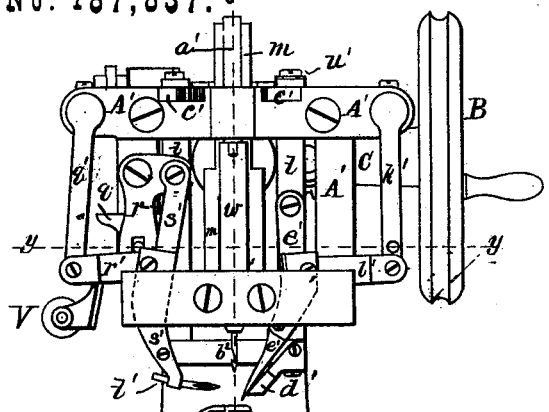
4 Sheets—Sheet 1.

W. ESTY.

SEWING-MACHINE.

No. 187,837. Patented Feb. 27, 1877.



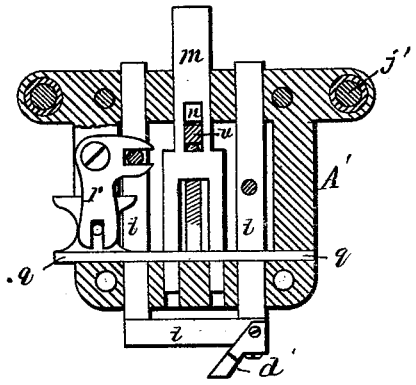


Fig. 3.

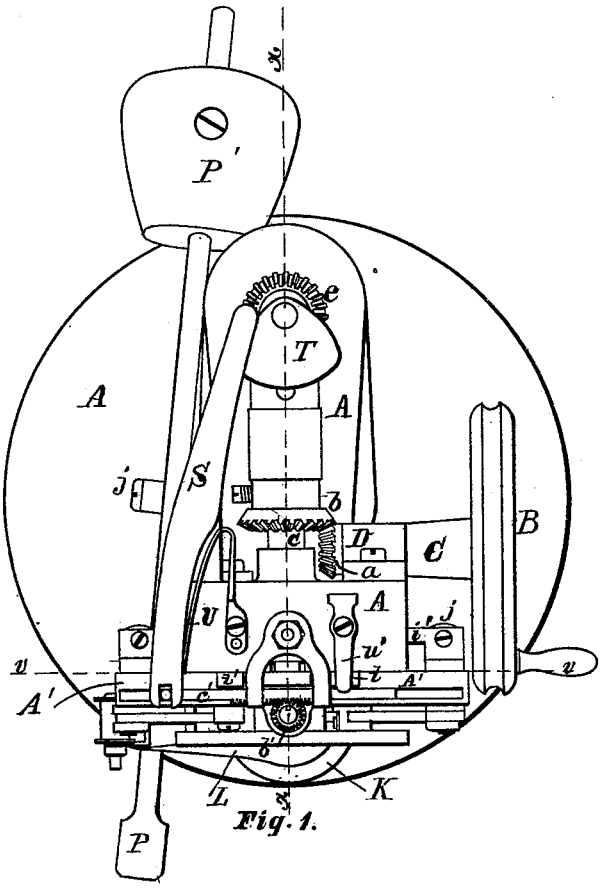


Fig. 1.

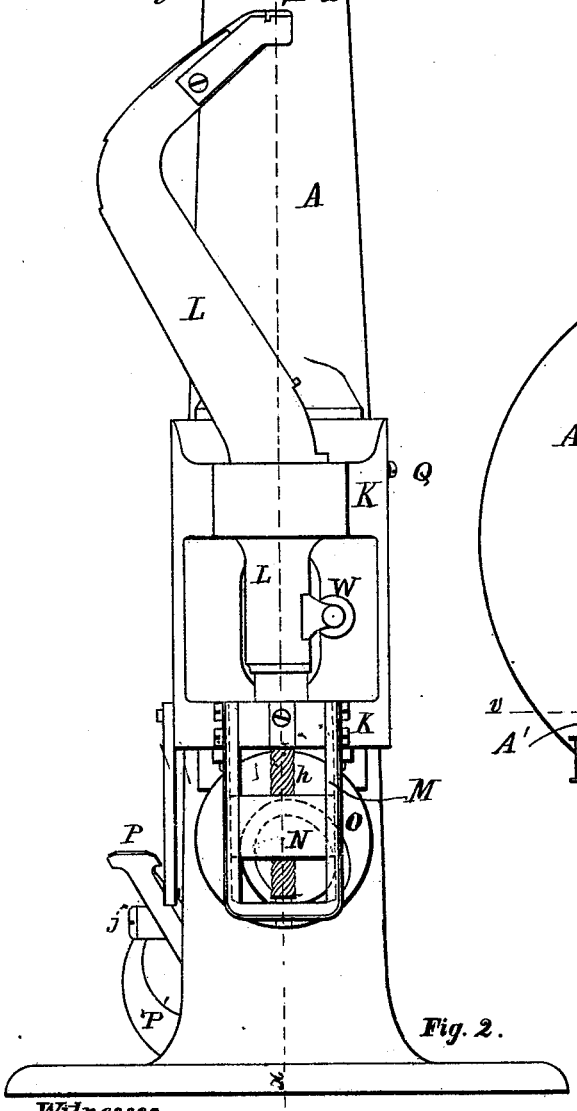


Fig. 2.

Witnesses.
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by his Attorney
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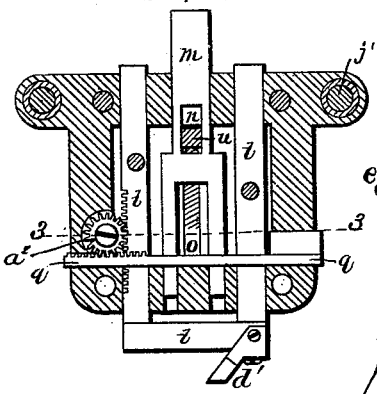

Fig. 9.

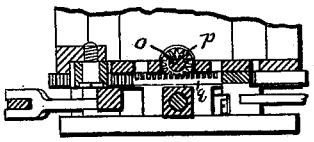

Fig. 10.

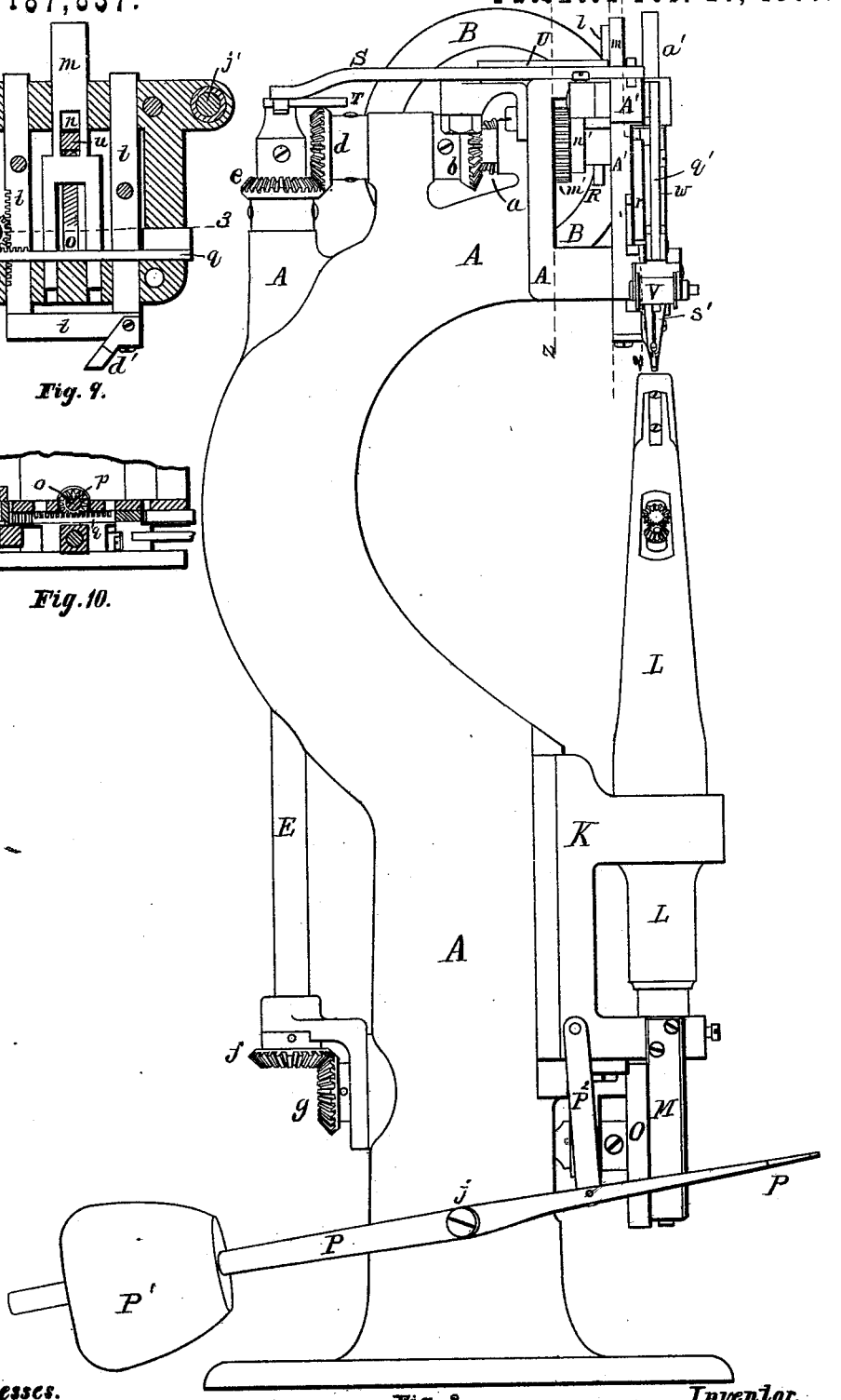

Fig. 3

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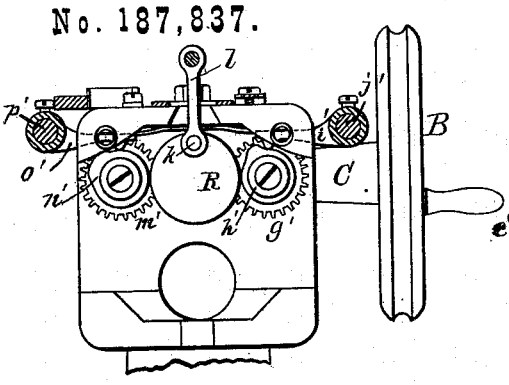

Fig. 7.

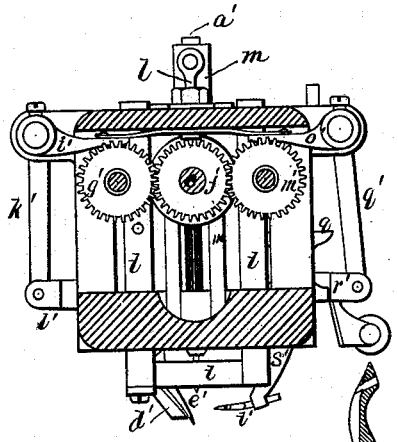

Fig. 6.

Fig. 11.

Fig. 12.

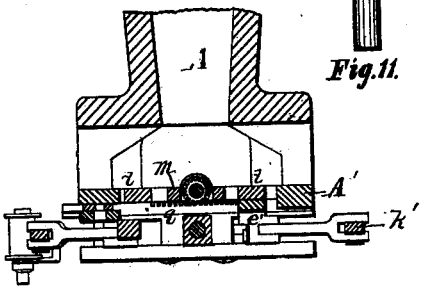

Fig. 5.

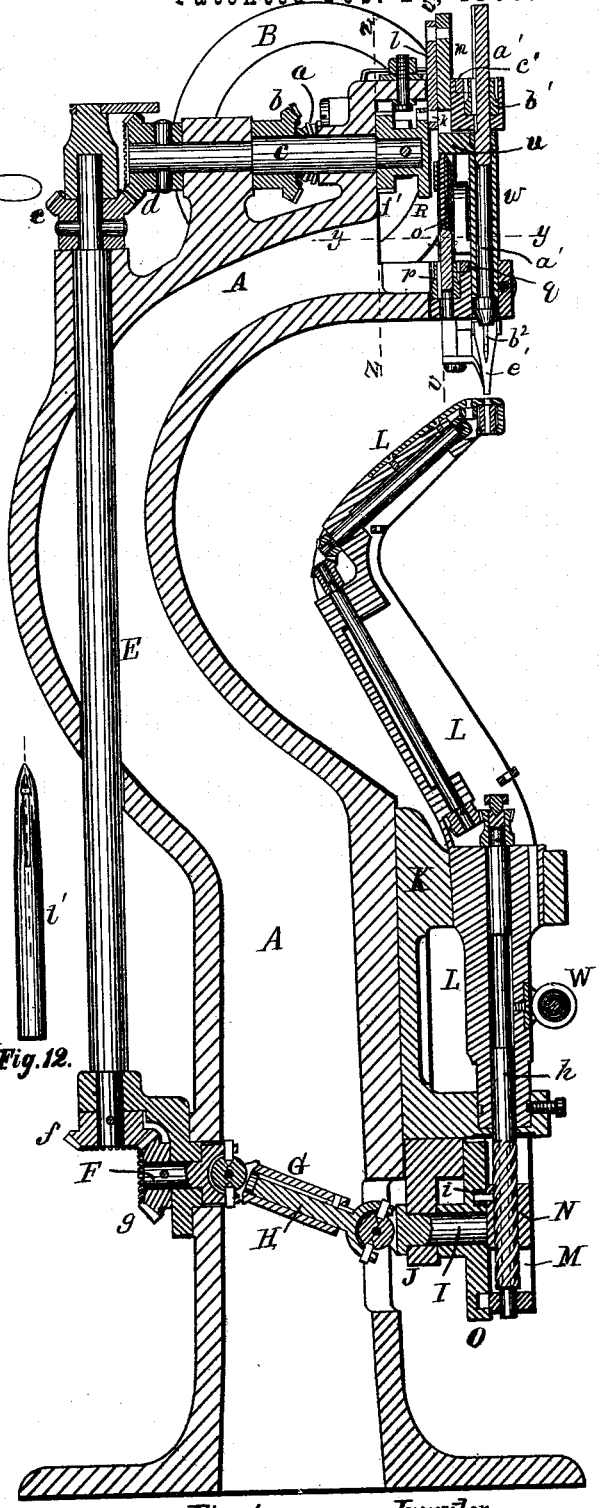

Fig. 4

Witnesses.
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4 Sheets—Sheet 4.

W. ESTY.

SEWING-MACHINE.

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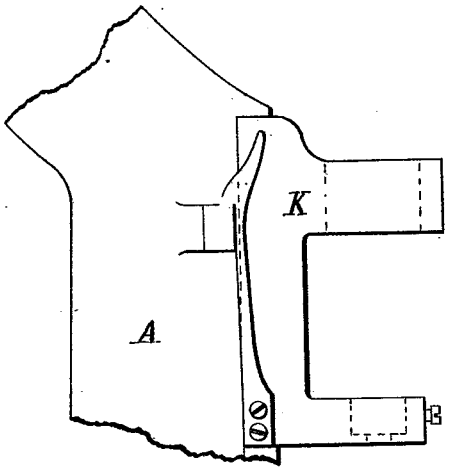

Fig. 11.

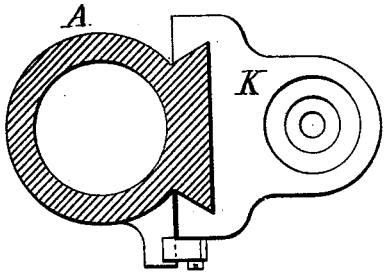

Fig. 12.

Witnesses.

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E. A. Hemmenway.

Inventor.

William Esty
by his Attorney
N. C. Lombard

UNITED STATES PATENT OFFICE.

WILLIAM ESTY, OF FITCHBURG, MASSACHUSETTS, ASSIGNOR TO NATHANIEL CORNING, OF NORTH LONDONDERRY, NEW HAMPSHIRE, GEO. W. HOBBS, OF UXBRIDGE, AND DENNISON W. B. JACKSON, OF BOSTON, MASS.

IMPROVEMENT IN SEWING-MACHINES.

Specification forming part of Letters Patent No. **187,837**, dated February 27, 1877; application filed March 16, 1876.

To all whom it may concern:

Be it known that I, WILLIAM ESTY, of Fitchburg, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Sewing-Machines, of which the following, taken in connection with the accompanying drawings, is a specification:

My invention relates to a machine for sewing the soles of boots or shoes to their uppers; and it consists, first, in the combination, in a sewing-machine adapted to form a seam by the interlocking of two threads, of a reciprocating barbed needle adapted to be partially rotated about its axis at each extreme of its reciprocation, a whirl or looper mounted in a horn or work-support, and adapted to carry the lower thread around the barbed needle to form a loop, and a reciprocating eye-pointed needle or looper carrying the upper thread and moving horizontally above the material to be sewed, and adapted to carry the upper thread doubled through a loop of the under thread, previously drawn up through the material by the barbed needle, and then remain in a state of rest till the barbed needle descends through the loop of the upper thread and enters the material, and then recede to allow the barbed needle, in drawing up the next loop of the under thread through the material and the loop of the upper thread, to draw down and tighten the previously-formed loop of the under thread upon the upper thread.

My invention further consists in the use, in combination with a vertically-reciprocating barbed needle, of an eye-pointed looper-needle arranged above the material to be sewed, and adapted to reciprocate horizontally, or nearly so, in a plane perpendicular to the surface of the material, and parallel to the line of motion of the feed-point, and having its shank between its eye and its carrier bent to one side, in such a manner that when the looper has moved horizontally across the path of the barbed needle toward the feeding device and presser-foot the rear strand of the thread carried by the looper will be held some distance away from the side of the looper-needle, leaving a free space for the descent of the barbed needle through the loop of the upper thread between its rear strand and the bent part of the looper-needle, the front strand of the loop of the upper thread being held in a groove formed in the front side of the looper-needle, as will be further described.

My invention further consists in the use of a bar arranged parallel to the vertically-reciprocating needle bar or carrier, and in close proximity thereto, provided with a slot, into which projects a stud or arm attached to said needle-bar, a screw placed below said slot, and adapted to be automatically rotated, to vary the length of the slot or the distance between the points of contact of the first-named bar with the needle bar or carrier, and thereby increase or diminish the throw of the needle, the first-named bar having a constant reciprocation of invariable length imparted thereto by means of a crank and connecting-rod, and by contact with the stud or arm attached to the needle-bar imparts thereto a reciprocating motion of less length, with a short stand-still or dwell at either extreme of its reciprocation, the relative length of the movement of the needle-bar as compared with its operating-bar being determined by the distance between the ends of the slot in the operating-bar, or between the points of contact thereof with the stud or arm attached to the needle-bar.

The adjusting-screw is operated by means of a pinion mounted thereon, in such a manner that the two must rotate together, while the screw is free to move endwise through the pinion, a reciprocating toothed bar or rack engaging with said pinion, and a lever connected at one end to said rack, and at the other with the presser-foot bar, by which it is operated, all so arranged that any movement of the presser-foot upward or downward, occasioned by variations in the thickness of the stock being sewed, shall cause a corresponding variation in the throw of the needle.

My invention further consists in operating the needle by means of a slotted bar acting

intermittently thereon, and provided with a screw having a thread of steep pitch, so connected by a pinion, rack, and lever to the presser-foot bar that the resistance to the upward movement of the needle, caused by drawing the looped waxed thread through the material, shall, by the pressure of the needle-bar upon the end of said screw, cause it to rotate, and, acting through the pinion, rack, and lever, cause the presser-foot to be forced downward upon the stock with a force corresponding to the force exerted to draw the needle upward, minus the friction of the parts.

My invention further consists in making the presser-bar of a U-shaped form, or in the form of two parallel bars connected at their lower ends, so as to form one rigid frame, said bars being mounted in independent bearings one upon either side, and a little in the rear of the needle-bar, and adapted to carry upon one side the presser-foot and the feeding-point, and upon the other side the looper-carrier for manipulating the upper thread, all so arranged that the looper-needle will always bear the same relation to the upper surface of the stock to be sewed, whatever its thickness may be.

My invention further consists in the use of certain mechanical devices for operating the feed-point and the eye-pointed needle or looper, which will be more clearly described and best understood in connection with the description of the drawings.

My invention further consists in mounting a horn or work-support, adapted to enter the inside of a boot or shoe, and provided with a whirl or looper located in its tip, substantially in line with the axis of the needle, and suitable mechanism for imparting thereto an intermittent rotary or oscillating motion upon a stand or frame attached to the main standard by means of ways or slides, in such a manner that it may be depressed to place a boot or shoe on the horn, and be raised again and held firmly in position without the aid of the operator while the sewing is being done.

My invention further consists in the combination of a work-supporting horn, provided with a whirl or looper, and suitable mechanism contained therein for operating said whirl, mounted upon a stand or frame adapted to slide vertically upon suitable ways on the main standard, and a treadle-lever for moving said sliding frame and the work-supporting horn downward, and a counter-weight for moving the parts upward again after the foot of the operator is removed from the treadle.

My invention further consists in the use, in combination with a work-supporting horn, provided with a whirl or looper mounted in its tip, substantially in line with the axis of the needle, and suitable shafting and gearing for imparting to said whirl a motion about its axis, of a coarse-pitch screw formed on a vertical shaft which passes through the center of the journal or base portion of the horn, and a nut fitted to said screw and to vertical ways parallel to said screw, and adapted to be reciprocated in said ways, and thereby rotate said screw-shaft, first in one direction and then in the other.

My invention further consists in the combination of a coarse-pitch screw-shaft, a nut mounted in vertical ways, and a cam for imparting to said nut a reciprocating motion, with a period of rest at either extreme of its reciprocation, as will be more fully described.

My invention further consists in the use of a sectional shaft provided with two universal or gimbal joints, and a telescopic connection between the parts, as a means of communicating motion from a shaft in the rear of the standard, arranged vertically and in a fixed position to a cam on the front of the standard, the axis of which is at right angles to the axes of the rear shaft and the horn, and so connected with the frame in which the horn is mounted that it moves up and down with it, all so arranged that the whirl may be operated equally well in whatever position the horn may be placed as to height.

Figure 1 of the drawings is a plan of a machine embodying my improvements. Fig. 2 is a front elevation. Fig. 3 is a side elevation. Fig. 4 is a central vertical section on line *x x* on Figs. 1 and 2, with the horn rotated one-quarter of a revolution from the position shown in Figs. 2 and 3. Fig. 5 is a partial section on line *y y* on Figs. 2 and 4. Fig. 6 is a vertical section on line *z z* on Fig. 4, looking toward the front of the machine. Fig. 7 is a vertical section on line *v v* on Figs. 1 and 4, looking toward the rear of the machine. Fig. 8 is a vertical section on line 2 2 on Fig. 3. Fig. 9 is a similar section, representing a modification of the devices for operating the automatic adjustment of the needle by the movement of the presser-bar. Fig. 10 is a horizontal section on line 3 3 on Fig. 9; and Figs. 11 and 12 are, respectively, a sectional plan and an elevation of the eye-pointed looper-needle.

A is the main standard or column, upon which all the working parts are mounted. B is the driving-pulley, mounted upon a short horizontal shaft, C, having its bearing in the box or stand D, bolted to the rear of the head, as shown, and having secured to its inner end the bevel-pinion *a*, which meshes into the bevel-gear *b*, mounted on the middle of the horizontal shaft *c*, to the rear end of which is secured the bevel-gear wheel *d*, which meshes into the similar gear *e*, mounted on the vertical shaft E, to the lower end of which is secured the bevel-gear wheel *f*, which meshes into the gear-wheel *g*, mounted upon the outer end of the short shaft F, connected at its inner end by a universal or gimbal joint to one end of a sleeve or tubular shaft, G, into which is fitted the central shaft H, in such a manner that it is free to move endwise therein, but must revolve with the sleeve, and connected at its outer end by a universal or gimbal joint with the inner

end of the short horizontal shaft I, which has its bearing in a stand, J, secured to the lower end of the stand or frame K.

The stand K is fitted to a dovetailed slide on the front of the standard A, and has mounted in suitable bearings formed thereon the base of the horn L, with its axis in line with the axis of the barbed needle.

The form of the horn, the arrangement of the whirl or looper, and the mechanism contained in the horn are all substantially the same as shown and described in Letters Patent granted to Sylvanus Sawyer and myself February 29, 1876, and, therefore, need not be further described here.

The shaft *h*, which passes centrally through the base portion of the horn L, projects some distance below the lower end of the horn, and has an additional bearing in the U-shaped stirrup M, secured to the lower end of the stand K, and has cut thereon a coarse-pitch screw-thread, as shown. N is a nut fitted to said screw, and to parallel grooves formed in the inner faces of the two upright portions of the stirrup M, and having set in its rear side a pin, which carries a truck, *i*, which fits into the path in the cam O, which is secured to the short shaft I, as shown in Fig. 4. P is a treadle-lever, pivoted at *j* to the standard A, and provided at its rear end with the adjustable weight P^1, and connected by the link P^2 with the stand K, so that the operator, by placing his foot on the front end of the treadle P, can draw the stand K and horn L downward away from the sewing mechanism, for the purpose of taking off or putting on a shoe without disturbing the linear position of the axes of the horn and whirl relative to the axis of the needle, and when his foot is removed from the treadle, the weight P^1 will cause the parts to assume their proper position for sewing.

The stand K and the horn L may be held firmly in position, while the sewing is being done, by the set-screw Q; or, instead thereof, a spring-catch may be used to engage with some part of the standard A, and hold the stand K rigidly in position, as shown in Figs. 11 and 12, Sheet 4.

R is a crank-disk, secured to the front end of the horizontal shaft *c*, and having set therein the crank-pin *k*, which is embraced by the lower end of the connecting-rod *l*, the upper end of which is pivoted to the upper end of the bar *m*, which is fitted to bearings in the rear face of the removable frame A′. The bar *m* is forked at its lower end, and has formed in its upper portion a slot, *n*, as shown in Fig. 8. The bar *m* is also provided with a coarse-pitch screw, *o*, fitted to work through a nut formed at the lower end of the slot *n*, so that the point of said screw projects more or less into the slot, and by its position determines the length of free opening through the bar or the working length of the slot *n*. The screw *o* is splined, and works freely endwise through a pinion, *p*, which is provided with a suitable feather to fit the spline in the screw, and mounted in a suitable housing in the removable frame A′, between the forks of the lower end of the bar *m*, and engages with teeth formed on the side of a horizontal rack, *q*, which is connected by a bell-crank lever, *r*, to one of the prongs of the U-shaped presser-bar *t*, as shown in Fig. 8, in such a manner that when the presser-foot is raised the rack *q* will move to the right, rotate the pinion *p*, and cause the point of the screw *o* to project farther into the slot *n*, thereby reducing its length, and when the presser is lowered, the reverse action takes place, and the length of the slot *n* is increased.

The lengthening and shortening of the slot *n* has the effect to increase or diminish the throw of the needle, as the two extremes of the slot *n* are the points of contact, which, by acting upon the lug *u*, projecting from the rear of the sleeve *w*, causes the reciprocations of the needle-bar a^1, the motion of the needle-bar being as much less than the motion of the bar *m* as the vertical length of the slot *n* exceeds the vertical width of the lug *u*, the needle always descending to the same point, but the upper extreme of its motion varying according to the position of the presser-foot, which, of course, is controlled by the thickness of the stock being sewed.

The construction, arrangement, and operation of the needle-bar a^1 and sleeve *w* are substantially as described in the patent to Sawyer and myself, before referred to, the two parts reciprocating together, and the needle-bar being rotated in the sleeve by means of the pinion b^1 and the rack *c′*, motion being imparted to the rack *c′* by the lever S and cam T, aided by the spring U.

The presser-bar *t* is made U-shaped, or in the form of two parallel bars, connected together at their lower ends, and mounted in independent bearings in the removable frame A′, in the same plane with the bar *m*, as shown in Figs. 8 and 9, and has firmly secured to its right-hand lower corner the presser foot *d′*, and near the middle of the right-hand prong has pivoted thereto the jointed feed-prong *e′*, as shown in Fig. 2.

Motion is imparted to the feed-point *e′* as follows: A spur-gear wheel, *f′*, is secured to the front end of the shaft *c*, in the rear of the crank-disk R, and may be made in one piece with the said crank-disk R, as shown, or separate therefrom. This gear *f′* meshes into and imparts motion to another spur-gear wheel, *g′*, which has formed in one piece with it, or firmly secured to its front face, a cam, *h′*, which acts upon a lever, *i′*, secured to the rear end of a short rocker-shaft, *j′*, having its bearing in the frame A′, and having secured to its front end the pendent lever *k′*, to the lower end of which is pivoted the link *l′*, the opposite end of which is pivoted to the feed-prong *e′*, as shown in Fig. 2. The gear *f′* also meshes into, and imparts motion to, another spur-gear

wheel, m', having a cam, n', formed in one piece therewith, or secured to its front face, which acts upon a lever, o', secured to the rear end of a short rocker-shaft, p', having its bearing in the frame A', and having secured to its front end the pendent lever q', to the lower end of which is pivoted one end of the link r', the opposite end of which is pivoted to the middle of the looper-carrier s', pivoted at its upper end to the left-hand prong of the presser-bar t, and carrying at its lower end the eye-pointed and curved looper-needle t'.

V is the thread-spool, which supplies the dry thread to the eye-pointed looper-needle t', and W is a similar spool, which carries the lower or waxed thread.

The presser-foot is forced down onto the stock by the leaf-spring u' bearing upon the upper end of one of the prongs of the presser-bar t.

A modification of the devices for automatically operating the screw o is shown in Figs. 9 and 10, where a pinion, a^2, mounted upon a stud set in the frame A', and meshing into rack-teeth in the outer edge of the left-hand prong of the presser-bar t and similar teeth cut in the upper surface of the rack q, is substituted for the lever r.

The looper t' is made substantially as shown in Figs. 11 and 12, being curved between the thread-eye and the point where it is seized by its carrier, so that the barbed needle may pass by it, between it and one of the strands of the loop of thread carried thereby, when the point and thread-eye of the looper t' is at the right of the barbed needle.

The operation of the parts which directly co-operate to produce the stitch is as follows: Motion being imparted to the driving-pulley, the feed-point and the looper carrying the upper thread move toward each other and the barbed needle b^2, the looper continuing its forward movement after the feed-point begins to recede, and till its eye has passed to the right of the barbed needle, when it remains stationary till the barbed needle descends, passing between it and the back strand of the thread carried by the looper, and enters the stock, when the looper recedes to its former position, where it remains till the barbed needle completes its downward motion, turns a half-revolution about its axis, so that its barb faces toward the feed-point, seizes the loop of the lower or waxed thread formed by the whirl or rotary looper in the horn, and is drawn up to its former position, taking with it the loop of the lower thread, and turned back a half-revolution, so that its barb faces toward the looper-needle, when the feed-point again moves forward and the looper-needle again advances, carrying the upper or dry thread doubled through the loop of the lower or waxed thread, and assuming the same position as before, when the barbed needle descends as before through the loop of the upper thread, the loop of the waxed thread previously drawn up thereby being released from its barb by the combined action of the barbed needle in its downward motion and the feeding of the stock forward. These motions are continually repeated, each needle carrying a loop of its thread through a loop of the thread carried by the other needle, and when the seam is completed the under or waxed thread is in the form of a series of staples, all connected together on the under side of the material, and the doubled prongs extending through the stock to its upper surface, and there clinched by having their ends enlarged to prevent withdrawal, and the upper or dry thread is passed around each and every loop of the wax-thread, and then is passed doubled through each of said loops above where it passed around, thus fastening the ends of the prongs of the staples of the waxed thread, and by virtue of the doubled thread lying in the bight of the loop of the waxed thread effectually enlarges the point of the loop, and if said enlargement is properly drawn into the stock by a properly-regulated tension, the upper thread may be entirely worn off or cut between every two stitches, and the seam will still remain intact.

The operation of the other devices in my improved machine may be readily understood from the foregoing description without further explanation.

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

1. The combination, in a machine for uniting two or more pieces of material by means of two threads, of a reciprocating barbed needle, adapted to pierce the material, and to be partially rotated about its axis at each extreme of its reciprocation, a whirl or looper mounted in a work-support, and adapted to carry the lower thread around the barbed needle to form a loop, and an eye-pointed looper-needle, adapted to be reciprocated horizontally above the material to be sewed, and to carry the upper thread doubled through a loop of the under thread, drawn up through the material, and a previously-formed loop of the upper thread, substantially as described.

2. In combination with a vertically-reciprocating barbed needle, adapted to enter the stock from above, the eye-pointed looper-needle t, curved or cut away upon the side toward the barbed needle, and between its eye and its attachment to its carrier, and mechanism, substantially as described, for imparting thereto a reciprocating motion in the same plane with, but at right angles, or nearly so, to, the barbed needle, as and for the purposes described.

3. In combination with a reciprocating needle-bar carrying a barbed needle, the bar m, provided with the slot n and the coarse-pitch screw o, adapted to be automatically rotated by an upward or downward move-

ment of the presser-bar, the lug *u*, secured to the needle-bar, and projecting therefrom into the slot *n*, and a mechanism, substantially as described, for imparting to the bar *m* a constant reciprocation of invariable length, as and for the purposes described.

4. In combination with the needle-bar and presser-foot of a sewing-machine, the coarse-pitch-screw *o*, adapted to be rotated by the pressure of the needle-bar upon its end, the pinion *p*, and rack *q*, all arranged and connected together as set forth, and adapted to operate as and for the purposes described.

5. The combination, with the bifurcated or U-shaped presser-bar *t*, of the presser-foot *d'*, feed-prong *e'*, secured thereto upon one side of the needle-bar, and the looper-carrier *s'*, secured thereto upon the other side of the needle-bar, all arranged and adapted to operate as and for the purposes described.

6. The combination of the spur-gear wheels *f'* and *g'*, cam *h'*, lever *i'*, rocker-shaft *j'*, lever *k'*, link *l'*, and jointed feed-prong *e'*, all arranged and adapted to operate substantially as described.

7. The combination of the spur-gear wheels *f'* and *m'*, cam *n'*, lever *o'*, rocker-shaft *p'*, lever *q'*, link *r'*, and looper-carrier *s'*, all arranged and adapted to operate substantially as described.

8. The combination of the horn or work-support L, movable stand K, and the standard A, provided with suitable slides to carry said stand K, the several parts being arranged as described, whereby the work-support may be raised or lowered without disturbing the linear position of the tip of the horn relative to the axial line of the needle, as and for the purposes described.

9. The combination of the work-supporting horn, provided with suitable mechanism for forming a loop of the under thread in the inside of the shoe, the stand K, adapted to be moved vertically upon suitable ways on the main standard, and a counterweighted treadle-lever for operating the same, substantially as described.

10. In combination with a work-supporting horn, provided with a whirl or looper, mounted in its tip substantially in line with the axis of the needle, the shaft *h*, provided with a coarse-pitch screw-thread, as shown, and the nut N, fitted to said screw and to vertical ways parallel to said screw, and adapted to be reciprocated in said ways, and thereby rotate the shaft *h*, and, through the connecting shafting and gearing contained in the horn, rotate the whirl in the tip of the horn, first in one direction and then in the other, substantially as described.

11. The combination of the shaft *h*, provided with a coarse-pitch screw, as shown, the nut N, fitted to parallel ways, and the cam O, adapted to impart to the nut N a reciprocating motion, with a period of rest at either extreme of its reciprocation, substantially as described.

12. In combination with the work-supporting horn of a sewing-machine, mounted upon a movable stand adapted to be reciprocated vertically, and provided with gearing and shafting to operate a whirl in its tip, and a vertical shaft at some distance from the whirl-operating shaft, two pairs of bevel-gears and a complex shaft, provided with two universal or gimbal joints and a telescopic means of extension, all arranged and adapted to operate as set forth, to impart motion to the whirl in whatever position vertically the horn may be placed.

Executed at Boston, Massachusetts, this 29th day of December, 1875.

WILLIAM ESTY.

Witnesses:

C. WARREN BROWN,

N. C. LOMBARD.