(No Model.) 9 Sheets—Sheet 1.

J. E. BERTRAND.

SOLE SEWING MACHINE.

No. 421,541. Patented Feb. 18, 1890.

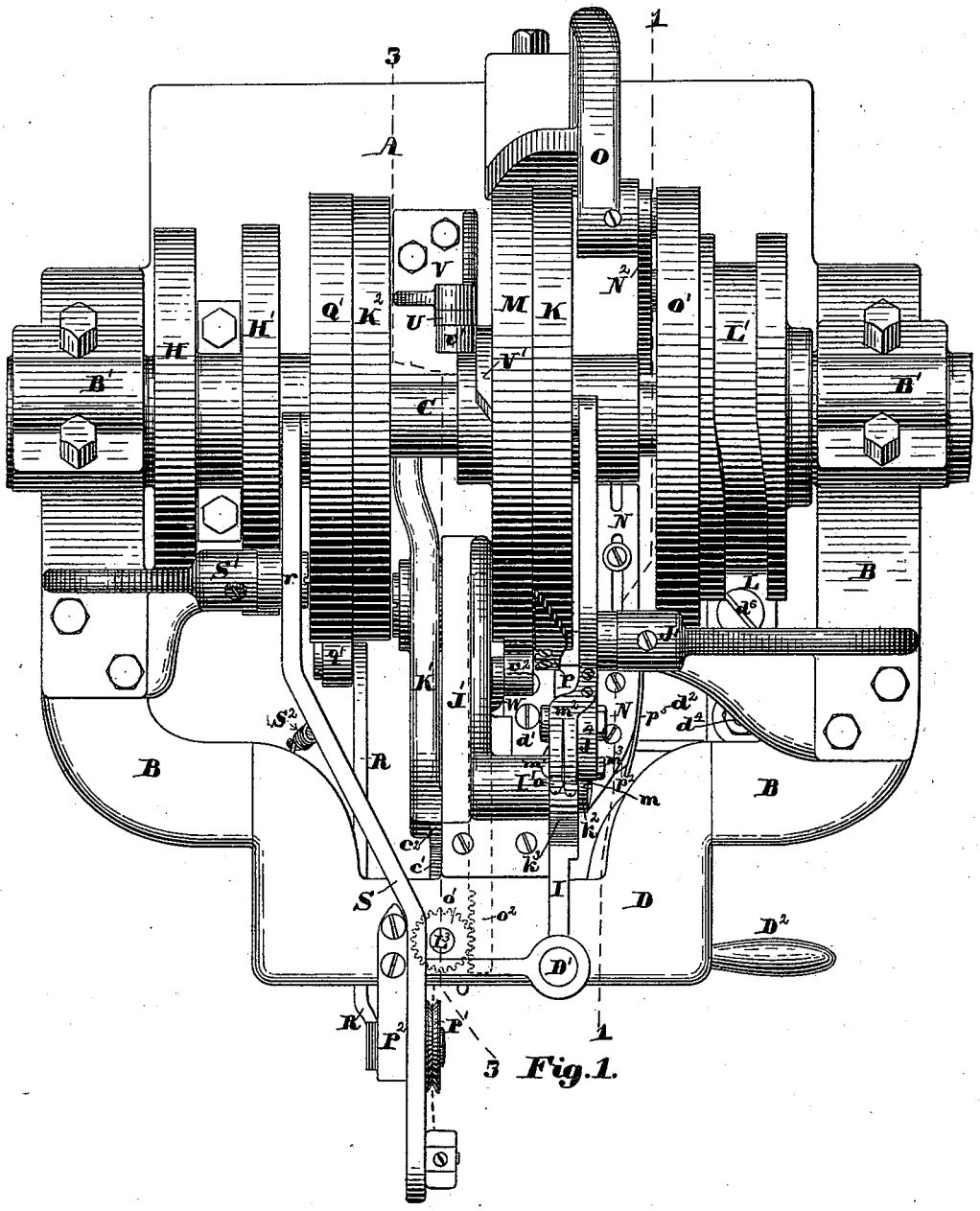

Fig. 1.

Witnesses:
Walter E. Lombard.
Henry H. Kendall

Inventor:
Joseph Eli Bertrand,
by N. C. Lombard
Attorney.

(No Model.) 9 Sheets—Sheet 2.

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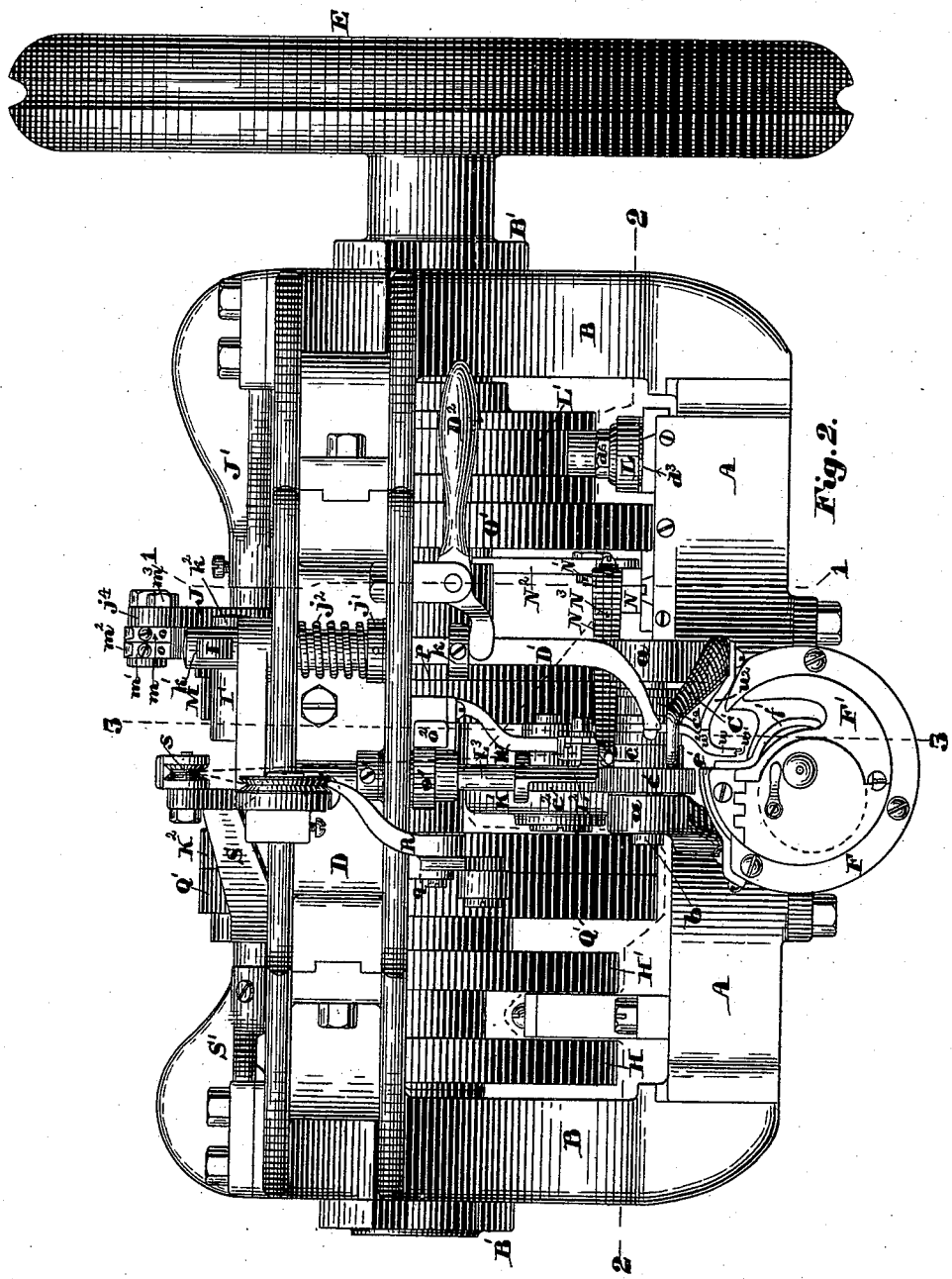

Fig. 2.

Witnesses:
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(No Model.) 9 Sheets—Sheet 3.

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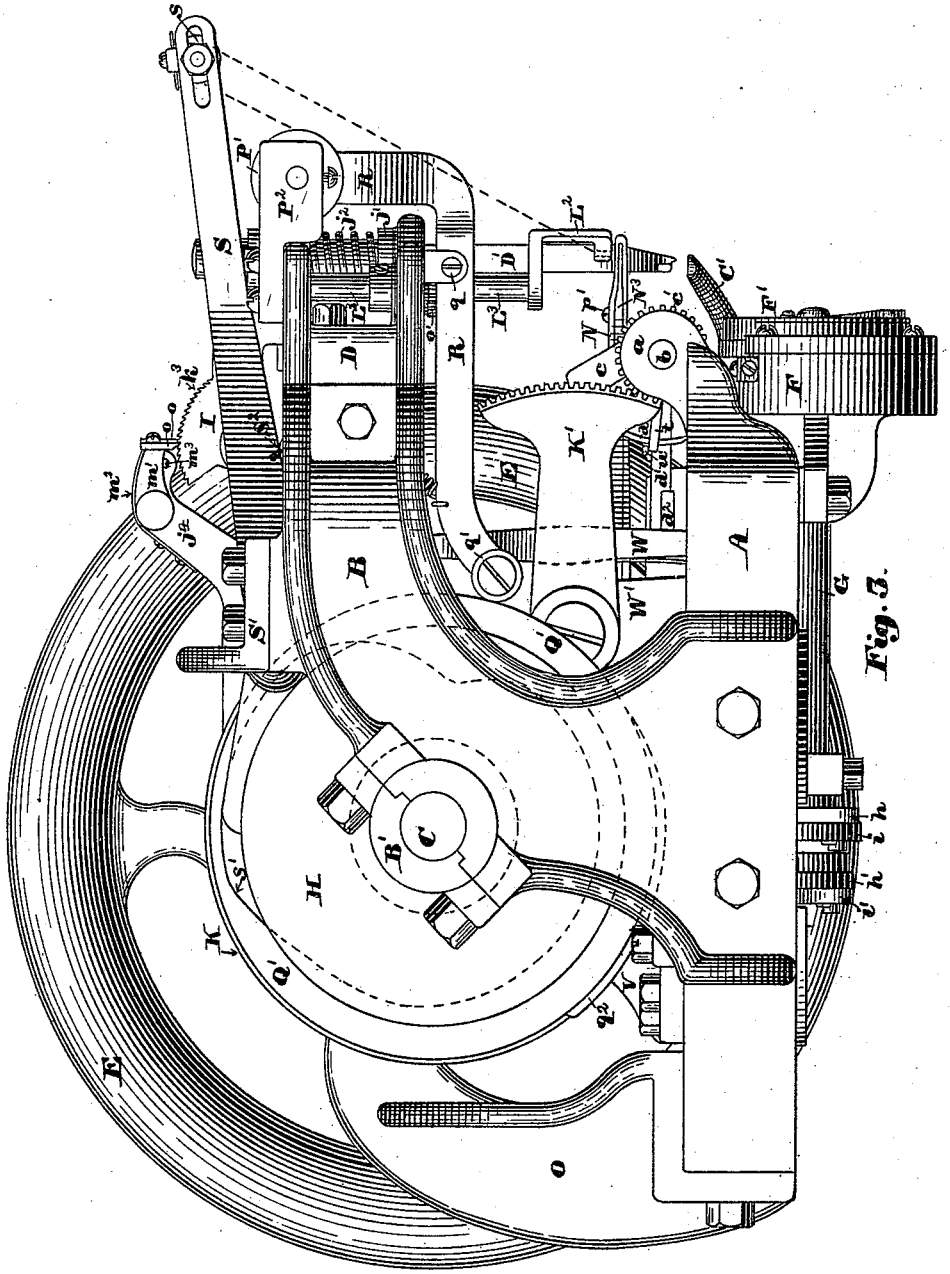

Fig. 3.

Witnesses:
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(No Model.) 9 Sheets—Sheet 4.

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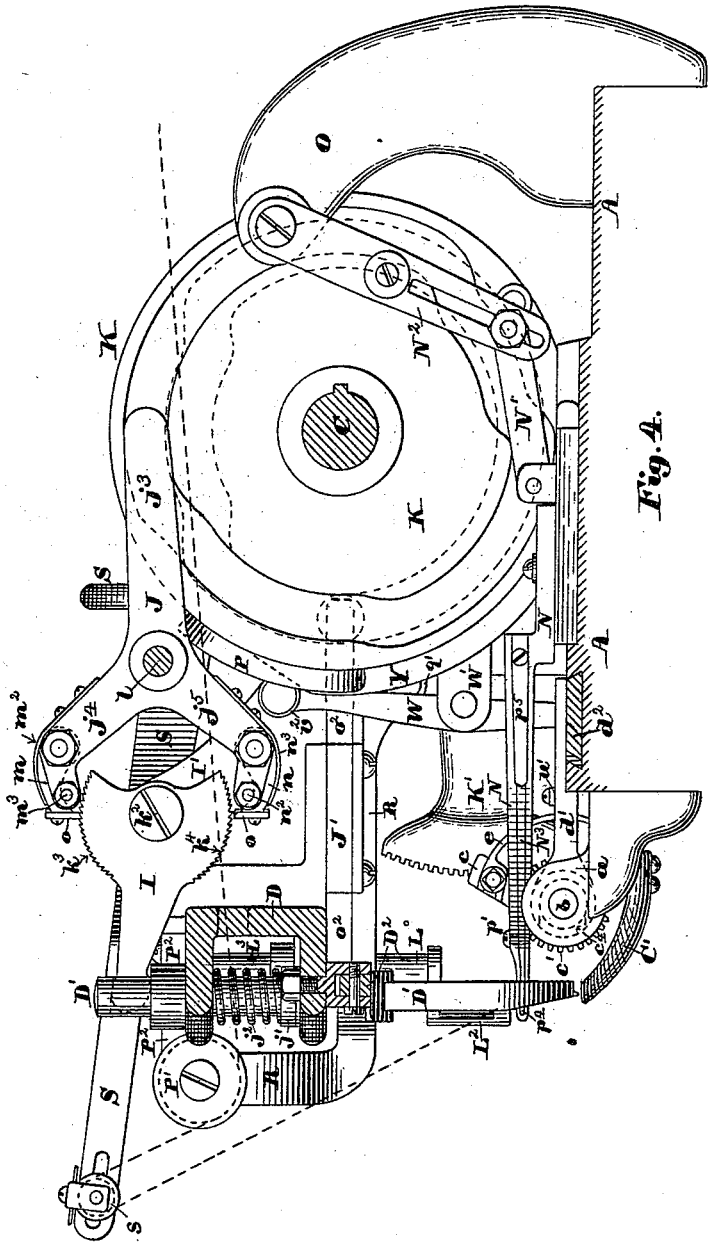

Fig. 4.

Witnesses:
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(No Model.) 9 Sheets—Sheet 5.

J. E. BERTRAND.

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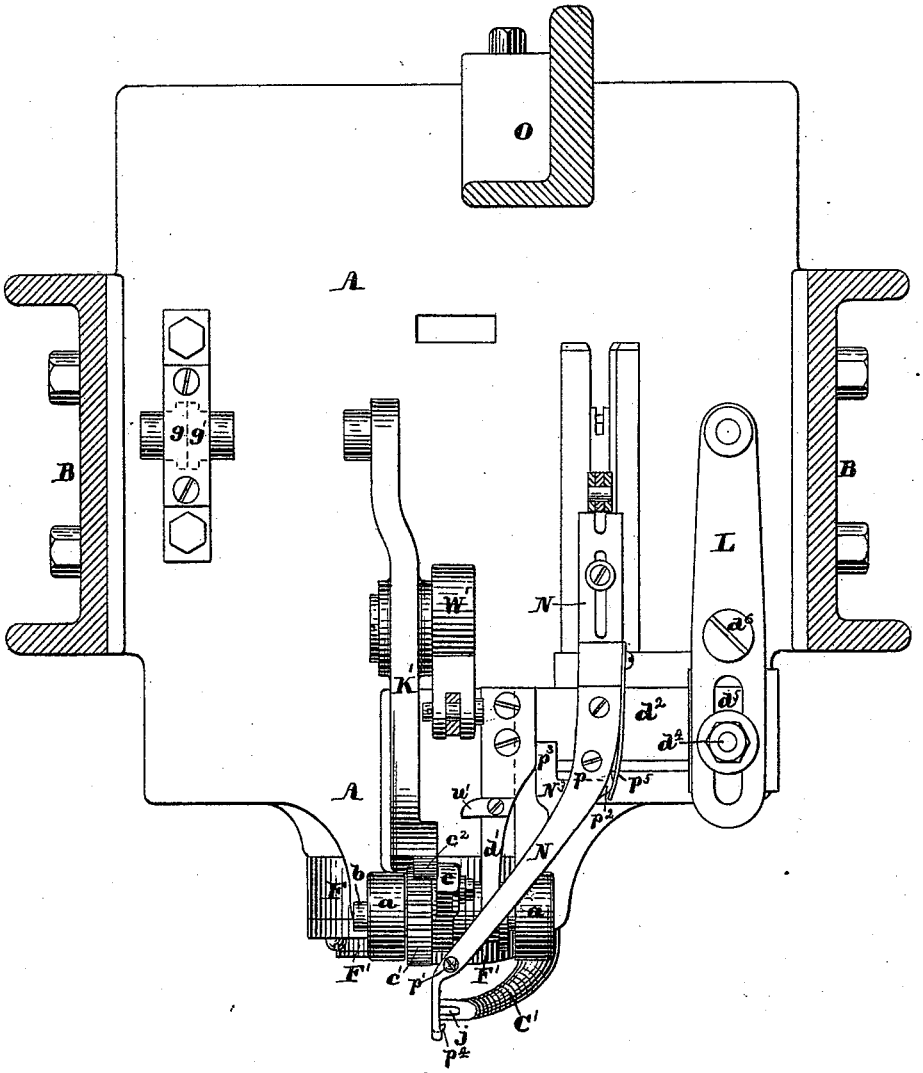

Fig. 5.

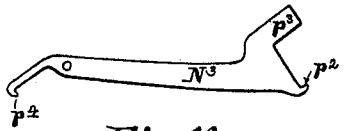

Fig. 11.

Witnesses:
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(No Model.) 9 Sheets—Sheet 6.

J. E. BERTRAND.

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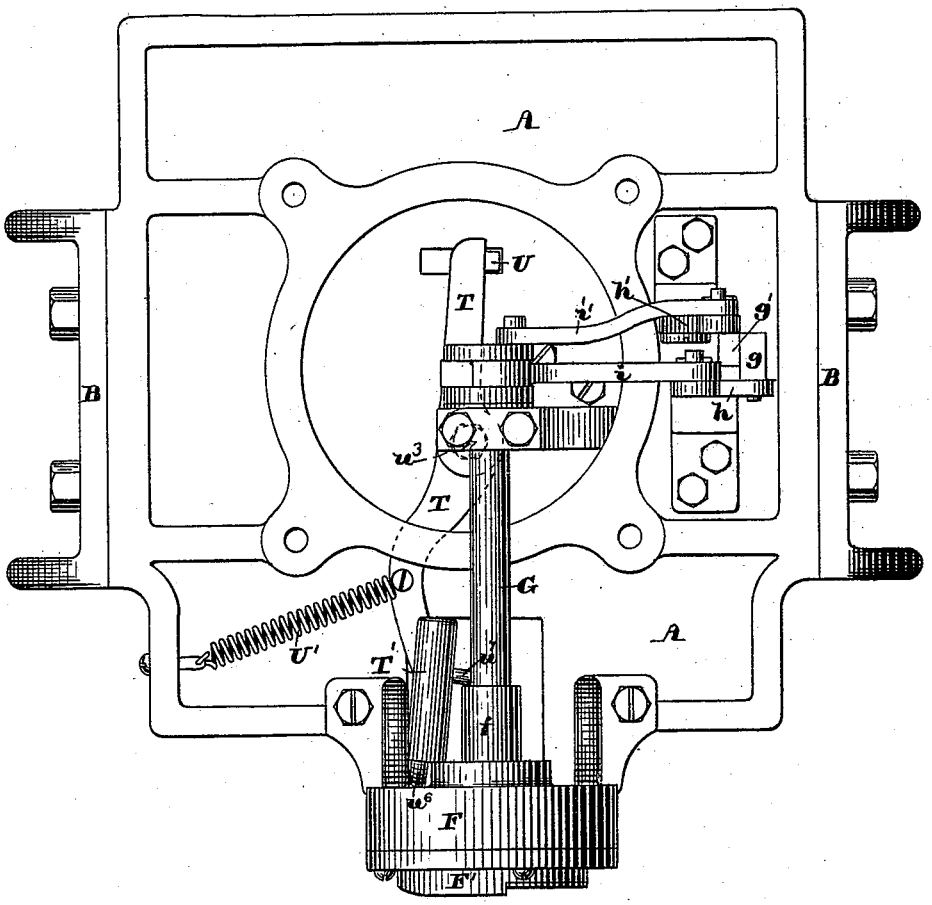

Fig. 6.

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(No Model.) 9 Sheets—Sheet 7.

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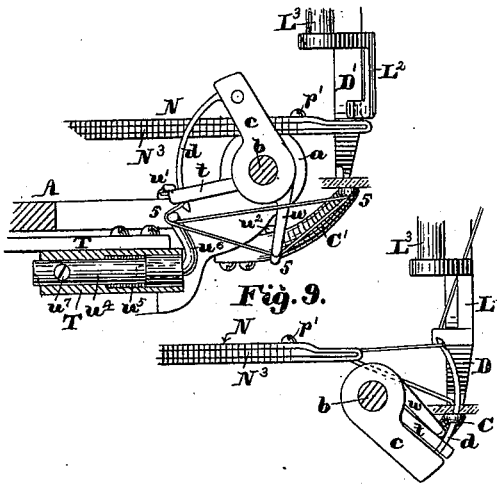

Fig. 9.

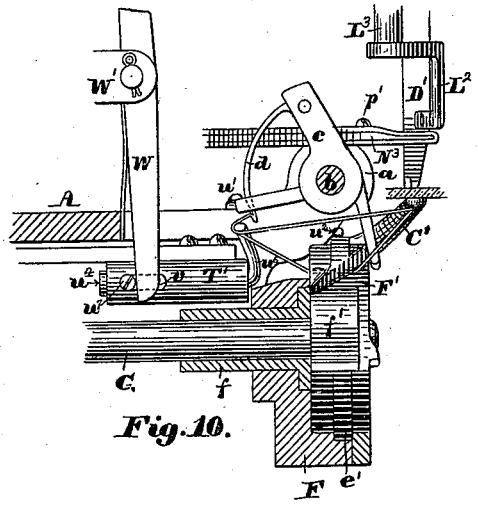

Fig. 10.

Fig. 8.

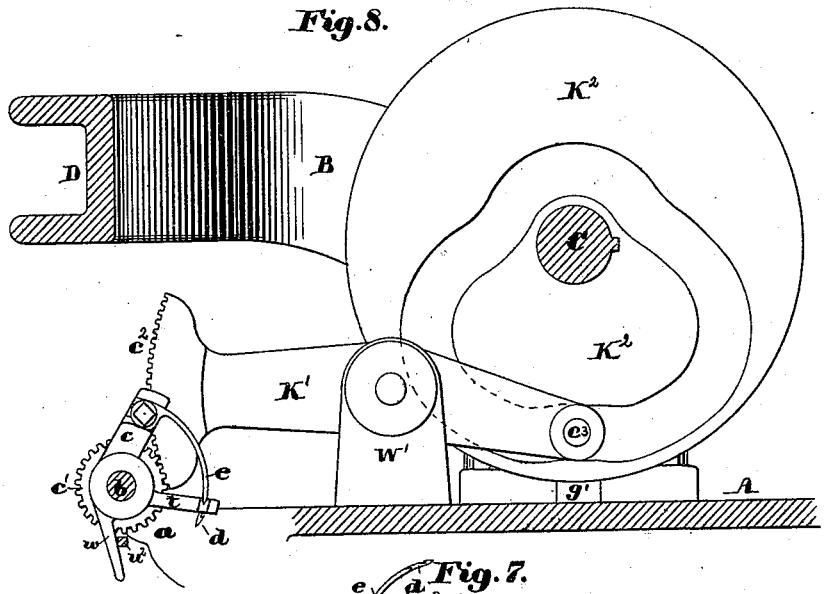

Fig. 7.

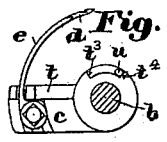

Fig. 12.

Fig. 13.

Witnesses:

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Inventor:

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by N. C. Lombard

Attorney.

(No Model.) 9 Sheets—Sheet 8.

J. E. BERTRAND.

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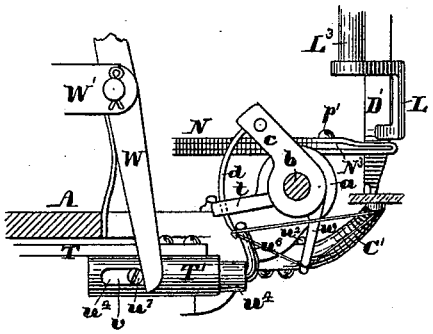

Fig. 14.

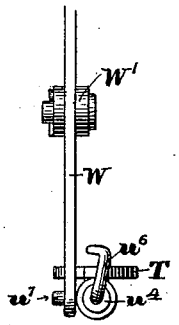

Fig. 15.

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(No Model.) 9 Sheets—Sheet 9.

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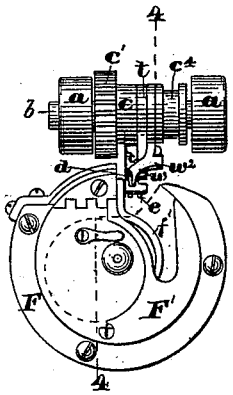

Fig. 16.

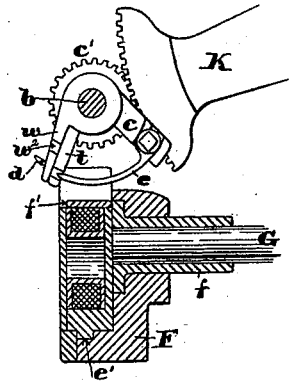

Fig. 17.

Witnesses:
C. A. McClure.
Walter E. Lombard.

Inventor:
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by N. C. Lombard
Attorney.

UNITED STATES PATENT OFFICE.

JOSEPH ELI BERTRAND, OF BOSTON, ASSIGNOR OF ONE-HALF TO MELLEN BRAY, OF NEWTON, MASSACHUSETTS.

SOLE-SEWING MACHINE.

SPECIFICATION forming part of Letters Patent No. 421,541, dated February 18, 1890.

Application filed July 29, 1889. Serial No. 319,015. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH ELI BERTRAND, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Sole-Sewing Machines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to sole-sewing machines, and is an improvement upon the machine described in another application of mine filed September 17, 1888, and serially numbered 285,775; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the drawings, and to the claims hereinafter given, and in which my invention is clearly pointed out.

Figure 1 of the drawings is a plan of a machine embodying my invention. Fig. 2 is a front elevation of the head of the machine, the supporting-column being omitted, as it constitutes no part of this invention. Fig. 3 is a side elevation of the same. Fig. 4 is a sectional elevation, the cutting-plane being on line 1 1 on Figs. 1 and 2. Fig. 5 is a sectional plan, the cutting-plane being on line 2 2 on Fig. 2. Fig. 6 is an inverted plan. Fig. 7 is an elevation of the devices for reciprocating the needle and awl, and showing a portion of the frame and bed in section, the cutting-plane being on line 3 3 on Figs. 1 and 2. Fig. 8 is a diagram illustrating the formation of a loop in the needle-thread above the work. Fig. 9 is a diagram illustrating the formation of the loop below the work, through which the shuttle is to pass. Fig. 10 is a diagram illustrating the same loop and the position of the several devices used in forming said loop when the point of the shuttle has entered said loop and cast it off from the loop-spreader. Fig. 11 is a plan of the loop-measuring hook-lever, and Figs. 12 and 13 are respectively a side elevation and an edge view of the needle and awl carrying arm and the needle-supporting guide. Fig. 14 is a diagram illustrating the positions of the several parts of the mechanism for forming the loop of thread below the work at the time when the loop-holding finger w^6 commences to move laterally toward the left-hand side of the machine to engage both strands of the loop of thread. Fig. 15 is a front end elevation of the loop-holding finger and its carrying-lever, and showing a portion of the lever that moves said finger toward the rear. Fig. 16 is a front elevation of the shuttle, its holder, the needle and awl, the needle-carrying radius-arm, the shaft for carrying said arm, and the pinion for operating the same detached from the other parts of the machine. Fig. 17 is a sectional elevation of the same, the cutting-plane being on line 4 4 on Fig. 16.

In the drawings, A is the bed of the machine, designed to be mounted upon a column or other suitable support and at the desired height.

B B are two side frames firmly secured to opposite sides of the bed A, and each provided with a bearing B′, in which is mounted the cam-shaft C, and having their front ends connected together by the tie-girt D.

The shaft C has mounted upon one end thereof the grooved fly-wheel E, by means of which and a suitable belt rotary motion may be imparted to said shaft, and also has secured thereon, between the frames B B, the several cams for imparting motion to the stitch-forming mechanism, the work-feeding mechanism, and thread-controlling mechanism.

The bed A has formed upon its front edge two ears *a a*, which project forward beyond the main line of the front edge of said bed and upward above the top face of said bed, as shown in Figs. 2 and 3, and in which are formed bearings for the shaft *b*, which has firmly secured thereon the radius-arm *c*, to the free end of which are secured the curved needle *d* and the curved awl *e* in the same manner as shown and described in my prior application before cited.

F is the shuttle-holder bolted to the front of the bed A beneath the ears *a a*, and having formed therein a circular chamber to receive the shuttle F′, of ordinary construction, but of large size in order that it may carry a bobbin capable of holding an extra length of thread. The shuttle F′ is of the revolving class, and is guided in its revolution by an outwardly-projecting lip or rib *e′*

on its periphery, which fits a corresponding groove in the outer peripheral wall of the chamber in the holder F, and said shuttle is in axial line with the shaft G, which is mounted in suitable bearings on the under side of the bed A, and has secured to its front end a collar or sleeve *f*, upon the front end of which is formed the curved wing *f'*, which engages with the shuttle in advance of its hook-point, to impart the motion of the shaft G to the shuttle F'.

The shuttle-carrying shaft G is arranged with its axis in a vertical plane at right angles to the axis of the shaft *b*, which carries the needle-carrying arm, and at such a distance below the same that when said shuttle is revolved its hook will intersect or cut across the path of the needle, and the needle, when it is reciprocated, passes across the path of revolution of the shuttle below the periphery or point of the hook, this latter motion taking place while the shuttle is in a state of rest and in the position shown in Figs. 2 and 16. By reason of this arrangement of the shuttle or bobbin carrying hook and the needle a much larger shuttle can be used and passed through a loop formed from a given length of thread, or with a given size of shuttle a less amount of thread will be drawn out by the needle to form the loop for the passage of the needle, whereby the wear of the thread is very much lessened.

The shuttle-shaft G is intermittently rotated by means of the two cams H and H' and suitable connections, as the vertically-sliding bars *g* and *g'*, levers *h* and *h'*, links *i* and *i'*, and two cranks on the said shaft. This shuttle-operating mechanism forms the subject-matter of another application of even date herewith, and serially numbered 319,014, and therefore is not claimed or further described in this application.

C' is the work-supporting horn or arm, secured in a fixed position to the bed A, and provided at its work-supporting end with the slot *j* for the passage of the awl and needle, said slot being of sufficient length to permit of the work being moved a distance equal to the length of the longest stitch when the needle and awl are within the work and said slot, substantially as shown and described in my other application before cited.

D' is the presser-foot, the rod of which is mounted in suitable bearings in the frame of the machine, so as to be movable vertically therein, and has fitted thereto the collar *j'* and spring j^2, by which it is forced downward upon the work to be sewed, and also has secured thereon the collar *k*, by means of which and the hand-lever D^2, co-operating therewith, said presser-foot may be raised against the tension of the spring j^2 for inserting or removing the work, all in a well-known manner.

In the upper end of the presser-foot bar is formed a transverse slot *k'* to receive the front end of the lever I, mounted upon the horizontal fulcrum-pin k^2, which is set in the upper end of the stand I', bolted to the tie-girt D.

At the rear end of the lever I, and concentric with the axis of its fulcrum-pin k^2, are formed two segmental ratchet-surfaces k^3 and and k^4, one above and the other below said fulcrum-pin, and each having the radial shoulders of their teeth facing toward the rear of the machine, as shown in Fig. 4.

J is a three-armed lever mounted upon a fulcrum-pin *l*, set in the stand J', with its axis parallel to and in the same horizontal plane as the fulcrum-pin k^2 of the lever I and directly in the rear thereof. The arm j^3 of the lever J carries at its free end an anti-friction roll, which fits into and is acted upon by the path of the cam K, to impart to said lever J an intermittent vibratory movement about its fulcrum-pin *l*.

The arms j^4 and j^5 of the lever J each have pivoted thereto two pawls *m m'* and *n n'*, respectively, the pawls *m* and *m'* being arranged to engage with the teeth of the upper segmental ratchet-surface k^3 to lock the lever I and the presser-foot D' against upward movement when the awl and needle are being forced upward through the work, and the pawls *n* and *n'* engaging with the segmental ratchet-surface k^4 to raise the front end of the lever I, and through it the presser-foot to relieve the pressure on the work during the time that it is being fed preparatory to forming a new stitch. The two pawls *m* and *m'* are of different length, as are also the pawls *n* and *n'*, the difference in length in each case being about equal to one-half the distance between the radial shoulders of two contiguous teeth of the ratchets k^3 or k^4. The free ends of the pawls *m* and *m'* are pressed toward the ratchet k^3 by the springs m^2, but are limited in their movements in that direction relative to the arm j^4 by the stop-pin m^3, set in the extreme end of said arm. In like manner the pawls *n* and *n'* have their free ends pressed into contact with the stop-pin n^2 by the springs n^3. Substantially the same result as is obtained by the devices hereinbefore described for intermittently locking and unlocking the presser-foot and raising the same was produced by devices shown and described in my before-cited application; but in that case two cams and four levers were required to do the work that is done in the machine herein described by two levers and one cam. Each of the pawls *m*, *m'*, *n*, and *n'* has its working-point formed upon a separate steel plate *o*, secured to the free end of said pawl by a screw, so that it may be removed, sharpened, and reset to proper engagement with the teeth of its ratchet when it has become worn.

The shaft *b*, upon which is secured the needle-carrying radius-arm *c*, also has secured thereon the toothed pinion *c'*, with which the teeth of the gear-segment c^2, formed on the front end of the lever K', engages to impart

to said pinion c' and its shaft b an intermittent oscillating motion about the axis of said shaft as said lever K′ is vibrated by the action of the path of the cam K^2 upon an anti-frictional roll carried by a stud c^3, set in the rear end of the lever K′, as shown in Figs. 5 and 7. The shaft b also has firmly secured thereon the grooved collar c^4, with the groove of which the forked end of the arm d' engages for the purpose of imparting to said shaft and its needle-carrying arm a reciprocating motion in the direction of the length of said shaft, said arm d' being rigidly secured to the plate d^2, fitted to a bearing in the bed A, so as to be movable endwise therein in the direction of the length of the shaft b. This plate d^2 has formed in its upper side, at the end opposite to the arm d', a dovetailed groove d^3, which receives the head of the bolt d^4, the shank of which passes through the longitudinal slot d^5, formed in one arm of the lever L, and is adjustable therein to a greater or less distance from the fulcrum d^6 of said lever to vary the length of the endwise movement of the plate d' and the shaft b with a fixed and constant vibration of the lever L, which is imparted thereto by the action of the path of the cylinder-cam L′ upon the anti-friction roll d^6, mounted on a stud set in the rear end of said lever, as shown in Figs. 2 and 5. The arm d' and the plate d^2 are practically one device, and may be made in one piece; but as a matter of convenience I prefer to make them in two pieces and bolt them together. The object of this variable endwise movement of the shaft b is to feed the work a greater or less distance, according to the length of stitch desired, this movement taking place while the needle and awl are in the work and the pressure of the presser-foot is removed from the work, substantially as described in my before-cited application; but the devices for accomplishing the desired end are somewhat simplified in this application and rendered less liable to defective operation by reducing the number of joints and increasing the wearing-surfaces.

L^2 is the thread guide or carrier, mounted upon the lower end of the vertical rod L^3, fitted to bearings in the tie-girt D and having firmly secured thereon the spur-gear wheel or pinion o', with which the teeth of the sliding rack o^2 engage to impart thereto an intermittent oscillating motion about its axis to carry the thread into engagement with the barb of the needle, said rack being reciprocated by the action of the path of the cam M upon an anti-friction roll mounted on a stud set in the rear end of said rack-bar, as shown in dotted lines in Fig. 4. The rack-bar o^2 is fitted to a bearing in the stand J′ in a horizontal position and in substantially the same horizontal plane as the axis of the cam-shaft C. The thread-guide L^2 is constructed and operates substantially the same as the thread-guide shown and described in my before-cited prior application.

N is an arm fitted at its rear end to a dovetailed bearing formed in or secured to the upper surface of the bed A, so as to be movable endwise toward and from the front of the machine, its rear end being connected by the link N′ to the lower end of the lever N^3, pivoted at its upper end to the stand O, and carrying upon a stud set therein between its two ends an anti-friction roll, which fits into and is acted upon by the path of the cam O′, to impart to the arm N an intermittent reciprocating movement toward and from the front of the machine. The arm N is so shaped and arranged and has such a movement imparted thereto that its extreme front end, when moved to the limit of its forward movement, extends somewhat beyond the path of the needle, in near proximity thereto, at the left hand of said needle, and just below the lower end of the thread-guide L. The arm N has formed therein a horizontal slot extending from near its front end to the line p, (see Fig. 5,) in which is fitted and pivoted to said arm, at p', the lever N^3, having at one end the stop-shoulder p^2 and the arm p^3, and at its front end the hook p^4 to engage the thread between the work and the thread-guide just as the needle enters the work from below, and, as it moves to the rear, with the arm N draw out the desired length of thread to form the loop above the work when the thread-guide has thrown the thread into engagement with the barb of the needle, said loop above the work to contain a length of thread equal to one-half the length required for the loop below the work. When the arm N and the loop-forming lever N^3 have reached the limit of their rearward movement, the thread-guide has thrown the thread into engagement with the barb of the needle, and the needle commences to recede to draw the thread down through the work, and the cam P, secured upon the periphery of the cam K, comes in contact with the arm p^3 of the lever N^3 and moves its rear end to the right against the tension of the spring p^5 a sufficient distance to cause the hook p^4 to be drawn within the slot of the arm N, thereby disengaging the thread therefrom. The spring p^5 serves to hold the lever N^3 in its normal position relative to the arm N—that is, with the shoulder p^2 in contact with the edge of the arm N at the rear end of the slot therein—until said lever is acted upon by the cam P, as above described.

P′ is a thread guiding and clamping wheel mounted upon a stud set in the stand P^2 and having a V-shaped groove in its periphery, around which the thread is wound between the thread-guide L^2 and the take-up or loop-drawing lever S.

R is a brake-lever pivoted at q and carrying at its rear end the anti-friction roll q', which is acted upon by the face-cam q^2 on the periphery of the disk Q′, to impart to said lever a slight vibratory motion. The front end of the lever R is bent upward and has its end

surface fitted to the V-shaped groove in the locking-wheel P′, so as to bear upon the two inclined sides of said groove when the rear end of the lever R is depressed by the action of the cam q^2, so as to prevent the wheel P′ from rotating when the loop-drawing or take-up lever S is moved upward to draw the thread forming the loop below the work into the material. The loop-drawing or take-up lever S is fulcrumed at r on the stand S′, and carries at its front end the thread-guiding sheave s and at its rear end an anti-friction roll upon which the internal face-cam s', formed in the side of the disk Q′ and shown partly in full lines and partly in dotted lines in Fig. 3, acts to raise the front end of said lever to draw the loop of thread into the material, while the spring S^2 moves said lever in the opposite direction to keep said anti-friction roll in contact with said internal cam-surface or in such a position as to be acted upon thereby when said cam revolves.

The needle-operating shaft b has loosely mounted thereon, contiguous to the needle-carrying arm c, the needle and awl guiding and supporting arm t, which has formed in its free end the hole t' for the passage of the needle and the laterally-open slot t^2 for the passage of the awl, said slot being so formed as to stay or support the awl in two directions, while at the same time the awl may be adjusted toward or from the needle without changing or disturbing said guide. This guide is also provided with two stop-shoulders t^3 and t^4, with which the pin or lug u, set in the hub of the needle-carrying arm c, engages to compel said guide to move with the needle and awl during a portion of their reciprocation and prevent the needle and awl being drawn entirely out of said guide. The guide t is limited in its forward movement by coming in contact with the loop-spreader interposed between it and the work supporting horn C, and in its backward movement by the stop or lug u', formed upon or secured to the arm d'.

The guide t is designed to be moved in unison with the needle and awl during a portion of their movements in both directions by the friction of the awl and needle and the needle-carrying arm thereon; but when the needle and awl are approaching the work, and said guide forces the loop-spreader w into contact with the work-support C′, the movement of said guide l is arrested, and it remains in a fixed position, where it can do the most good in supporting the needle and awl as they are being forced through the material, and when the needle and awl are moving to the rear, after having been withdrawn from the work and are drawing out the loop of thread for the passage of the shuttle, the guide comes in contact with the lug u' and its motion is arrested, while the needle continues to recede until the barb of the needle is near the under side of said guide, as shown in Figs. 9 and 10.

The shaft b also has mounted loosely thereon the loop-spreading arm w, having formed in its free end a thread-receiving notch w', and is also provided with the laterally-projecting lug w^2. This loop-spreader is moved about the axis of the shaft b toward the front of the machine first by the passage of the shuttle through the loop spread thereby, and then by the forward movement of the needle-guide and needle-carrying arm, and toward the rear by the contact of the thread of the loop as the needle recedes after being withdrawn from the work.

The free end portion of the loop-spreader w is so formed and arranged that it moves in a plane parallel with and in close proximity to the plane of vibration of the needle, so that when the needle is withdrawn from the work, carrying upon its barb a bight of the thread, and said needle continues to recede, one strand of the loop of the thread carried by the barb of the needle is carried into the notch w' of the loop-spreader w and it is moved toward the rear until its lug w^2 comes in contact with the stop-arm u^2, when it remains stationary and holds the loop below the work in the spread position shown in Fig. 9, while the needle continues its movement to the extreme of its backward movement. When the hook of the shuttle enters the loop formed as in Fig. 9, it casts the thread off from the loop-spreader and moves said spreader toward the work-support, as shown in Fig. 10.

T is a lever mounted upon a fulcrum-pin set in the under side of the bed A at u^3, and having secured to or formed upon its front arm the cylindrical chamber T′, in which is fitted the plunger u^4, surrounded by the spring u^5, and carrying at its front end the loop-holding finger u^6 and has set in its rear end the pin u^7, which projects through the slot v in the side of the chambered cylinder T′, as shown in Fig. 10. The rear end of the lever T is held in contact with the lower end of the lever U by the spring U′. The lever U is pivoted at or near the middle of its length to the stand V, and carries at its upper end the anti-friction roll v', which is acted upon by the face-cam V′, formed on or secured to the side of the cam-disk M, near its hub, as shown in Fig. 1, for the purpose of giving a lateral movement to the loop-holding finger.

W is a lever pivoted at or near the middle of its length to the stand W′, engages the pin u^7 at its lower end, and carries at its upper end the anti-friction roll v^2, which is acted upon by the face-cam Y, formed upon or secured to the periphery of the cam-disk M, to impart to the loop-holding finger u^6 an endwise movement. The loop holding and releasing finger u^6 has its main body in a nearly vertical position, with its extreme end portion bent into nearly a horizontal position, or at right angles, or nearly so, to said main body, as shown in Fig. 15, and has imparted thereto four motions, and is so arranged relative to

the needle and awl that as the needle and awl are receding and drawing out the loop below the work said loop holding and releasing finger is moved from the right toward the left above both strands of the loop of thread, and is then moved to the rear to a point outside of the circular path of the needle's movement, as the needle reaches the extreme of its rearward movement, when the loop of thread will be as indicated by the lines 5 5 5 in Fig. 9. When the hook of the shuttle has fairly entered the loop of the thread, as shown in Fig. 10, the needle is given a slight advance movement, which casts off the loop, and then it recedes again to its position. (Shown in Figs. 9 and 10.) The front end of the lever T, with the loop-holding finger, is moved toward the right, and then the finger u^6 is moved toward the front of the machine preparatory to being moved to the left over the next loop of thread drawn to the rear below the work by the needle.

The shuttle-operating mechanism herein shown and described forms the subject-matter of another pending application of mine, filed July 29, 1889, Serial No. 319,014, and therefore is not claimed in this case.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a sewing-machine, the combination of the presser-foot and its rod, a pivoted lever connected at its free end with said presser-foot bar and provided with two segmental ratchets arranged concentric with and on opposite sides of its pivotal axis, with the radial shoulders of their teeth facing to the rear or away from the presser-foot rod, a three-armed lever, a pawl mounted upon each of two arms of said lever and arranged to engage intermittently one with one of said ratchets and the other with the other of said ratchets, and a cam constructed and arranged to act upon the third arm of said lever to vibrate it and cause said pawls to engage alternately with said ratchet to raise the presser-foot and then to lock it to prevent its being raised while the needle and awl are piercing the material.

2. The combination of the presser-foot rod, the lever I, provided with the two segmental ratchets k^3 and k^4, the three-armed lever J, the pawls m and m', mounted upon one arm of said lever, the pawls n and n', mounted upon another of said arms, and the cam K, all constructed and arranged to operate substantially as described.

3. In combination with the presser-foot k^4, the three-armed lever J, and the cam K, rod, the lever I, the segmental ratchets k^3 and the pawls m, m', n, and n', each provided with the detachable engaging plate O, as set forth.

4. The combination, with a curved needle and a curved awl arranged side by side in the same carrier-arm and adjustable relative to each other, of a needle and awl guide or support mounted loosely upon the needle-carrying shaft and provided with a perforation for the passage of the needle, a laterally-open slot for the passage for the awl, and two stop-shoulders, and a pin or lug set in or formed upon the needle-carrying arm and adapted to engage with said stop-shoulders to prevent said needle and awl being withdrawn from said guide.

5. In combination with a curved needle and a curved awl arranged side by side in the same carrier-arm and adjustable to a greater or less distance from each other, a needle and awl guide or supporting-stay mounted loosely upon the needle-carrying shaft, constructed and arranged to be moved with the needle and awl through a portion of their reciprocation by friction, and stops to limit the movement of said guide or stay in both directions before the movement of the needle and awl carrier is completed.

6. In combination with a reciprocating needle and awl arranged side by side and adjustable to a greater or less distance from each other, a guide or stay support movable with said needle and awl for a portion of their reciprocation and having a perforation therein for the passage of the needle, and an open slot for the passage of the awl, whereby the needle and awl may be adjusted relative to each other without changing said guide, substantially as described.

7. In a sole-sewing machine, the combination of a reciprocating curved barbed needle and a curved awl mounted side by side in the free end of a radius-arm, a bobbin-carrying hook or shuttle constructed and arranged to intersect or cut across the path of said needle, a shaft carrying said needle-carrying radius-arms, a pinion mounted upon said shaft and having a radius less than the radius of the path of said needle, a lever having formed on one end thereof a segment of a gear to engage said pinion and carrying at its other end a cam roll or stud, and a cam constructed and arranged to act upon said roll to impart to said shaft an oscillating motion, whereby a much longer reciprocation can be given to the needle without said pinion coming in contact with the work.

8. In a sole-sewing machine, the combination of a reciprocating curved barbed needle and a curved awl mounted side by side in the free end of a radius-arm, an intermittently-revolving bobbin-carrying hook or shuttle constructed and arranged to intersect or cut across the path of said needle at right angles thereto, a shaft carrying said needle radius-arm, a pinion mounted upon said shaft and having a radius less than the radius of the path of said needle, a lever having formed on one end thereof a segment of a gear to engage said pinion and carrying at its other end a cam roll or stud, and a cam constructed and arranged to act upon said roll to impart to said shaft an oscillating motion through an arc equal to or exceeding one-half of a revolution, whereby a shorter

loop of thread is necessary to be drawn out for the passage of a shuttle of a given size.

9. The combination, with a reciprocating curved needle, of a loop-spreading arm mounted loosely upon the needle-carrying shaft and freely movable about its axis and having in its free end a thread-receiving notch arranged in position to receive one strand of the loop of thread drawn out by the needle below the work, and a stop to limit the rearward movement of said loop-spreader, substantially as described.

10. In combination with a curved and barbed reciprocating needle constructed and arranged to draw out the required length of loop of thread for the passage of the shuttle, the loop-holding finger w^6, having its upper end bent at a right angle, or nearly so, to its main body, and mechanism, substantially as described, for imparting to said loop-holding finger a lateral and rearward movement, said finger w^6 being so arranged relative to the path of movement of the needle that when said needle is moving toward the rear and drawing out the loop of thread and the finger w^6 is moved laterally toward the left the bent upper portion will pass over both strands of the loop of thread and hold them from rising above said bent portion of the finger, while the needle completes its rearward motion and moves a short distance toward the front to cast off the loop, substantially as described.

11. The combination, with a curved and barbed reciprocating needle constructed and arranged to draw out the required length of loop for the passage of the shuttle and a loop-spreader, of the loop-holding finger w^6, set in the plunger w^4 and having its upper portion bent at right angles, or nearly so, to its main body, (see Fig. 15,) the lever T T′, carrying the plunger w^4, the levers U and W, the cams V′ and Y, and the springs U′ and w^5, all constructed, arranged, and adapted to operate substantially as and for the purposes described.

12. In combination with a reciprocating barbed needle and a thread-guide for throwing the thread into the barb of the needle, a loop-measuring arm, a lever carried by said arm and provided with a hook to engage the thread, a cam and connecting lever for reciprocating said arm, and a cam for vibrating said hook-lever to disengage the hook from the loop of thread.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 22d day of July, A. D. 1889.

JOSEPH ELI BERTRAND.

Witnesses:
N. C. LOMBARD,
WALTER E. LOMBARD.