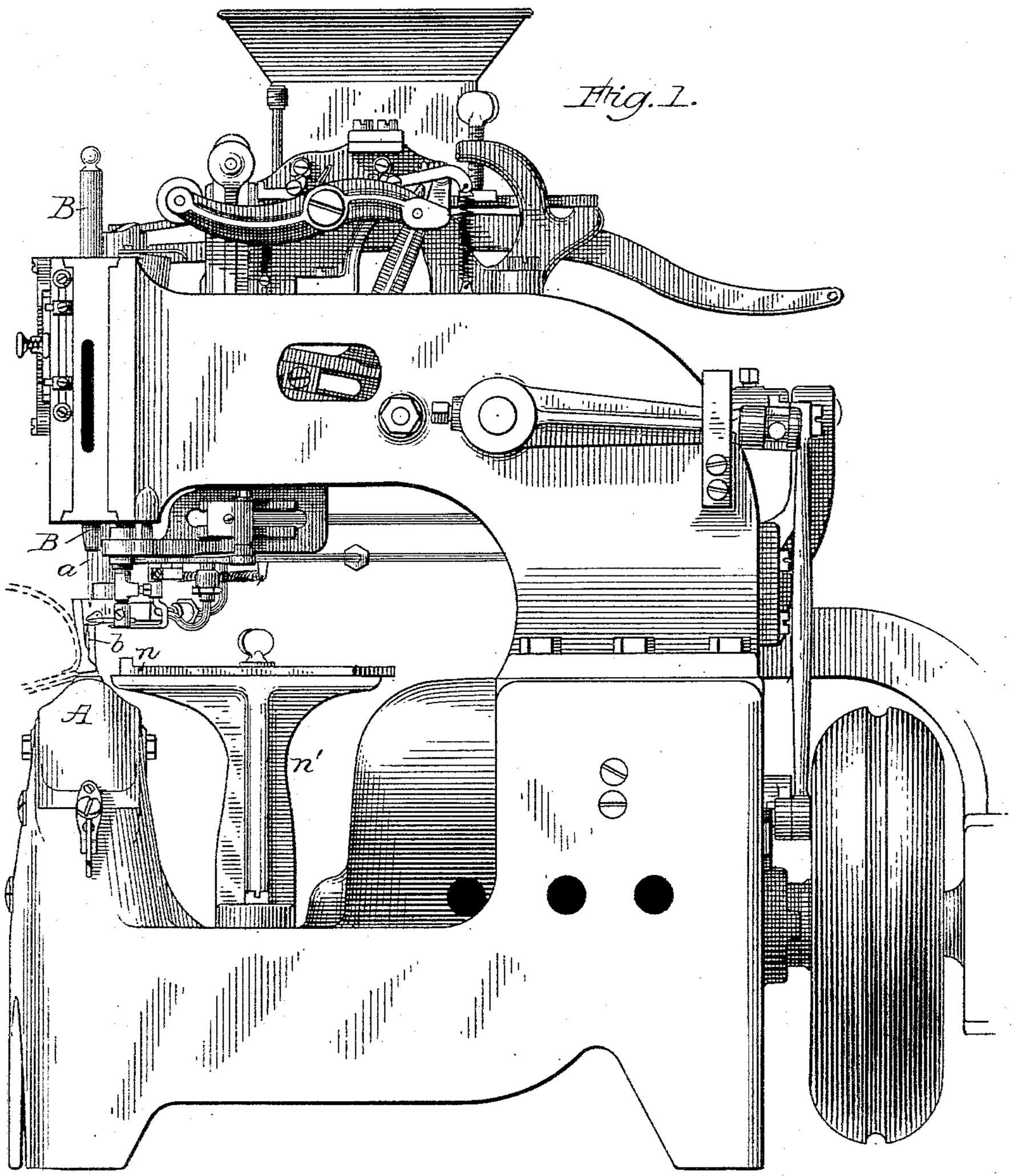
(No Model.) 3 Sheets—Sheet 1.

G. AMBORN, Jr.

WAX THREAD SEWING MACHINE FOR STITCHING UPPERS TO SOLES.

No. 388,752. Patented Aug. 28, 1888.

Fig. 1.



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Attorneys.

(No Model.) 3 Sheets—Sheet 2.

G. AMBORN, Jr.

WAX THREAD SEWING MACHINE FOR STITCHING UPPERS TO SOLES.

No. 388,752. Patented Aug. 28, 1888.

Fig. 2.

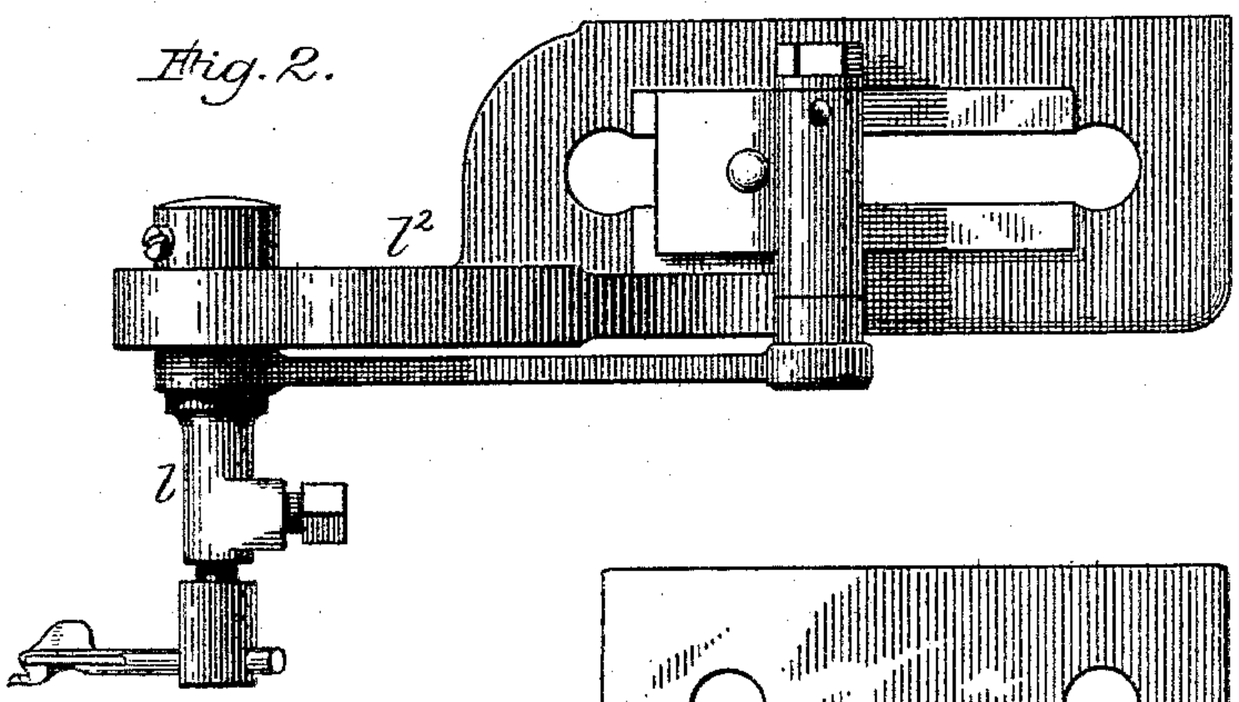


Fig. 3.

Fig. 4.

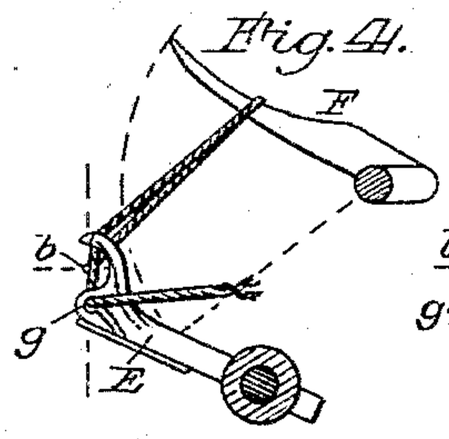


Fig. 5.

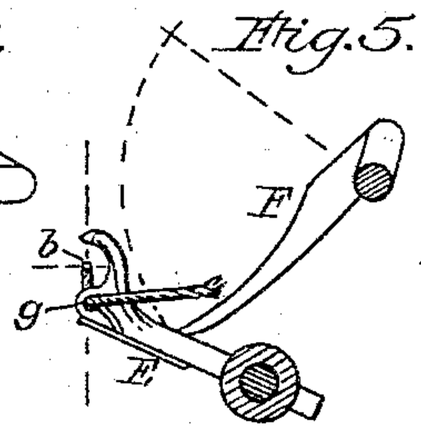


Fig. 6.

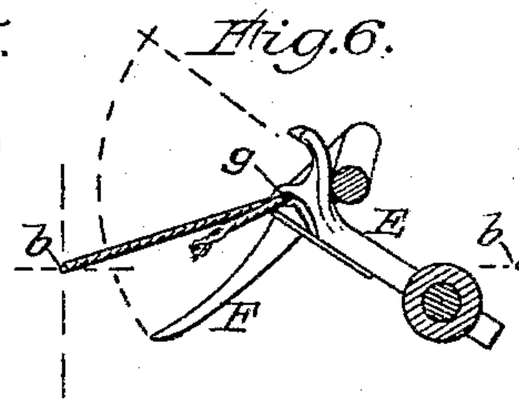


Fig. 7.

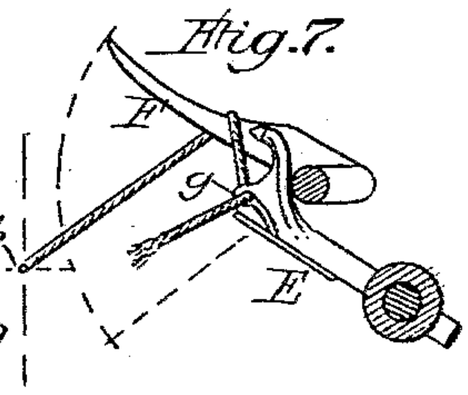


Fig. 8.

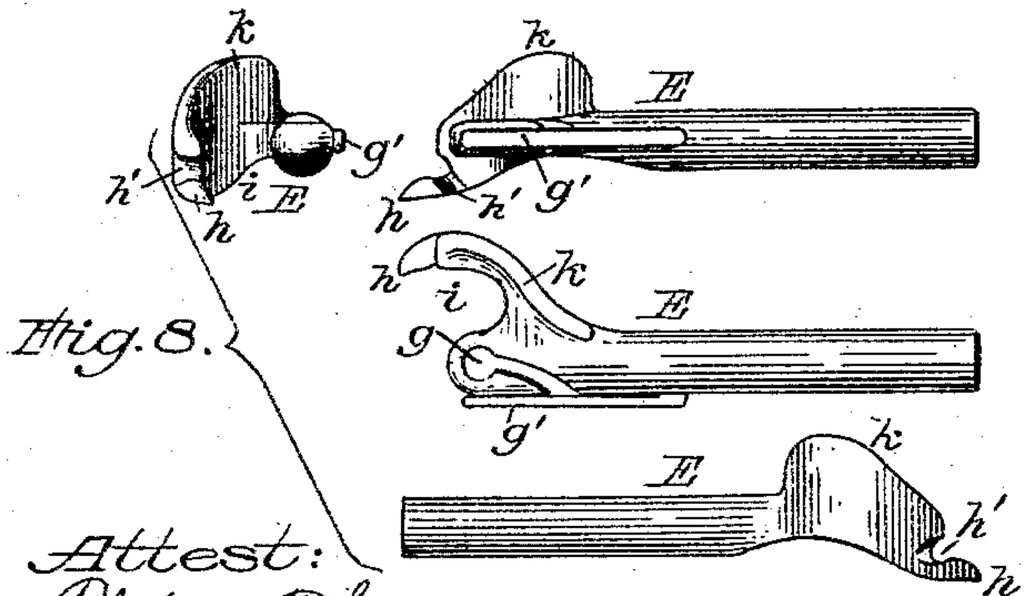
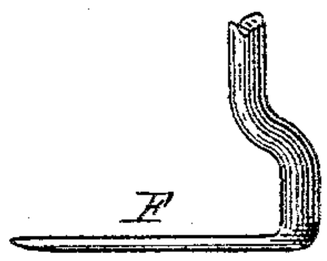
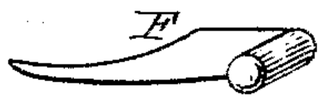


Fig. 9.





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(No Model.) 3 Sheets—Sheet 3.

G. AMBORN, Jr.

WAX THREAD SEWING MACHINE FOR STITCHING UPPERS TO SOLES.

No. 388,752. Patented Aug. 28, 1888.

Fig. 10.

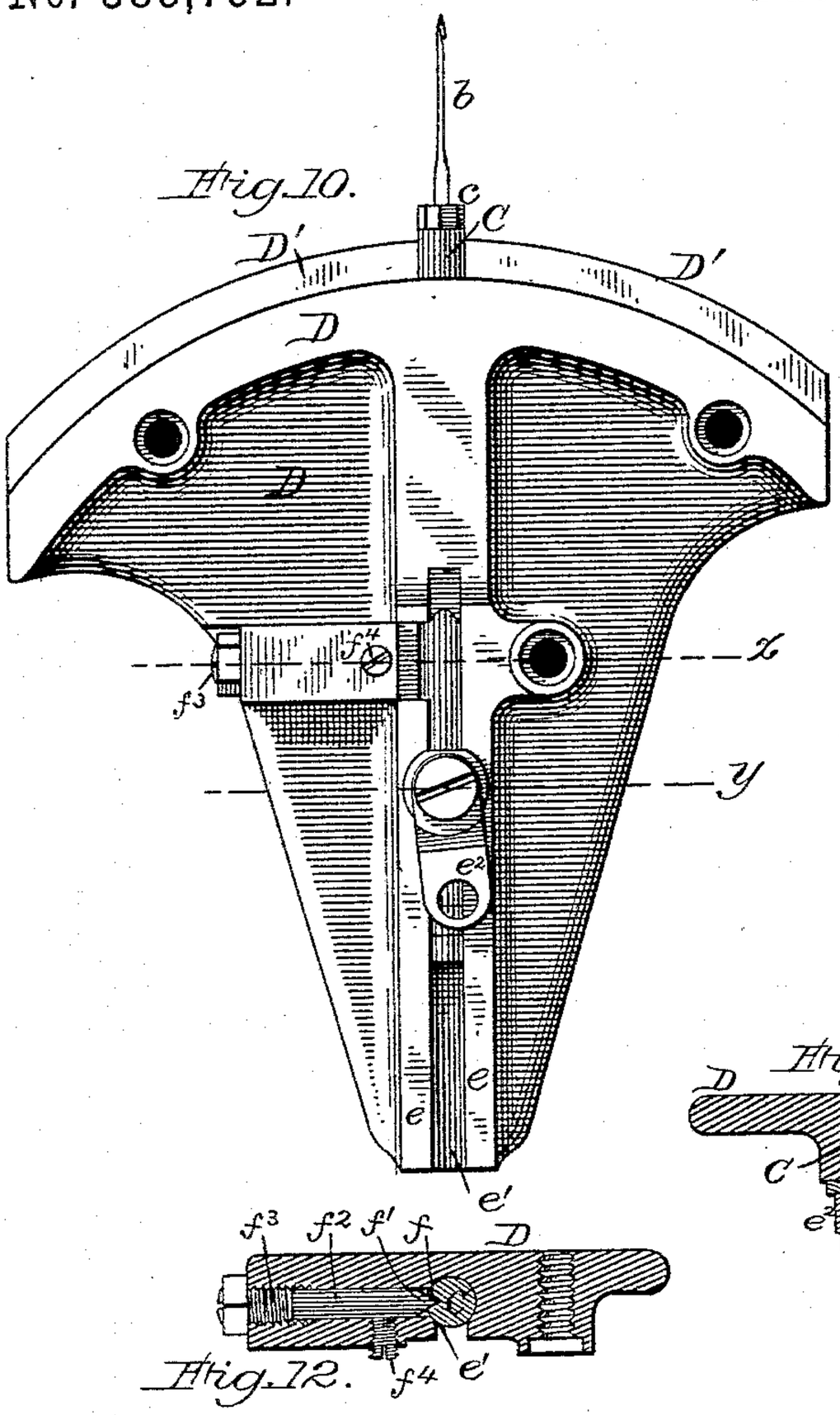


Fig. 12.

Fig. 11.

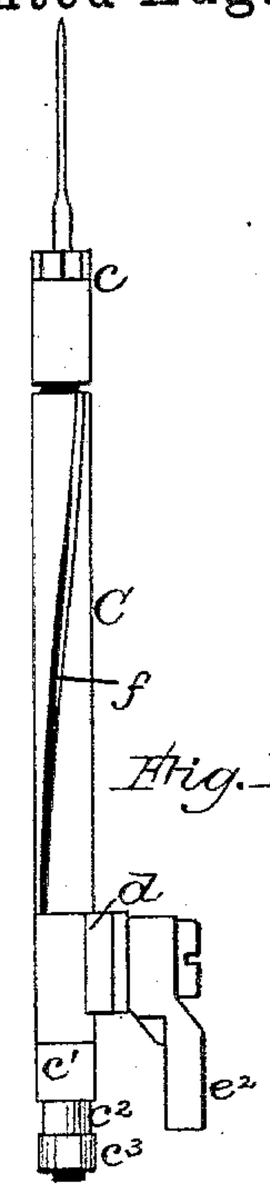


Fig. 13.

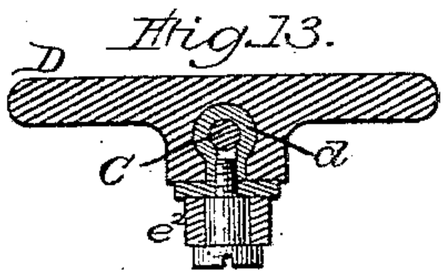


Fig. 14.

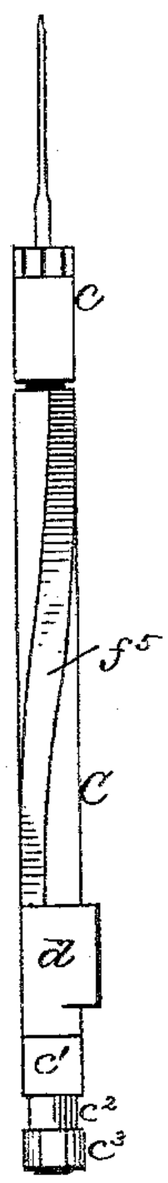
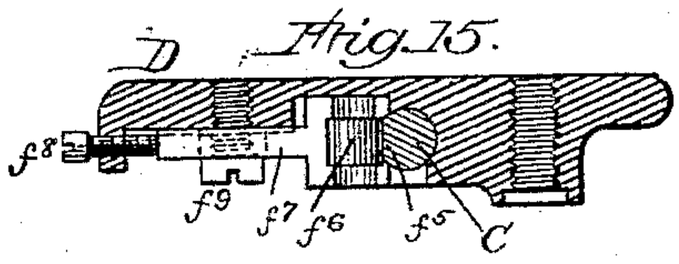


Fig. 15.



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UNITED STATES PATENT OFFICE.

GEORGE AMBORN, JR., OF LINCOLN, ASSIGNOR TO THE CAMPBELL MACHINE COMPANY, OF PAWTUCKET, RHODE ISLAND.

WAX-THREAD SEWING-MACHINE FOR STITCHING UPPERS TO SOLES.

SPECIFICATION forming part of Letters Patent No. 388,752, dated August 28, 1888.

Application filed October 19, 1887. Serial No. 252,817. (No model.)

To all whom it may concern:

Be it known that I, GEORGE AMBORN, Jr., of Lincoln, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Wax-Thread Sewing-Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

All of my said improvements have been devised with special reference to their use in or upon what are known as the "lock-stitch Campbell machines" with a view to enabling them to better perform certain special duty, but other forms of straight-hook-needle machines are receptive of said improvements. The special duty thus referred to is the stitching of "uppers" to soles in the manufacture of boots or shoes, which is an operation heretofore fraught with more or less difficulty or objection, because straight needles and the straight awls used therewith must occupy such positions, practically rectangular to the top surface of the edge of a sole or of a welt, that the adjacent portions of a shoe-upper are liable to serious defacement through possible contact therewith of an awl or a needle, or both, as well as with thread-delivery arms, heretofore in their movements projected between the path of the needle and the adjacent portion of the upper. The protection of the upper from an awl or a needle is fairly well secured by means of certain forms of presser-foot shanks, but these latter have been slotted to afford space into which the outer end of the thread-arm moves when delivering thread to the needle-hook, thus exposing the upper to more or less pounding contact with said arm during the stitching of a shoe. Various forms of rotative thread-arms have heretofore been used with hook-needles, but these arms of necessity at times occupy space between the needle and presser-foot, or between said needle and the upper of a shoe while being stitched; but the necessity of having the path of the needle closely adjacent to the coincident surface of the upper in the performance of this special duty renders it impracticable to interpose any portion of a presser-foot shank between the upper and the needle when prior vibrating thread-arms are used, or to project any portion of a rotary thread-arm between the needle and the shoe-upper. I have now, as I believe, for the first time combined with a hook-needle a thread-arm above the work-plate which in supplying thread to the hook does not materially project or pass beyond or to the front side of the vertical plane or path of the needle toward a shoe-upper as the shoe is being moved along the work-plate during the operation of stitching, thus not only avoiding contact of the arm with the upper, but also, if desired, enabling a thin unslotted presser-foot shank to be interposed between the needle and the shoe-upper, and thereby afford absolute protection to the upper.

In a lock-stitch machine having a straight awl and hook-needle it is obvious that a thread-arm could not be thus operated and restricted as to its movement toward the front side of the needle-path or the upper of a shoe if the hook-needle did not execute certain co-operative movements—as, for instance, with the usual mere vertical reciprocating movement the hook-needle of the Campbell machine could not be fed by such a thread-arm as I employ, and hence I have now so organized the needle and its bar that the needle is not only longitudinally reciprocated, but also axially or rotatively reciprocated, for turning its hook toward said arm and enabling it to receive the thread, and then while moving downward with the thread it turns backward, so as to properly present the thread-loop for the entrance and passage of the shuttle. This complex longitudinal and axial reciprocation of a hook-needle is quite old and is found in several forms of the earliest wax-thread machines known in the art; but so far as I know no needle has heretofore been thus operated for attaining the ends now accomplished by me, nor used in combination with a thread-arm which vibrates only toward and from the path of the needle and wholly at the rear side therof, and opposite to that side at which a shoe upper could be presented, and which did not and could not pass or project materially beyond said path to the front side of the needle toward

the path of vertical coincident portions of material moving on the work-plate during the operation of stitching. Nor do I know of any prior machine in which the needle was thus operated, wherein the thread delivering and controlling devices were located above the work-plate at the rear of the path of the needle, so as to enable a shoe to be placed in front of the needle for stitching the upper to the sole, it being obvious that such duty could not be practically performed by passing along the rear of the needle and beneath the usual overhanging arm of a machine. This protection of a shoe upper from defacement is of special value whether the stitching of an upper to a sole be performed without a last inside of the shoe or with one; but if a last be thus used this protection of the upper from the thread-arm is quite imperative, inasmuch as the leather, when backed by an unyielding last, if struck or pounded by the end of the thread-arm, is badly dented and liable to be so defaced as to seriously impair the mercantile value of the goods, and especially if these be of the fancy or high-grade varieties.

It may be proper to here state that the earliest stitching of uppers to soles with straight-needle machines of the lock-stitch type is of comparatively recent date, and it is still more recent that this duty was first executed while the shoes are held to form on the lasts on which they are made.

Having thus indicated the general status of my said improvements in this art, I will, after describing in detail the mechanism illustrated in the drawings, specify the features of construction and combination deemed novel in the several clauses of claim hereunto annexed.

Referring to the three sheets of drawings, Figure 1 illustrates in side elevation a Campbell machine embodying my said improvements. Fig. 2 illustrates in side view a detached bracket on which the thread-delivering arm is vibrated to and fro, together with said arm, as in position for delivering thread to the hook of a needle. Fig. 3 is a plan view of said bracket and discloses the guiding-slot therein, from which the thread delivering arm is suspended and in which it is guided and moved. Fig. 4 is a top view of the thread-delivering arm, a hook-needle, and a thread-controlling arm, all as when thread is being delivered to the hook of a needle. Fig. 5 illustrates the two arms in position after the needle has carried down the thread and just after the controlling-arm has released the thread. Fig. 6 illustrates said arms in position just before the rise of the needle, the delivering-arm being in its most rearward position. Fig. 7 illustrates said arms as when the needle is ascending, the thread-controlling arm having been swung around for picking up the standing thread and the delivering-arm being just ready to advance toward the needle and resuming the position indicated in Fig. 4. Fig. 8 in top, front, and two side views illustrates the thread-delivering arm on an enlarged scale. Fig. 9 in top and side view illustrates the thread-controlling arm. Fig. 10 illustrates in side view a shuttle-rail and its plate detached from beneath the arched work-plate, Fig. 1, and disclosing the guide-bearing for the needle-bar, its cross-head, and the link by which it is coupled to its operating-lever. Fig. 11 is a side view of the needle, needle-bar, and cross-head. Figs. 12 and 13 illustrate sections of the parts shown in Fig. 10, respectively, on lines *x* and *y*. Fig. 14 is a side view of a needle-bar of a different form and its cross-head. Fig. 15 is a sectional view of a rail-plate and such a bar as is shown in Fig. 14, with its bearings, on a line corresponding to line *x* of Fig. 10.

The machine shown in Fig. 1 illustrates, aside from my improvements, what is well known as a "Campbell wax-thread" machine of the "arch" pattern, in that its work-plate A is "arched" crosswise of the machine, and its shuttle is curved and traverses an arched rail or raceway beneath said plate. In describing my invention I shall deem it only necessary to particularly refer to and describe certain portions of said machine, and for a better understanding of the remainder thereof reference can be had, if need be, to United States Letters Patent to Duncan H. Campbell, No. 253,156, dated January 31, 1882.

The awl-bar B, its straight awl *a*, and their operating mechanism are all as described in the said Letters Patent, the feeding of the leather or other fabric being performed by the awl in the usual manner.

The straight hook-needle *b* is as heretofore, but its needle-bar, C, Fig. 10, is constructed and operated quite unlike the needle-bar of said machine. The needle-bar formerly had only a right line reciprocation, but now it has in addition thereto an axial or rotative reciprocation of ninety degrees, so that the needle, instead of receiving thread into the throat or hook of the needle when said hook stands crosswise to the work-plate and to the underlying shuttle-rail, now receives its thread while the hook stands parallel with the feed-line, or lengthwise of the work-plate, and it turns a quarter of a circle as it descends, so as to then stand crosswise of the shuttle-rail for properly presenting the loop of thread carried down for the entrance and passage of the shuttle.

As hereinbefore indicated, it is not new in wax-thread machines to impart to a hook needle-bar this complex rotary and longitudinal reciprocation, and it is to be understood that the mechanism heretofore employed to this end may be employed in this machine without departure from certain portions of my present invention, although certain other portions thereof pertain to features of construction which I have devised in this particular connection. The said early types of wax-thread machines containing hook needle-bars which were operated with the said complex reciprocation were intended for service with and were used with soft wax only, and under such

conditions as to the relative sizes of needle, awl, and thread as to enable said machines to operate fairly well in such light lines of leather stitching as were then performed. The present conditions are widely different in that hard wax is now used, and the awls, needles, and thread employed therewith are so proportioned in size that the thread is packed solidly in the leather, and the latter is stitched regardless of its bulk or character as to density or hardness, and for successfully working under these conditions the complex moving needle-bar must be operated in a manner and by means quite unlike what might have served fairly well under said old conditions. These present conditions involve special accuracy in movement and in the rests or dwells of the needle and bar, and greater strains are borne thereby while making the complex movements, and hence I have formed on the needle-bar a bearing for what may be termed a "cross-head," in which the bar may rotate, and said cross head is semi-cylindrical and fits the same guide-bearing to which the needle-bar is fitted and in which it reciprocates. These features of construction are fully illustrated on Sheet 3, Figs. 10 to 15, inclusive. The segmental shuttle rail-plate D is, in the main, as in prior Campbell machines, the path of the needle-bar C being through the arched shuttle-rail D', and said bar has the usual needle-clamp at *c*.

The cross-head *d* is located near the lower end of said bar, the latter being at that point reduced in diameter, so as to rotatively occupy its bearing within the cross-head, the latter being cylindrical for more than one hundred and eighty degrees, and to that extent of the same external diameter as the needle-bar, so that both fit and smoothly slide in the vertical guide-bearing *e* in the rail-plate, said bearing being slotted at *e'* for a portion of its length for receiving the protruding portion of the cross head, which is squared up at its sides, so as to accurately fit said slot. The link e^2 is coupled to the usual needle-driving lever. (Not shown.) Below said cross-head there is a rotative sleeve, *c'*, and nuts c^2 c^3 are tapped on the threaded lower end of the bar, each nut having one set of squared-up wrench-faces, but they are otherwise cylindrical, and hence they afford a guide-bearing surface for the lower end of the needle-bar below the cross-head.

The nuts and sleeve *c'* provide against any lost motion of the needle-bar longitudinally, and the sleeve being rotative the bar is semi-rotated within the cross-head with but little friction, and the bar, the needle-clamp, and the nuts at its lower end, with the semi-cylindrical portion of the cross-head, being within and closely fitting the guide-b aring *e*, it is obvious that the needle-bar can be operated under the heaviest piercing strains ever involved without any liability of springing, and that during its longitudinal movements it is free to be semi-rotated. This semi-rotation of the needle-bar I have provided for in practice by several different ways, two of which are illustrated. In Figs. 10, 11, and 12 the bar is spirally slotted, as at *f*, said slot affording a V-shaped bearing-face engaged by the V-shaped tip *f'* of a transverse pin, f^2, serving as a guide, and rendered adjustable longitudinally by means of a forcing-screw, f^3, abutting against its outer end, and it is firmly locked against rotation by a transverse clamp-screw, f^4. This arrangement is very reliable, affords compensation for wear of the contacts, and securely confines the bar when at rest against rotation during the heavy torsional strains incident to operating the needle-clamp *c* while applying and removing needles.

In Figs. 14 and 15 the needle-bar has a flat spiral bearing-face, f^5, and against this a roller, f^6, serving as a guide, is firmly pressed, said roller being mounted upon a transverse longitudinally-adjustable sliding bar, f^7, occupying a guide-groove, the needle-clamp, cross-head, sleeve, and nuts being the same as on the bar previously described, and the adjusting-screw f^8 performing the same function as the screw f^3, which is used with the other form of bar, and the clamp-screw f^9 here shown performs a function similar to that of the clamp-screw f^4, in that it prevents axial movement of the bar f^7. As a rule, I prefer to employ the V-shaped spiral guide-face and the guide having the V-shaped tip.

In the Campbell machines as heretofore constructed two arms above the work-plate at the rear of the needle co operate for delivering the thread to the needle and controlling it properly during the downward movement of the needle. In said prior patent, No. 253,156, one of these arms is termed a "vibrating thread-eye," said eye being on an arm which delivers thread to the hook of the needle, and the other was termed a "thread-arm." I also employ two arms; but as one of the arms devised by me has not only a thread-eye, but also a notched finger co-operating therewith, I now call it a "thread-delivering arm" and the other a "thread-controlling arm."

The thread-delivering arm E is, I believe, radically new in its construction and in its mode of operation in presenting thread to the hook of the needle. Said arm has a thread-eye, *g*, which may be as shown in said prior patent, so as to be threaded only by introducing thread thereto longitudinally; but a more convenient form is shown in Fig. 8, wherein the eye is open at the side by way of a slot guarded by a spring, *g'*, which enables the eye to be threaded and unthreaded by lateral movements of the thread. Said arm E has also a notched finger, *h*, so located with reference to the thread-eye that the end of the arm is forked, so as to afford an intervening space, *i*, which is occupied by the needle when thread is delivered to its hook. The notch *h'* of the finger *h* is horizontal and at the end thereof, so that thread passing downward through the eye *g*, and thence horizontally, will occupy said

notch and lie in a direct line across the space *i* in a position favorable for presentation to the hook of the needle.

The lower side of the notch *h'* is projected slightly beyond the upper side, and also slightly depressed for enabling it to better engage with and to maintain its hold upon the thread. Between the finger *h* and the eye *g* this arm has also a curved web, *k*, which so overlies said finger that the thread cannot in kinking fly over and on top of the finger when released by the thread-controlling arm F during the descent of the needle.

For operating the thread-delivering arm E, I employ mechanism similar to that in the prior machines, but with certain variations, which will be designated. Said arm is mounted upon a stud or spindle, *l*, pendent from and sliding in a guide-slot, *l'*, in a bracket, l^2, and actuated by means of rods, levers, and a cam, as in said prior patent. This slot *k'* is, however, really a mere guide-slot, whereas in said patent the corresponding slot was a cam-slot, by which the thread-eye was not only guided to and fro, but made to partially encircle the path of the needle, and in the prior machines and in said patent the cam which imparted the movement to the thread eye caused the latter to retire from its most forward position earlier or quicker than the cam now used by me, because after the hook-needle now engages with the thread and turns in its descent it carries that part of the thread standing down from the eye around to the front side of the awl-hole, and if the eye should retire too soon it would pull the thread over toward the rear side of said hole and put a twist or cross into the two sides of the loop or bight of thread carried down by the needle, and cause a tendency of the loop to be twisted or turned, so as to prevent the proper entrance of the nose of the shuttle. The thread-controlling arm F performs generally the functions of the corresponding arm in the prior machines and some additional functions. In the prior machine said controlling-arm co-operated with the thread-eye for holding the thread in position for presentation to the needle, and then releasing it as the needle descended; but now said arm co-operates with the thread-eye in enabling the notched finger *h* to properly engage with the thread. The controlling-arm vibrates beneath the delivery-arm, but in such close proximity thereto that the finger *h* sweeps along and in contact with a part of the upper surface of the controlling-arm, and it is therefore enabled to assuredly pick up and engage with that part of the thread which passes from beneath the eye *g* over the controlling-arm. This controlling-arm F is pivoted in its bearings, and is semi-rotated by means of a rod, levers, and cam, as in the prior machines; but said arm is slightly different in form and of greater dimensions and has an offset or bend at *m* for affording ample space for the delivery-arm when at its most rearward position. The operation of these arms will be readily comprehended by observing Fig. 4, wherein the arm E is shown in the act of delivering thread to the needle *b*, and the arm F is shown in position as when after it has drawn thread laterally and downward through the eye *g* and is holding it taut. As the needle descends, the controlling arm F swings toward the needle, giving off thread, until said arm reaches the position shown in Fig. 5, the delivery-arm meantime remaining in the same position, the thread being thus fully released from the controlling-arm. Then the controlling-arm stands still and the delivery-arm retires until it reaches the position shown in Fig. 6, thereby so locating the inclined standing thread below the eye *g* that when the controlling-arm next swings it will engage therewith, as shown in Fig. 7. Now, when the delivery arm next advances, its notched finger *h* will pick up the thread from the surface of the controlling-arm and continue to advance into the original position, as shown in Fig. 4, the hook of the needle then being again in proper position to receive the thread.

In explanation of my use of the terms "front side" and "rear side" in connection with the needle and its path, it should be understood that the front side is that side of the needle and of the machine which is faced by the operator during the stitching of soles to uppers, and that in the particular form of machine shown the rear side is the side toward the frame-arm, because the line of feed is at right angles to said arm; but in a machine wherein the line of feed is parallel with the frame-arm the operator would stand facing one side of the frame-arm, and also facing what would then be the front side of the needle and its path, and the rear side in that case would of course be the side most remote from the operator, as in the machine shown.

Now, referring to Fig. 1, it will be readily obvious that it would be impracticable and even impossible to locate a shoe at the rear of the needle and beneath the frame-arm while stitching the upper to the sole, and that by restricting the thread delivery and controlling devices to positions wholly at the rear of the needle and its path, the front side of said needle and path can be occupied by the upper of a shoe, indicated in dotted lines, in performing the duty stated, and that the surface of the upper can be located closely adjacent to the front side of the needle without liability of contact therewith, and that, if need be, the space between the needle and the upper may be occupied by a very thin portion of a presser-foot shank. It should be observed that in Fig. 1 the presser-foot is not elevated, as it would be if a shoe-sole were interposed between it and the work-plate, and it should also be observed that although the gage-plate *n* and its standard *n'* are not shown in said prior patent, they constitute no portion of the present invention and perform no duty in the stitching of uppers to soles, and also that if they were removed the impracticability of pass-

ing a shoe beneath the frame-arm would be the same, because the shoe must be held firmly by both hands of the operator and guided with the greatest care while forced with much pressure against the front face of the presser-foot and its shank.

With the use of hot hard wax, needles as usually reciprocated are frequently liable to become so roughened or coated as to involve much power in forcing them through leather, and I find with the present complex reciprocations of the needle that this difficulty is practically obviated and the machine can be operated with much greater ease and facility than when the needle has no axial reciprocation, and it is to be understood that if said axial movement be no greater than fifty degrees the thread will be delivered to the needle-hook with reasonable certainty.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with a hook-needle, of a forked thread-delivering arm located at and restricted in its movements to the rear side of said needle and its path, substantially as described, whereby free space is afforded at and closely adjacent to the front or opposite side of said needle and path for the presence of materials in the process of stitching, for obviating the liability of their defacement heretofore incident to the contact therewith of a thread-delivering arm.

2. The combination, with a longitudinally and axially reciprocated hook-needle, of a reciprocating forked thread-delivery arm and a vibrating thread-controlling arm, substantially as described, whereby when said needle is elevated and its hook presented at the rear side of the needle-path thread will be delivered to the needle-hook by said arm without materially projecting any portion of said arm beyond the path of the needle, and the thread properly controlled while carried by the delivery-arm to said needle, and also during the rotative movement of the latter in carrying downward a loop of thread.

3. The combination of a hook-needle with a thread-delivering arm provided with a thread-eye, and also with a notched finger, and having an intervening space betwen said eye and finger for occupation by the needle during the delivery of thread to its hook, substantially as described.

4. The thread-delivering arm having a thread-eye, a slotted finger, and a guard on top of said finger and extending toward said eye, substantially as described.

5. The combination, with the cylindrical needle-bar and the slotted guide-bearing, in which said bar is longitudinally and axially reciprocated, of a semi-cylindrical cross-head axially coupled to said bar and fitted to said bearings and to the slot therein, substantially as described.

6. The combination, with a longitudinally and axially reciprocated needle-bar having a cross-head thereon, in which said bar can rotate, of a guide-bearing to which said bar and cross-head are mounted, and bearing-surfaces on said bar above and below said cross-head, substantially as described.

7. The combination of a needle-bar having a spiral guide-face thereon, a guide engaging with said face, a screw for forcing said guide against said face, and a clamp-screw for confining said guide in position, substantially as described.

8. The combination of the needle-bar provided with a V-shaped spiral guide-groove, a cylindrical guide-bearing in which said bar is reciprocated longitudinally and axially, a stud or pin V-shaped at its end occupying said spiral groove, a set screw for forcing said stud longitudinally, and a clamp-screw for confining said stud against rotation, substantially as described.

GEORGE AMBORN, JR.

Witnesses:
DANIEL MCNIVEN,
EDWD. M. NEWRY.