speed of the cam shaft is greater when the machine is running at high speed the angular movement necessary to withdraw the needle from the work is likewise greater so that the needle moves during its withdrawal at a speed considerably less than it would if the cam track 21 were entirely rigid and unchangeable throughout its length.

It may be noted that the increase in the length of that part of the cam track which retracts the needle (which increase is effected by the removal from shrouding position of the arm 25) is that gained only by flattening out in effect, the hump 51 until it reaches the point *b*. This arrangement is adequate because the part of the cam track *x* to *a* operates only to withdraw the needle through the work and it is only after the barb of the needle has been withdrawn completely through the work that the needle commences to put substantial tension upon the thread. The portion of the cam track *x* to *a* is therefore left fixed since no substantial gain will apparently arise from slowing down the needle movement during this early part of its retracting stroke.

The design of the cam track 21 is such and the lengths of the link 7 and lever 11 and the diameter and position of the cam roll 19 are so chosen that the part of needle withdrawing stroke which is effected by machine-speed-controlled changes in position of the arm 25 is that part which continues to the fixed end position in the machine of the needle in its withdrawing stroke from approximately the time when the barb of the needle is withdrawing clear of the work.

The incorporation in an inseam sewing machine of such a variable needle actuating cam as is above described allows the machine to be run at a higher speed without breaking the thread than is possible when the machine has a needle actuating cam of usual type since where the variable needle actuating cam is used the needle will be withdrawn from the work at a substantially slower speed than it otherwise would and the strain imparted to the thread by the withdrawal of the needle from the work will not be such as will be likely to break the thread. The fact that a machine fitted with such a variable needle actuating cam may be run at higher speeds than a machine fitted with a cam of usual type will

therefore enable a greater output to be obtained from the machine in a given time.

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

1. A hooked needle sewing machine having needle actuating means including a member the effective shape of which is adapted to be varied automatically on a change in the speed of the machine to impart to the needle a different movement from that which it would otherwise have.

2. A hooked needle sewing machine having a rotary shaft, needle actuating means the speed of operation of which normally bears a definite relation to the speed of rotation of said shaft and means arranged to be operated on a change in speed of rotation of said shaft to bring about a change in the relation between the speed of rotation of the said shaft and the speed of operation of the needle actuating means.

3. A hooked needle sewing machine having needle actuating means and a centrifugally operable member adapted to vary the speed of operation of the needle actuating means in accordance with the speed at which the machine runs.

4. A hooked needle sewing machine comprising needle actuating means including a rotary cam member and means on said cam member adapted to change the effective shape of the cam as the speed of the machine varies.

5. A hooked needle sewing machine comprising needle actuating mechanism, a member adapted to occupy a certain position when the machine is running at one speed but to occupy another position when the machine is running at another speed which member by movement from one position to the other is adapted to bring about a change in the speed of movement of the needle.

6. A curved hooked needle chainstitch sewing machine comprising needle actuating mechanism including means controlled by the speed of the machine and acting upon an alteration in the speed of the machine to alter the speed of movement of the needle at the latter part of its retracting stroke substantially less than the machine speed is altered while maintaining the angular time of the total needle cycle unchanged.

7. A hooked needle sewing machine comprising needle actuating means including a rotary cam member having a radially movable centrifugally operated section at the portion producing the retraction of the needle.

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