

(Model.)

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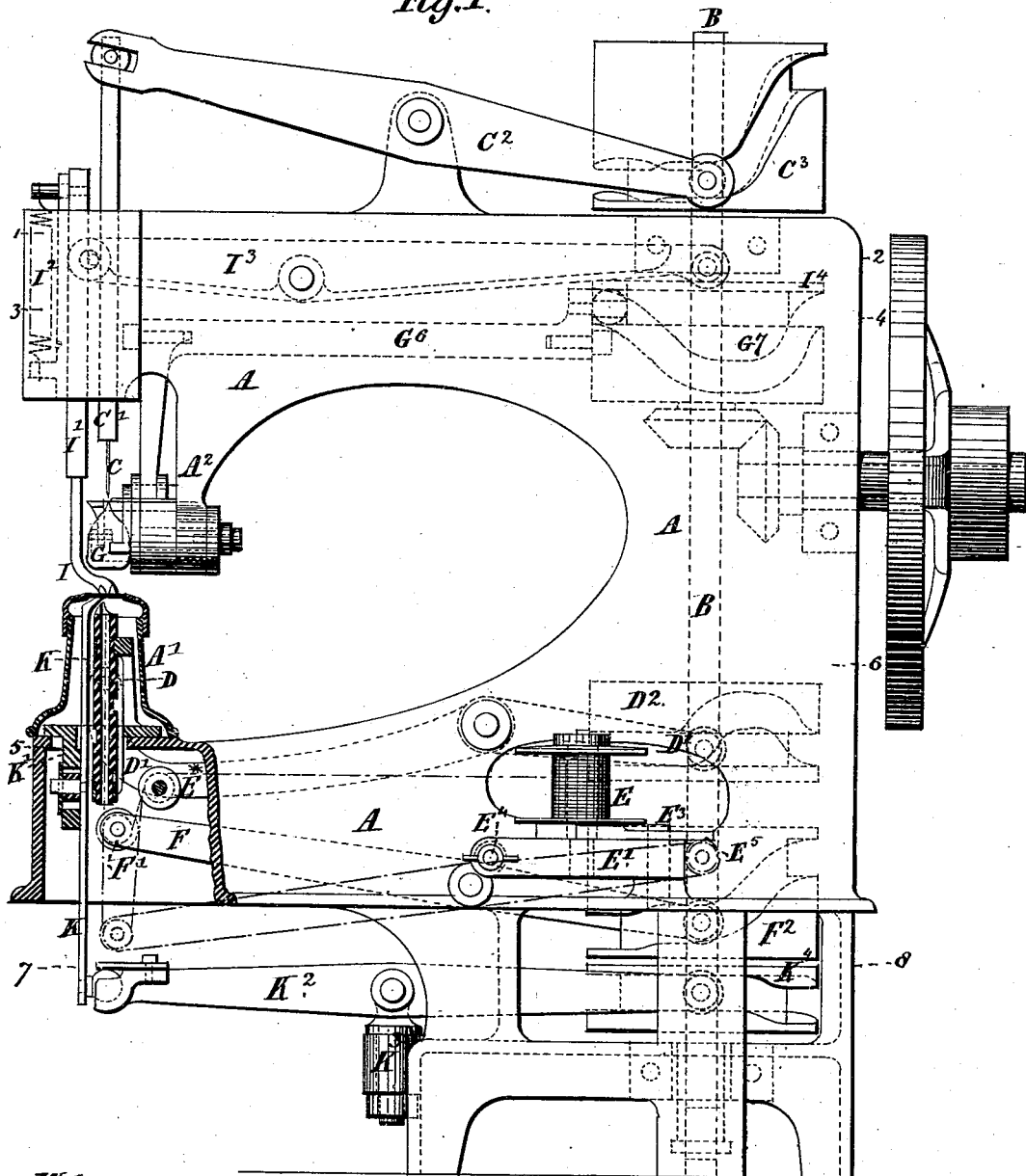
A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.

*Fig. 1.*



*Witnesses*  
*Thomas E. Birch*  
*Thos. Wagner*

*Inventor*  
*A. Keats*  
*by his Attorney*  
*Brown & Brown*

(Model.)

10 Sheets—Sheet 2.

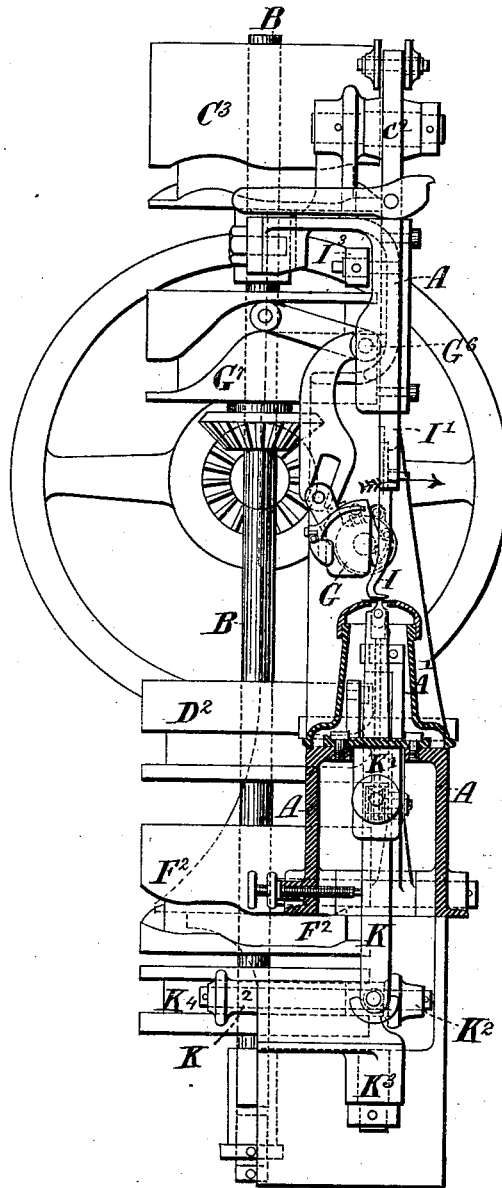
A. KEATS.

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*Fig. 2*



*Witnesses*  
*Thomas E. Birch*  
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*Brown & Brown*

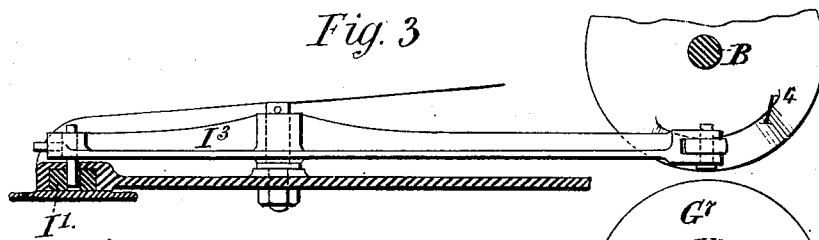
A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

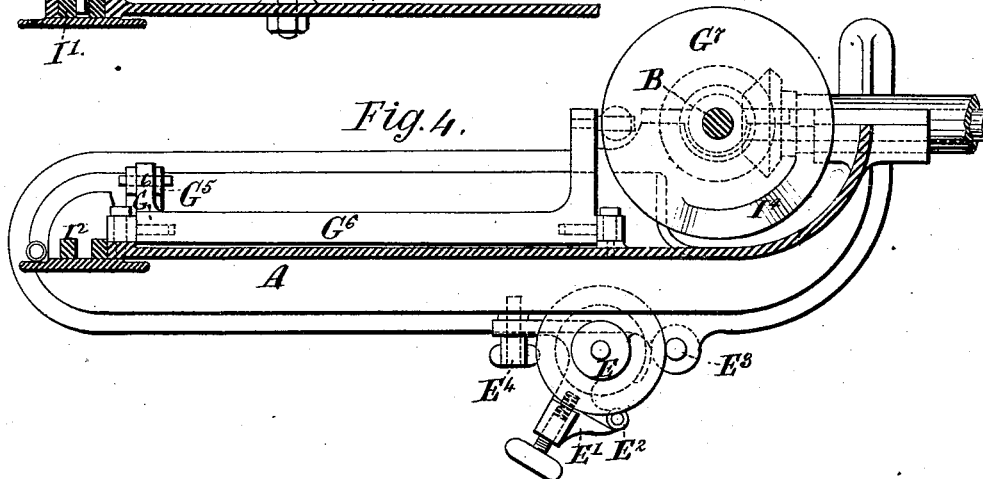
No. 260,990.

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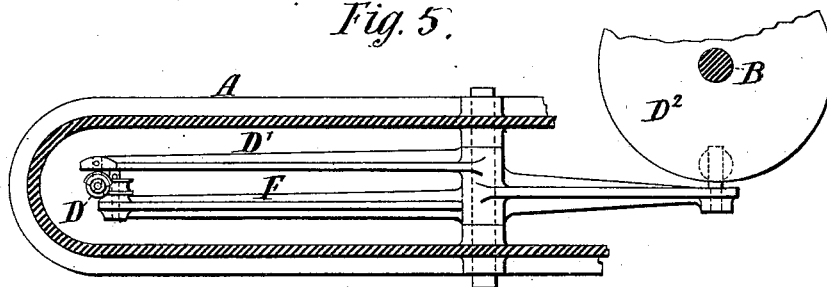
*Fig. 3.*



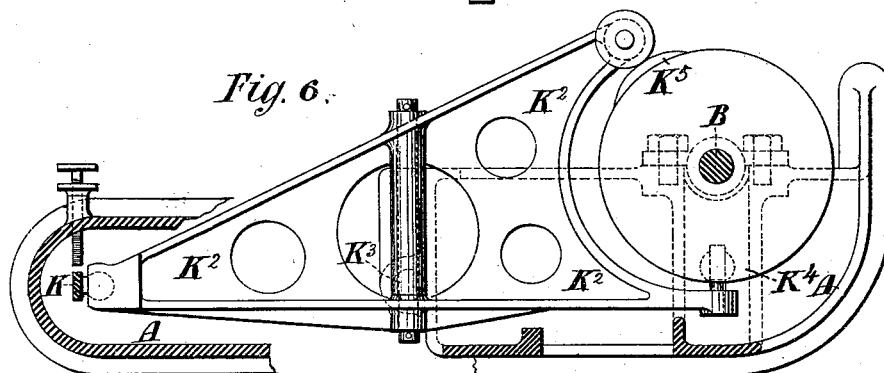
*Fig. 4.*



*Fig. 5.*



*Fig. 6.*



*Witnesses:*  
Thomas E. Birch.  
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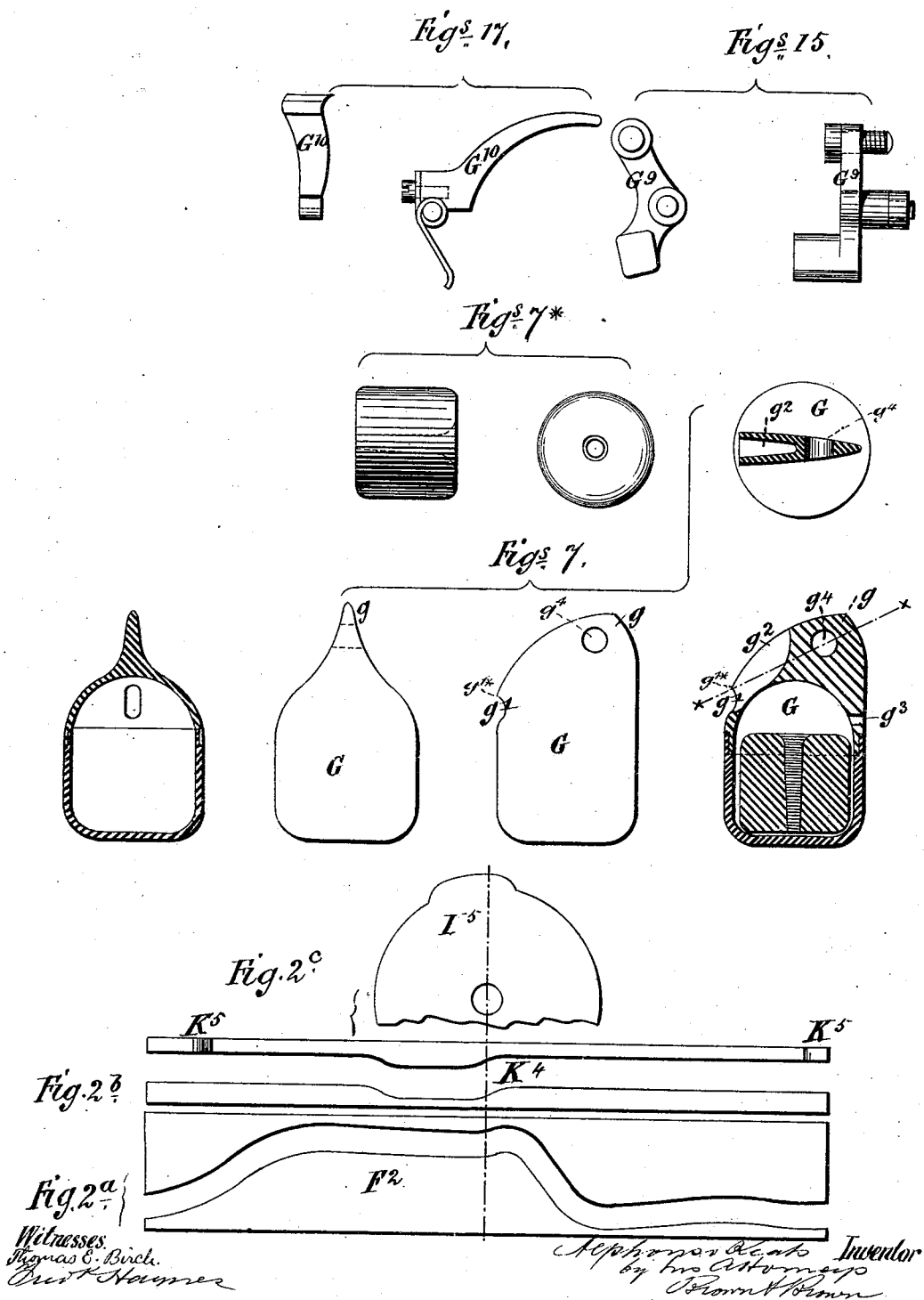
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MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

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(Model.)

10 Sheets—Sheet 5.

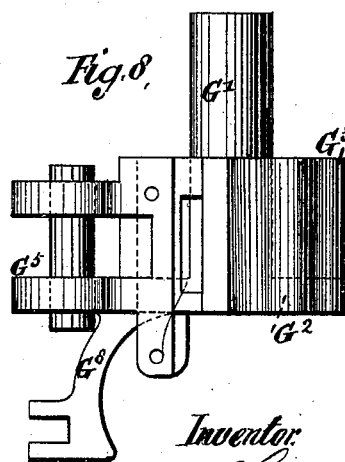
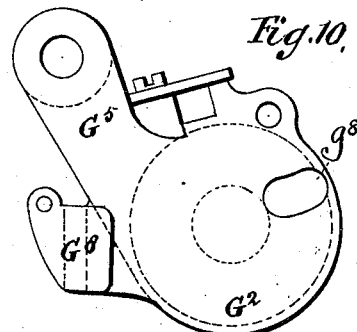
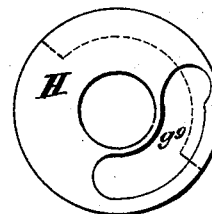
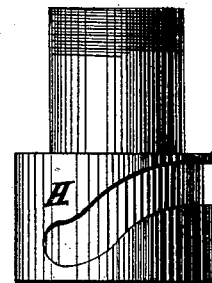
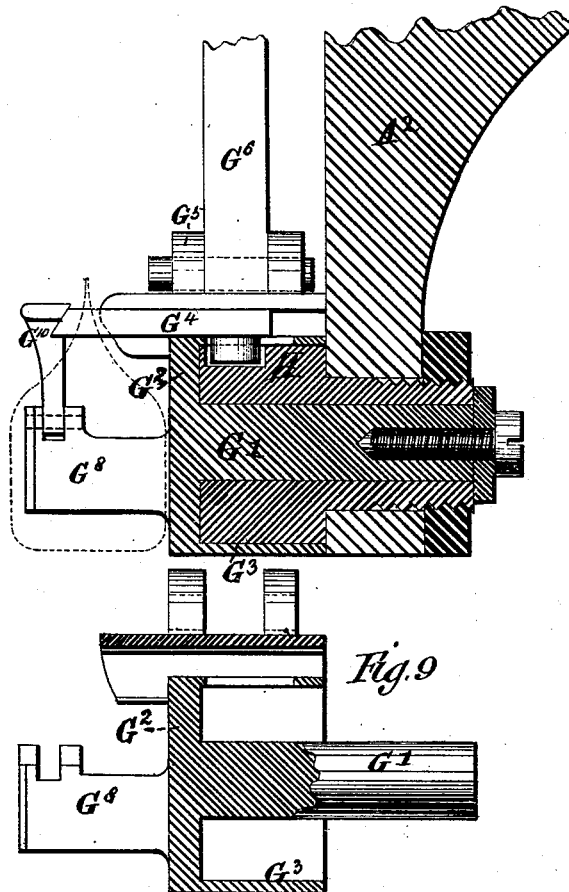
A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Fig. 14.

Patented July 11, 1882.



Witnesses  
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(Model.)

10 Sheets—Sheet 6.

A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.

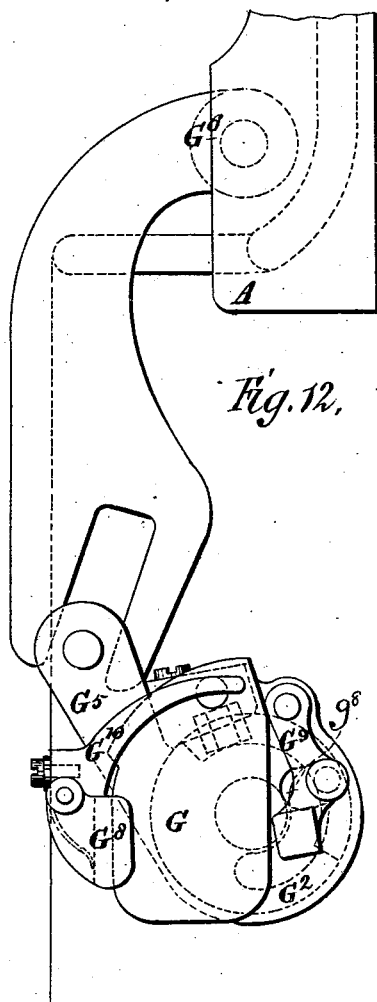


Fig. 12.

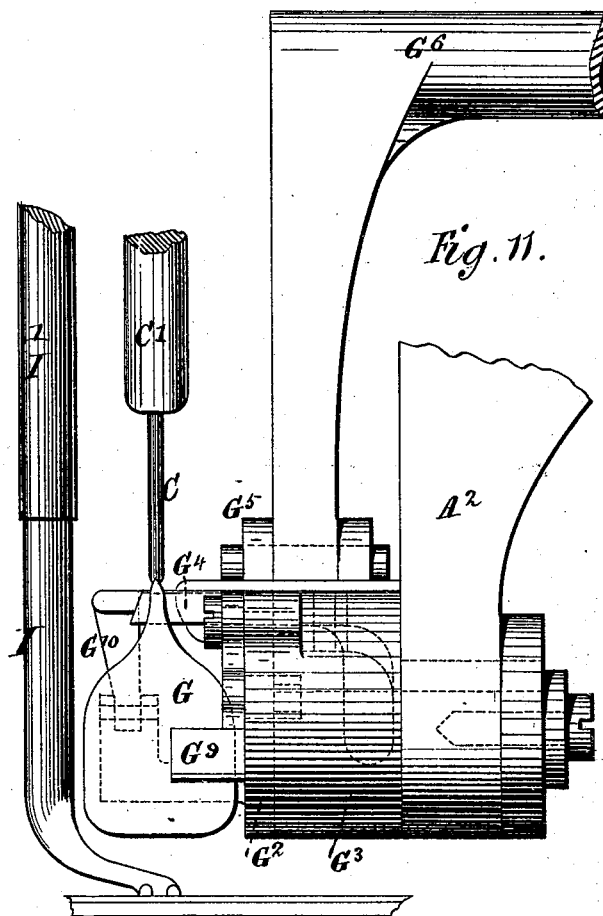


Fig. 11.

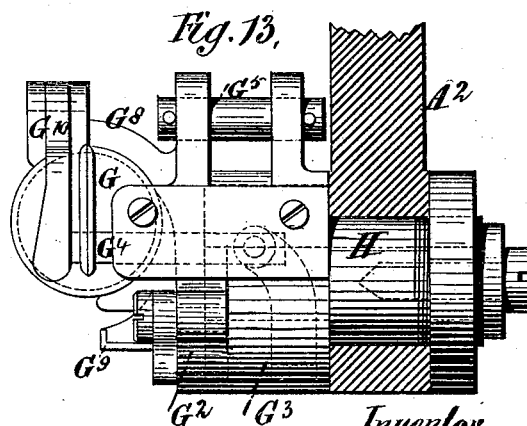


Fig. 13.

Witnesses.  
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(Model.)

10 Sheets—Sheet 7.

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MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.

Fig. 20.

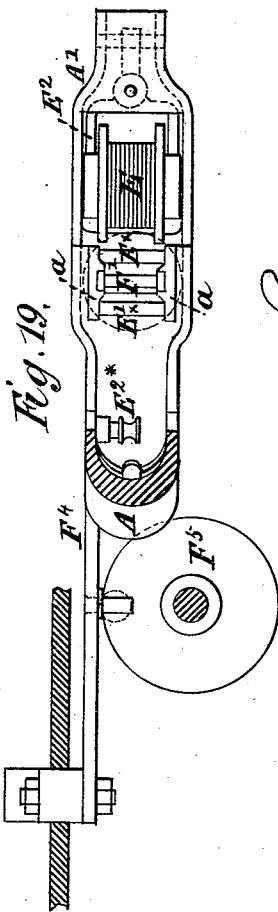
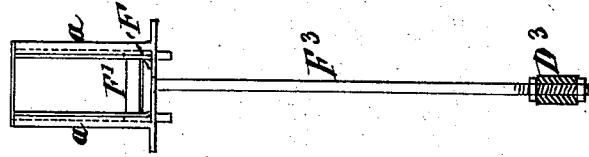
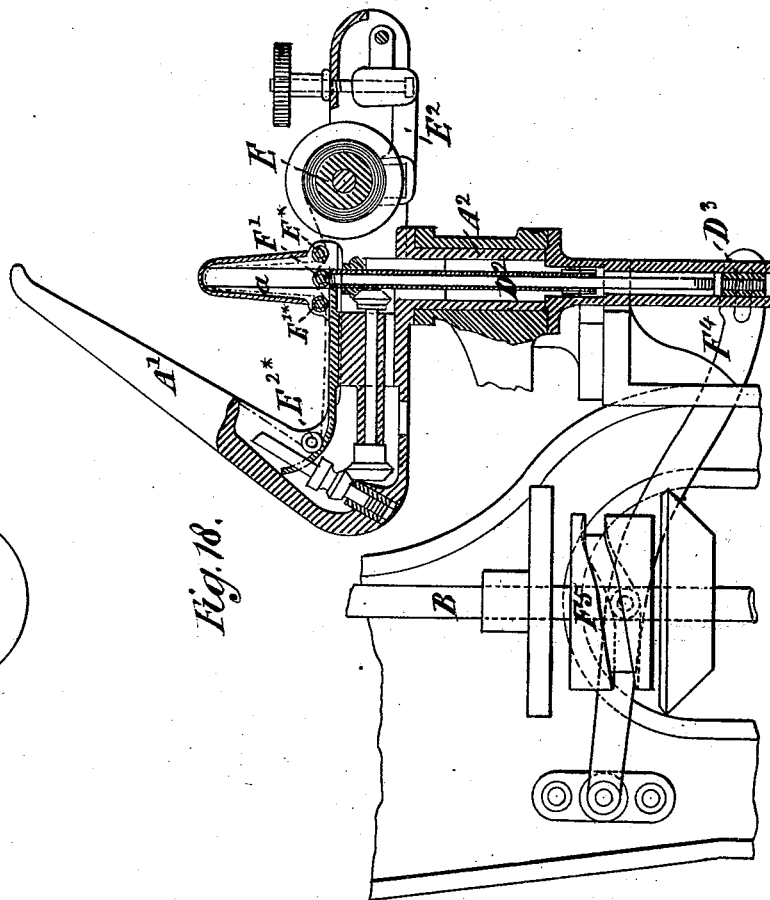


Fig. 18.



Witnesses.  
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(Model.)

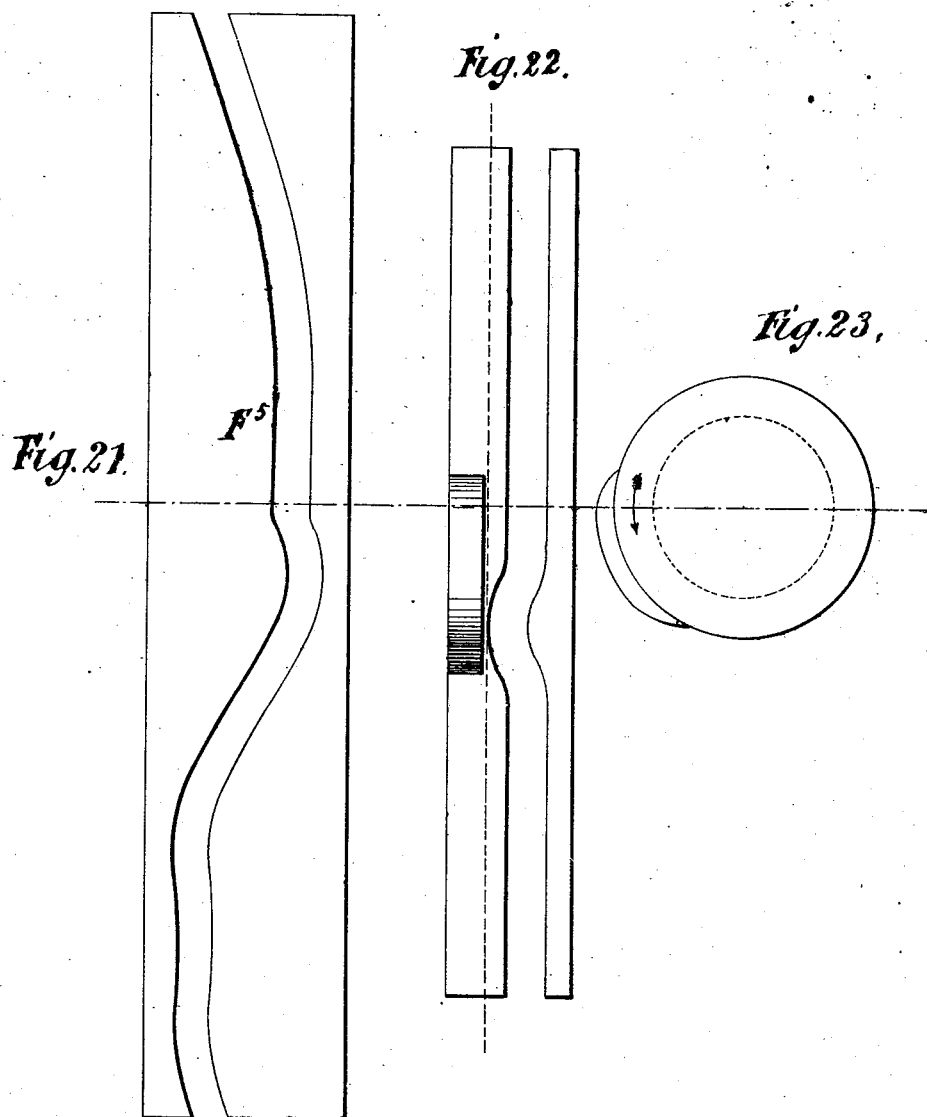
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A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.



Witnesses.  
Thomas E. Birch.  
Geo. Wagner

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P. H. H. H.



(Model.)

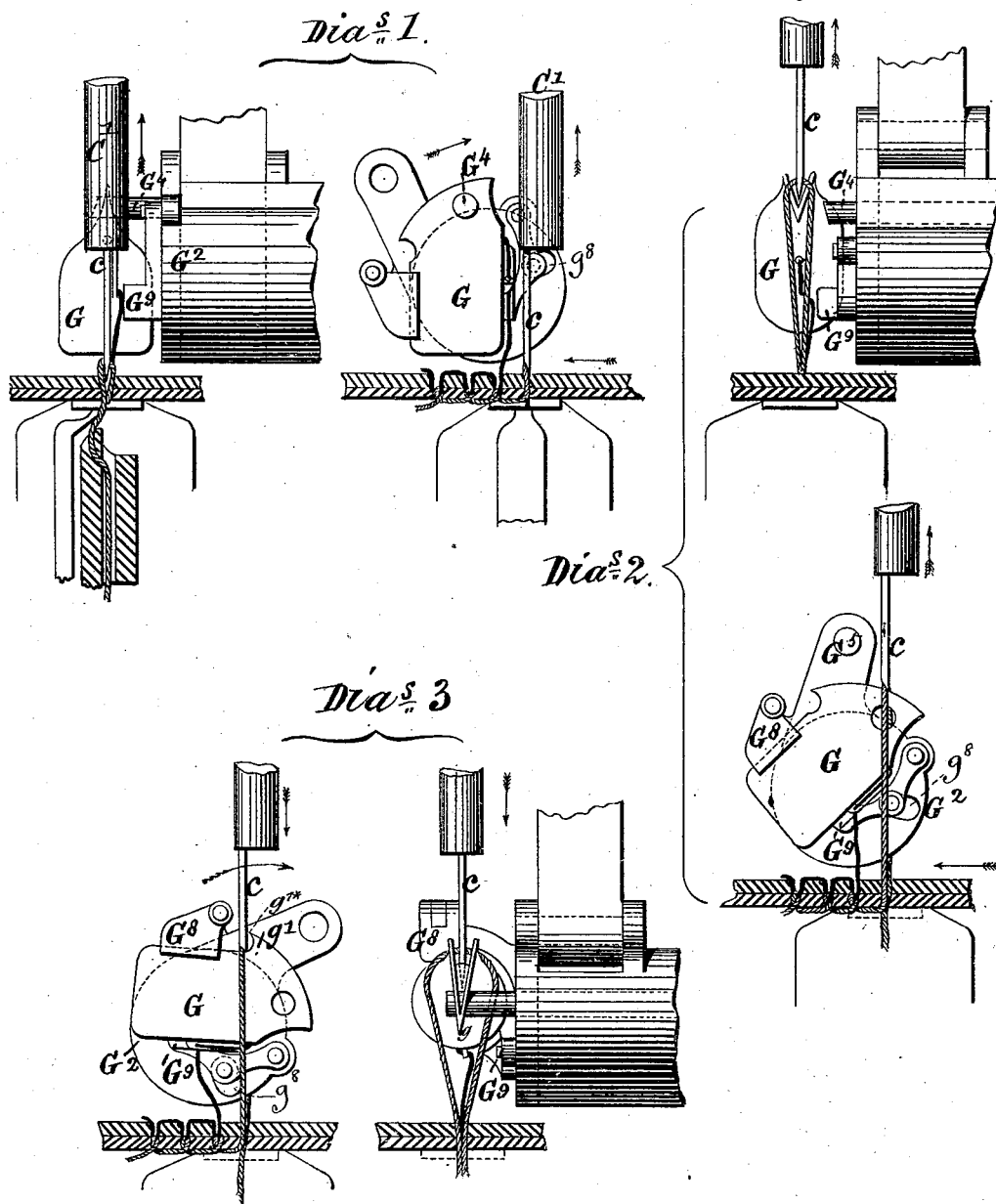
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MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.



Witnesses  
Thomas E. Birch  
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(Model.)

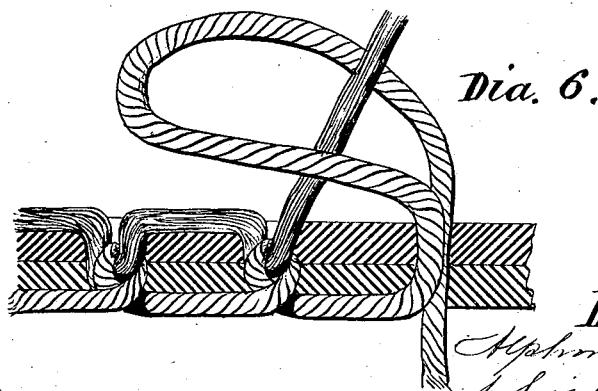
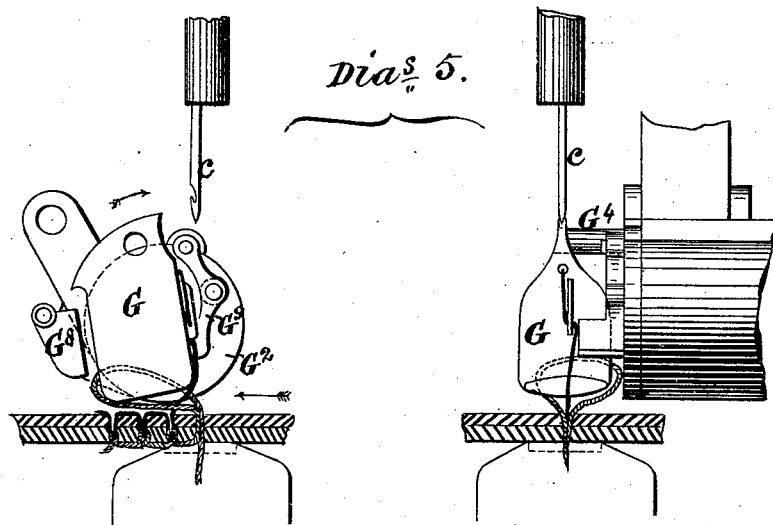
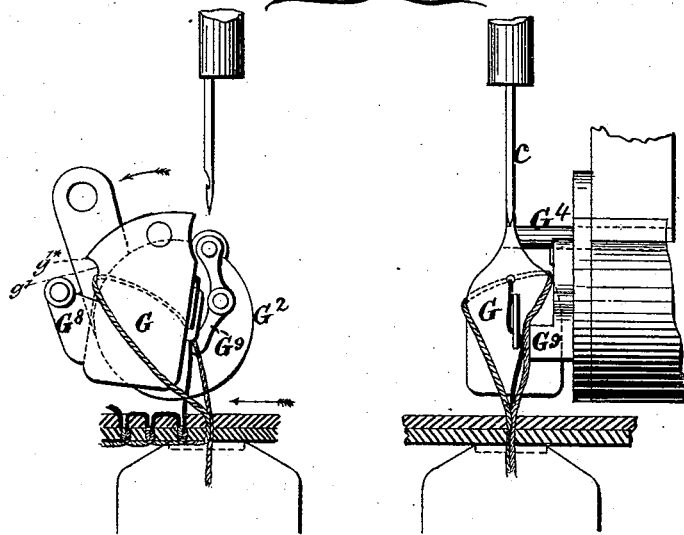
10 Sheets—Sheet 10.

A. KEATS.

MACHINE FOR SEWING BOOTS AND SHOES.

No. 260,990.

Patented July 11, 1882.



Witnesses.  
Thomas E. Birch  
Bro. Haynes

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by his Attorneys  
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# UNITED STATES PATENT OFFICE.

ALPHONSO KEATS, OF NEWCASTLE-UNDER-LYNE, COUNTY OF STAFFORD,  
ENGLAND.

## MACHINE FOR SEWING BOOTS AND SHOES.

SPECIFICATION forming part of Letters Patent No. 260,990, dated July 11, 1882.

Application filed April 1, 1881. (Model.) Patented in England June 28, 1879, No. 2,619, and December 23, 1879, No. 5,252; in Germany December 25, 1879, No. 12,790; in France December 26, 1879, No. 134,306, and in Austria May 4, 1880, No. 15,800.

*To all whom it may concern:*

Be it known that I, ALPHONSO KEATS, of Newcastle-under-Lyne, in the county of Stafford, England, have invented certain Improvements in Sewing Machinery to be Used in the Manufacture of Boots and Shoes, of which the following is a specification.

This invention relates to improvements on that class of wax-thread sewing-machines in which a hooked needle and whirl are employed, the objects being, first, to permit of a more rapid action of the machine than heretofore, and, secondly, to tighten the stitch and to time this action with respect to the movements of the feeding-instrument. The first of these objects I obtain by the use of a novel construction of rocking shuttle, which will allow of the insertion of a large supply of shuttle-thread, and which will act as a loop-opener, thereby rendering it unnecessary to use a special instrument for that purpose. The object of the second improvement I secure by employing a rocking lever carrying a guide-pulley for the thread, which lever serves to draw off the requisite supply of thread from the bobbin, deliver it to the whirl, provide the slack thread for the rising hooked needle, and take up the slack when the shuttle has passed through the loop, thereby drawing the shuttle-thread into the work, and by timing this action with respect to the movements of the feeding-instrument, as hereinafter explained, avoiding the cutting or indenting of the leather on the line of progress of the stitching by the pull of the needle-thread.

In Sheets I, II, and III of the accompanying drawings I have shown my invention as applied to what is known as a "post machine," but it is equally applicable, with obvious modifications, to what is known as the "horn machine." This I have also illustrated in Sheets IX and X, a top feed being in such case required for moving the work under the needle. Figure 1, Sheet I, shows the improved sewing-machine in side elevation, partly in section. Fig. 2, Sheet II, is an end elevation of the same, also partly in section. Figs. 3, 4, 5, and 6, Sheet III, are horizontal sectional plan views taken on the lines 1 2, 3 4, 5 6, and 7 8, respectively,

of Fig. 1. The figures in Sheets IV, V, and VI are full-size details of the shuttle and its carrier. The other figures will be herein-after referred to.

A A A, Figs. 1 and 2, indicate the hollow base, the standard, and the bracket-arm, which serve to carry the working parts of the machine, the same being cast in one piece. Standing up from the base is the short hollow post A', which serves to support the work, and in it the whirl for laying the thread in the hooked needle is mounted. The bracket-arm carries at its forward end the guides for the hooked needle-bar and presser-bar, as usual, and pendent from it is a bracket, A<sup>2</sup>, which serves to support the shuttle-carrier, and also a fixed cam for actuating the mechanism for holding the shuttle in position.

B is a vertical shaft, mounted in bearings in the standard and projecting below the base of the machine. Upon this shaft are mounted the rotating cams employed for operating the various parts of the sewing-machine. C is the hooked needle, fitted to the needle-bar C', which is pivoted to a rock-lever, C<sup>2</sup>, mounted on the bracket-arm. This lever is operated, as usual, by a cam, C<sup>3</sup>, on the cam-shaft B.

Within the post A' is mounted the whirl D, which is supplied with thread from a bobbin, E, mounted in an adjustable frame, E', at the side of the base of the machine. This whirl D is tubular, and on its periphery a helical groove is cut to receive a driver, which is carried by a rock-lever, D'. The pivot-pin of this rock-lever has its bearings in the sides of the hollow base, and it is actuated by a grooved cam, D<sup>2</sup>, on the cam-shaft B, its groove receiving an anti-friction bowl carried by the tail of the rock-lever D'. The needle-thread is led off the bobbin E to a guide-pulley, E\*, whence it passes to a tension-pulley, F', that guides it to the center of the whirl, which lays by its axial motion the thread in the hook of the needle in the usual manner. The tension-pulley F' receives the requisite motions for following the needle in its descent and drawing down the slack thread, tightening the stitch, and taking off a fresh supply of thread from the bobbin E.

G is the shuttle, the construction of which

is clearly shown at Figs. 7, Sheet IV. This shuttle G may be described as a short hollow cylinder, closed at bottom and terminating at its other or upper end in a knife-edged nose,  $g$ , which forms a divider for the loop of the waxed needle-thread. This nose takes a segmental shape, receding rearward from the point, which point is in line, or nearly so, with the under side of the cylindrical part of the shuttle when the shuttle is in a horizontal position. This segmental-shaped divider terminates at its broadest part in a shoulder,  $g^*$ , which is formed by making a transverse semicircular recess,  $g'$ , between it and the cylindrical part of the shuttle. The upper or back edge of the divider is recessed longitudinally at its rear, as at  $g^2$ , to permit of the hooked needle entering the shuttle and thereby disengaging it from the needle-thread, as will be hereinafter more fully explained.

The shuttle is made to open to receive the shuttle-thread cop, Fig. 7\*, Sheet IV, by the removal of the upper part from the lower part, the two parts fitting together like the lid and body of a pounce-box. The thread is drawn out from the shuttle through a hole,  $g^3$ , formed in the side thereof, heat being applied in the usual way to facilitate the withdrawal of a waxed thread. The nose of the shuttle is pierced transversely, as at  $g^4$ , to receive a sliding bolt, by which the shuttle is at times held in suspension. This bolt and the gripping apparatus, which forms part of the shuttle-carrier, are the instruments by which the shuttle is operated and caused to enter and pass through the loop of the needle-thread.

I have said that the shuttle-carrier is mounted in a pendent bracket,  $A^2$ . This carrier, without its fittings, is shown detached in several views in Sheet V: in plan view at Fig. 8, in sectional elevation at Fig. 9, and in end view at Fig. 10. In Sheet VI the carrier is shown with its fittings attached—viz., with the gripper for holding the shuttle, and with the bolt for suspending the shuttle. Fig. 11 is a side view of the complete carrier with the shuttle in place, and showing also the position of the needle at the time the shuttle is hanging from the bolt. Fig. 12 is a front view, and Fig. 13 a plan, of the shuttle-carrier complete. Fig. 14, Sheet V, is a vertical central section of the carrier, showing the mode of mounting the same and the fixed cam which serves to operate the suspending-bolt and the gripper.

$G'$  is a trunnion which works in a bearing formed for it in the fixed cam H, attached to the bracket  $A^2$ . On the front end of this trunnion is a disk,  $G^2$ , which is flanged rearward, as at  $G^3$ . This flange  $G^3$  serves to carry a sliding bolt,  $G^4$ , which enters the hole  $g^4$ , made through the nose of the shuttle for the purpose of supporting the same at certain parts of its motions. From this flange projects an arm,  $G^5$ , which is represented as having a fork and pin connection with the arm of a rock-shaft,  $G^6$ , mounted on dead-centers at the side of the bracket-arm A, but which may be geared

by toothed sectors with said arm of said rock-shaft  $G^6$ . This rock-shaft receives through a second arm a rocking motion from the cam  $G^7$  on the cam-shaft B, for the purpose of imparting a reciprocating axial motion to the shuttle-carrier. From the face of the disk  $G^2$  projects a horn or abutting piece,  $G^8$ , against which the shuttle G is held fast by means of the gripper  $G^9$ , (shown detached at Figs. 15, Sheet IV,) pivoted to a lug standing up from the flange  $G^3$ .

By reference to Figs. 8, 9, and 10 it will be seen that the parts marked  $G'$ ,  $G^2$ ,  $G^3$ ,  $G^5$ , and  $G^6$  constitute one casting. The disk  $G^2$  is slotted, as shown at  $g^8$  in Fig. 10, and also partly shown in Fig. 12, to permit of a bowl attached to the gripper  $G^9$  entering a groove,  $g^9$ , in the face of the fixed cam H, which is shown detached at Figs. 16, Sheet V. By means of this cam the gripper (when the shuttle-carrier is turned in its bearings) will be caused to close upon the rear end of the shuttle or to release its grip therefrom, as required. Immediately below the bolt  $G^4$  the flange  $G^3$  is slotted, to permit of a bowl which depends from the bolt entering a groove in the periphery of the fixed cam H. This groove is so formed as to insure the advance of the bolt to engage with the shuttle and the withdrawal of the bolt from the shuttle at the required moment, so that the shuttle may be held thereby when released from the pressure of the gripper  $G^9$  and withdrawn when the shuttle is on the point of entering the loop of the needle-thread. To prevent the shuttle from slipping off the bolt, a finger,  $G^{10}$ , is provided, which is hinged to the horn  $G^8$ , and is free to be shifted out of position when the shuttle is required to be removed. This finger is shown detached at Figs. 17, Sheet IV. The motions of the bolt  $G^4$ , as well as those of the gripper, will be produced by the action of the cam H, as the shuttle-carrier is moved around it by the pendent arm of the rock-shaft  $G^6$ . The varying positions, also, of the shuttle, for entering the loop and passing through the loop when it is disengaged from the hooked needle, more particularly referred to hereinafter, are also obtained from the reciprocating action of the shuttle-carrier.

I is the presser-foot, carried by the presser-bar  $I'$ , which is held down by a helical spring,  $I^2$ , as usual. This presser-foot is enabled to resist the upward pull of the needle-thread by means of a reciprocating bar or rock-lever,  $I^3$ , a pin from the forward end of which overlies a projection on the side of the presser-bar. This rock-lever is carried by a fulcrum-pin on the bracket-arm, and is fitted at its rear end with a bowl, which is operated by a tappet-cam,  $I^4$ , on the cam-shaft B. This cam is of the form of a disk, having upon its face a tappet-projection, (shown in plan view, Figs. 3 and 4,) so shaped as to hold the forward end of the lever down at the moment the upward pull of the needle-thread takes place, and immediately this action has passed the presser-foot will be free, so as to permit of the feed of the

work under it. The drawings show an under feed; but a top feed might be employed, if thought desirable. In this particular class of machine, K is the feed-bar, which stands up in the post A' and projects through the slotted cap or cover thereof to bear against or reach the work. This bar is pivoted to a slide, which is free to work up and down in guides formed to receive it in a fixed bracket, K', attached to the base of the machine. The lower end of this feed-bar is connected by a ball-and-socket joint to a rock-lever, K<sup>2</sup>, the pivot-pin of which is carried by a vertical swivel-pin, K<sup>3</sup>, (within the base A,) forked at its upper end to receive the lever. By thus mounting the rock-lever K<sup>2</sup> it is free to move horizontally as well as vertically under the action of a double-acting feed-cam, K<sup>4</sup> K<sup>5</sup>, mounted on the cam-shaft B. The rear end of the rock-lever K<sup>2</sup> is forked, and each prong of the fork is fitted with an anti-friction bowl—the one to enter a groove in the periphery of the cam K<sup>4</sup>, which is the lifting-cam, and the other to bear upon the periphery of the cam K<sup>5</sup>, which is the feeding-cam. These cams are shown as laid out in the diagrams Figs. 2<sup>a</sup> and 2<sup>b</sup>, Sheet IV, and their timed relation to the stitch-tightening cam, hereinafter referred to, is indicated by the dotted line which passes through the three diagram figures, it being important for the efficient action of the stitch-tightening apparatus, which forms the second head of my invention, that the relative turning of these cams should be exactly determined.

The pulley F', which rises with the needle, as before mentioned, and serves also to tighten the stitch, is carried by a rock-lever, F, which rocks on a fulcrum-pin carried by a hollow base. This rock-lever F carries at its rear a bowl, which enters a groove in the periphery of a cam, F<sup>2</sup>, on the cam-shaft B. This cam (which is shown as laid out in the diagram Fig. 2<sup>a</sup>, Sheet IV) by its rotation imparts the requisite rocking motions to the lever F for following the needle in its ascent, drawing down the slack thread to tighten the stitch, and taking off a fresh supply of thread from the bobbin E, and slackening the thread at the proper time relatively to the motion of the feed-bar and the whirl. The bobbin E, (see Fig. 4, Sheet III,) I mount upon an adjustable frame, E', from which stand up two pins—the one to receive the bobbin and the other an elastic pressure-finger, E<sup>2</sup>. This frame is carried by a fixed stud, E<sup>3</sup>, projecting from a lug on the base of the machine, and it is held fast to the base by means of an adjusting-screw, E<sup>4</sup>. The elastic finger E<sup>2</sup> serves merely to put the requisite tension on the thread.

Supposing that it is required to sew two pieces of leather together, these are placed upon the post A', and the hooked needle C, being caused to descend, will pierce the work, and, passing down into the center of the whirl D, will receive its thread therefrom. The needle, then rising through the work, will present its

loop to the shuttle G to receive a locking-thread therefrom. The shuttle-carrier will then be caused to rock forward in the direction of the arrow, Fig. 2, and thereby advance the nose of the shuttle, causing it to enter the loop and to take a horizontal, or nearly horizontal, position therein. When the shuttle-carrier commences its rocking motion to bring the shuttle into this position the shuttle will be held both by the gripper G<sup>3</sup> against the abutting piece G<sup>8</sup> and by the bolt G<sup>4</sup>; but so soon as the nose of the shuttle commences to divide or open the loop of the waxed needle-thread the bolt G<sup>4</sup> will by the action of the fixed cam H be withdrawn from the shuttle, leaving the shuttle free to take a horizontal position. When this position of the shuttle is attained the needle will descend into the recess g', cut in the back of the segment-shaped termination of the shuttle to a depth sufficient to release the loop from its hook and leave it resting upon the shuttle. At this moment the rock-lever F, below the base of the machine, will be caused to put a tension on the needle-thread, the result of which will be to make the loop slip over the shoulder g'' back to the bottom of the recess g', and out of line of motion of the needle. The loop having slipped out of the plane of motion of the needle, the needle will then be free to rise, and when it is moved up above the path of the shuttle the further movements of the shuttle will take place. For this purpose the shuttle-carrier is rocked backward by means of the arm on the rock-shaft G<sup>6</sup>, actuated by the cam G<sup>7</sup>, as before explained, and during this back movement of the carrier the cam H will be caused to advance the bolt G<sup>4</sup> and thrust it into the hole g<sup>4</sup> in the nose of the shuttle. The further back motion of the shuttle-carrier will cause the arm H to release the gripper G<sup>3</sup>, and thereby leave the shuttle suspended on the bolt. The continued downward movement of the rock-lever F will by putting a tension on the needle-thread draw the loop off the shuttle, its release being assisted by the tendency of the shuttle to move in the direction of the pull of the thread. When the shuttle has passed through the loop, the loop will be caught by the shuttle-thread, and the rock-lever F will by continuing its downward motion draw down the loop of the needle-thread and tighten the stitch in the work. The rock-lever, having done this, will descend farther to the dotted position of Fig. 1, and thereby draw off a fresh supply of thread from the bobbin E. The cam F<sup>2</sup>, which actuates this lever, is so cut (see Fig. 2<sup>a</sup>) as instantly to slacken the tension when the fresh supply of thread has been obtained, and thereby to provide sufficient slack for the feed of the work and the subsequent action of the whirl. This tightening of the stitch, it will be seen, is effected by the direct downward pull of the needle-thread by the lever F and its pulley F', and hence the indentation of the leather by the thread in the line of the stitches is avoided. I also avoid

the scraping of the wax from the thread, which is due to the needle-thread coming in contact with and being strained over some hard edge or surface between the work and the bobbin, where it is very liable to be frayed. This injurious result I avoid by so timing the feed that it shall immediately follow the tightening of the stitch and be contemporaneous with the rise of the lever to slacken the thread for the next succeeding action of the whirl. As this is clearly illustrated by the group of diagrams Figs. 2<sup>a</sup>, 2<sup>b</sup>, and 2<sup>c</sup>, no further explanation of the relations of the motions of the feed-bar and stitch-tightener to each other will be required.

The feed of the work forward the length of a stitch is done by means of the feed-bar K in the usual manner, and so soon as that operation is effected the needle, which is meanwhile making its descent, will pierce the work, pass into the whirl, and receive thread therefrom as before. The needle will then rise to draw a fresh loop through the work, and as it rises the rocking lever F will follow its movement, in order to give out such a supply of thread as will prevent any undue strain being put upon the loop. So soon as the needle commences to rise the shuttle-carrier will commence a forward rocking motion, and it will thereby cause the cam H to close the gripper G<sup>9</sup> onto the heel of the shuttle and withdraw the bolt from the nose thereof. The shuttle will then be caused to repeat the various movements traced out above for the purpose of entering the loop brought up by the needle, releasing the loop from the needle, and by passing through that loop to deliver its locking-thread into the loop of the needle-thread.

To render this series of motions more clear, I have appended to the drawings a series of diagrams, from which the progress of the entering of the shuttle into the loop of the needle-thread and the laying of the shuttle-thread therein and the tightening of the loop upon that thread may be clearly traced.

The diagrams 1, Sheet VII, show in front and side elevation the position of the parts when the needle-hook C, having descended into the whirl and received a thread in the hook of the needle, is commencing to pull the loop of thread through the work. At this time the shuttle G is held at the nose by the bolt G<sup>4</sup> and gripped between the horn G<sup>8</sup> and the gripper G<sup>9</sup>. The shuttle-thread (indicated by the black line) issues from a hole, g<sup>3</sup>, in the shuttle-case and leads down to the previously-formed stitch. For the purpose of putting a tension on this thread it may be threaded through holes formed in a projecting rib on the case of the shuttle in the manner well known.

Diagrams 2 show the needle rising to its highest position, the loop being entered by the nose or divider g of the shuttle and the bolt G<sup>4</sup> being momentarily withdrawn for the passage of that part of the shuttle through the loop. The disk G<sup>2</sup> is rocked in the direction of the

arrow, and the shuttle is held and moved solely by the horn and gripper G<sup>8</sup> and G<sup>9</sup>.

Diagrams 3 show the disk G<sup>2</sup> rocked to its farthest position in the direction of the arrow, the shuttle being then held in a horizontal position by both the bolt G<sup>4</sup> and the horn and gripper. The loop is now carried past the shoulder of the divider. The needle-hook, then descending, leaves the loop resting on the shuttle, and the reversal of motion of the disk G<sup>2</sup> causes the loop to be caught in the recess g' and carried by the shoulder g'\* from the path of the needle in a backward direction.

Diagrams 4, Sheet VIII, show the disk G<sup>2</sup> rocked in the direction of the arrow, so as to cause the loop of the needle-thread to fall downward onto the back of the shuttle; but it is still prevented from falling off the shuttle until the lower part is free from the gripper G<sup>9</sup>. The shuttle-thread is in this position nearly through the loop of the needle-thread.

Diagrams 5 show the farthest rocking motion of the disk G<sup>2</sup> in the direction of the arrow, by which time the gripper G<sup>9</sup> releases its hold of the shuttle, which thus hangs free on the bolt G<sup>4</sup>, falls forward, and allows the loop of the needle-thread to fall from between the back of the shuttle and the horn G<sup>8</sup>, when it is immediately drawn down and the stitch tightened by the special apparatus above described, thus forming a stitch similar to the one shown in the enlarged view at Fig. 6.

The work, it will be understood, is held by the presser-foot during the operations above enumerated, it being enabled to resist the upward pull of the needle-thread by means of the retaining-pin of the reciprocating bar or lever I<sup>3</sup>, resting on the shoulder of the presser-bar.

In adapting the stitch-tightening apparatus to the "swivel-horn" sewing-machine, which, as is well known, is required for sewing the outer sole of boots and shoes to the insole, I mount the apparatus upon the swinging horn, in order that it may follow the motions of that instrument.

Sheet IX, Fig. 18 shows in sectional elevation, and Fig. 19 in sectional plan view, so much of a swivel-horn machine as will explain the mode of applying thereto the stitch-tightening apparatus above described. A' is the swivel-horn, upon the elevated end of which the work to be sewed is placed, and within this extremity of the horn the whirl is mounted, as usual. The horn A' is carried by a hollow trunnion, A<sup>2</sup>, through which motion is conveyed to the whirl, as usual. Mounted on the horizontal extremity of this horn A' is the bobbin E, which carries the needle-thread or thread for the whirl. This bobbin is provided with friction-surfaces to receive the pressure of an adjustable forked brake-lever, E<sup>2</sup>.

Standing up from the hollow center A<sup>2</sup> of the horn is a pair of guides, a, for guiding a sliding frame, F, which carries a roller, F', of a length corresponding with that of the bobbin E and mounted parallel thereto. This

frame F (see the detached view, Fig. 20) is supported by a vertical rod, F<sup>3</sup>, which passes down the hollow trunnion A<sup>2</sup>, and is fitted loosely at its lower end with a collar, D<sup>3</sup>. Projecting horizontally from this collar is a pin, which passes through a vertical slot in a pendent bracket, from the bearing in which the trunnion A<sup>2</sup> works. The pin, after passing through this vertical slot, engages with a rock-lever, F<sup>4</sup>, which is slotted at its free end to receive the pin. This rock-lever is mounted upon a stud-pin projecting from the main framing, and it carries at its side a bowl, which enters a groove in the periphery of a cam, F<sup>5</sup>, of the cam-shaft B. By the rotation of this cam F<sup>5</sup> the rock-lever is caused to impart an up-and-down motion to the frame F, for the purpose to be presently explained. The thread from the bobbin E is led under a guide-pulley, E\*, carried by the horn, thence over the roller F', and down under a guide-pulley, E'', on the horn to a guide-pulley, E<sup>2\*</sup>, which is also mounted in stationary bearings, and from this guide-pulley the thread passes up to the whirl. If, now, the rise and fall of the roller in the frame F is properly timed, it will be caused to draw off thread from the bobbin E, deliver it to the whirl during the formation of a new loop, and take up the slack, so as to tighten the stitch as soon as it is formed.

The diagram Fig. 21, Sheet X, shows the cut of cam required for properly rocking the lever F<sup>4</sup> to produce these results, and its position in the machine with respect to the feed motion is illustrated by the group of Figs. 22 and 23, the two latter figures representing respectively the lifting and feeding cams for a top-motion feed, such as is used in swivel-horn machines. By the employment of these cams in the manner indicated a reciprocating motion is imparted at the proper moment to the frame F, and the roller F' is thereby caused to draw off thread from the bobbin, slacken the thread simultaneously with the feed motion, and supply it to the whirl, take up the slack of the loop formed by the hooked needle, and tighten the stitch, as before described. To enable the stitch-tightening apparatus to do this, the cams

for actuating the feed and for working the rock-lever must be timed in the manner already described.

Having now set forth the nature of my invention, I wish it to be understood that I claim—

1. The shuttle having a knife-edged nose for dividing the loop, a grooved segmental-shaped portion in rear of said nose, and a shoulder in rear of said grooved segmental portion, substantially as and for the purpose herein described.

2. The combination, with the hooked needle and the bracket-arm which contains the guide for said needle, of a bracket pendent from said bracket-arm, an oscillating shuttle-carrier pivoted into or having its bearings in said bracket, and a shuttle supported in and operated by said carrier, the said carrier being entirely above the work, substantially as herein described.

3. The combination, in an oscillating shuttle-carrier, of the horn G<sup>3</sup>, the pivoted gripper G<sup>9</sup>, the sliding bolt G<sup>4</sup>, and a stationary cam for operating said grippers and bolt, substantially as herein described.

4. The combination, with the feeding device in a sewing-machine having a hooked needle and a shuttle above the work-support, and mechanism for operating the said device, of the rising and falling take-up roller F', its carrying-lever F, and mechanism for operating the said lever, the two said mechanisms being so timed that the operation of the said roller for tightening the needle-thread to complete a stitch shall precede the feeding movement, and the slackening of the said thread following the tightening of the stitch shall be concurrent with the feeding movement, as herein described.

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