

UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN SEWING-MACHINES.

Specification forming part of Letters Patent No. **16,436**, dated January 20, 1857.

To all whom it may concern:

Be it known that I, ELIAS HOWE, JR., of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Sewing-Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, in which—

Figure 1 represents a plan of a sewing-machine embodying my improvement. Fig. 2 is a front elevation thereof. Fig. 3 is a vertical longitudinal section of the same at the line *x* of Fig. 1; and Fig. 4 is a full-sized view of a needle suitable for a full-sized machine.

My invention relates to a sewing-machine in which the thread is passed to and fro entirely through the cloth by means of a double-pointed needle having an eye at the middle of its length, so as to form stitches the same as are produced by hand-sewing.

My invention consists in drawing the slack or surplus thread through the cloth by means of an apparatus which is separate from the needle, but is operated in connection with the mechanism that actuates the needle, so that when the needle has passed the bite or loop of thread through the cloth the drawing apparatus draws the surplus thread through and relieves the mechanism that actuates the needle of this duty. As by this invention the duty of the needle is simply to insert the thread through the cloth and present it to the drawing apparatus, the needle need not be moved from the cloth farther than is necessary to clear the surface thereof and carry through sufficient thread to form a short loop which the drawing apparatus can seize. The amount of movement for this purpose is invariable, whether the thread be long or short, and as the drawing apparatus operates upon the surplus thread that trails from the eye of the needle, so that there is no danger of drawing the thread out of the needle, a surplus motion in the drawing apparatus is no disadvantage; hence this motion may also be invariable whether the thread be long or short. A machine, therefore, upon this principle may be built without arranging any portion of the mechanism to compensate the progressive diminution in the length of the thread as it is used up in forming the seam.

The machine represented in the accompanying drawings embodies my improvement. In

it the cloth to be sewed is extended upon a table, A, to which the other portions of the machine are made fast, and the sewing is effected near the front end of the table, where the cloth is held in its place by means of a presser-foot, B. This foot is supported by an arm, C, that extends forward from the hinder end of the table, and it is caused to bear upon the cloth by means of a spring. The needle employed is pointed at both ends, and has an eye at the center of its length to receive the thread, as shown at Fig. 4. This needle is seized alternately by two pairs of nippers, D and D', which are situated at opposite sides of the cloth, and which alternately push the needle into the cloth and withdraw it therefrom. Each pair of nippers is composed of a hand or hollow fixed jaw, which is secured to the extremity of an arm, and of a gripping-jaw that seizes the needle between it and the hand. The arm E of the upper pair of nippers projects forward from a rock-shaft, F, to which it is made fast, and the arm E' of the lower pair of nippers projects forward from a similar rock-shaft, F', situated in line with that of the other nipper-arm. Each of these rock-shafts is also fitted with a shorter arm or foot, by which it is caused to rock, and thus move the nippers toward and from the surface of the cloth to insert and withdraw the needle. The foot *b* of the rock-shaft of the upper pair of nippers is borne against the periphery of a cam, G, secured upon a revolving driving-shaft, H, that crosses the hinder end of the table, and the foot *b'* of the lower pair of nippers is borne against a similar cam, G', secured to the same shaft. The contact of each foot with its respective cam is maintained by a spring, *d* and *d'*, which, acting upon their respective feet, cause them to move toward the driving-shaft whenever the depressions in the cams permit, and thus draw their respective pairs of nippers from the surface of the cloth. The gripping-jaw of each pair of nippers is secured to the extremity of a rod that is moved endwise to cause the jaw to seize the needle or to let it loose. The jaw-rod *f* of the upper pair of nippers is held in its place by guide-lugs that are secured to its nipper-arm E, and through which it slides. Its hinder extremity is bent downward, and is borne against the rim of a cam, I, secured to the driving-shaft H. This cam, by moving the

jaw-rod endwise toward the front of the machine, causes the nippers to seize the needle. As the cam turns and the depressed portion of its rim comes in contact with the extremity of the jaw-rod, the latter is moved toward the driving-shaft by a spring, *g*, which thus causes the jaw to unclose and let loose the needle. The jaw-rod *f'* of the lower pair of nippers slides in guide-lugs secured to its respective nipper-arm E'. Its hinder extremity bears against an appropriate cam, I', upon the driving-shaft, and it is also fitted with a spring to maintain its hinder extremity in contact with its cam and move it to open the nippers whenever the depression of the cam permits.

The drawing of the slack thread through the cloth is effected by a vibrating finger, which, engaging in the loop of thread formed close to the cloth at each alternate passage of the needle, and then receding from the cloth, pulls the thread through and tightens the stitch. In the machine now under consideration the finger *a* is secured to the front extremity of an arm, J, which projects forward from a rock-shaft, K, that is supported in suitable bearings at the hinder extremity of the machine, and this rock-shaft is caused to rock and move the finger up and down by securing an arm, *h*, to one of its ends, and by connecting this arm by a link, *l*, with the pin of a crank, *m*, which is secured to the adjacent end of the driving-shaft.

In order to form a loop of thread in which the point of the finger *a* can engage, the cam G, that operates the lower pair of nippers, is formed in such manner that it permits the nippers to move the needle from the cloth a little farther than is necessary to withdraw the needle therefrom, and then forces the nippers to move the needle a slight distance toward the cloth, thus shortening the distance from the eye of the needle to the cloth and causing the bight of thread extending through the eye to shorten and open. This movement of the nippers is effected by a depression formed in the rim of the cam, in which the foot of the rock-shaft of the nipper-arm is received at the proper moment, and the depression is succeeded by a more protuberant portion, which, acting upon the foot, causes the nippers to carry the needle toward the cloth. In order to cause the point of the finger to engage in the loop thus formed, a lateral movement is imparted to it. This lateral movement is obtained by means of an inclined guide, *n*, which is secured to the lower side of the table-top in such a position that as the finger-arm is completing its upward stroke it comes in contact with the inclined face of the guide *n*, which bears it laterally from the lower nippers, and thus carries the finger out of the range of the needle. In order to permit this lateral movement, the finger is connected with its arm J by means of a spring-plate, *e*, which, although rigid in a vertical direction, is sufficiently flexible to permit it to yield laterally as it is moved upward in contact with the inclined face of the

guide *n*, and is sufficiently elastic to resume its form, and thus move the finger again laterally into the loop or bight of thread upon the needle as the spring-plate is carried downward by the finger-arm along the inclined face of the guide.

The feeding of the cloth is effected in a continuous manner by means of a revolving disk whose face has a series of spiral ribs formed upon it. This disk P is concentric, or thereabout, with the needle, and it is sunk in a recess formed in the table beneath the presser-foot B. It is perforated at its center to revolve upon a boss, *g*, which is held in its place by a bridge, O, that crosses the socket in which the disk is sunk. The disk has also a rim, *r*, which projects downward from its periphery, and is grooved to receive a band by which motion is imparted to the disk. This band is passed round the groove of the disk and round a similar groove, *e*, formed in the driving-shaft, so that by the revolution of the latter the disk is caused to revolve in the direction indicated by the arrow in the drawings. As the disk revolves the spiral ribs upon its upper surface act upon the cloth, which is pressed upon them by the finger of the operator, and cause it to move in any required direction according to the portion of the disk upon which the pressure is made. Thus, if the pressure of the finger be applied to the right side of the presser-foot, the cloth will be moved from left to right; if it be applied to the left side of the presser-foot, the cloth will be moved from right to left. In the same manner the cloth may be made to move either from or toward the operator, or at any inclination to these directions, by simply applying the pressure of the finger to the cloth upon the disk at that side of the presser-foot toward which the cloth is to be moved. As the feeding-disk revolves continuously, the feed of the cloth will also be continuous, provided the pressure of the finger be uninterrupted; and as this is the case, in practice it is necessary that the needle should have a slight lateral movement imparted to it, so as to take the "set back," as it is termed in hand-sewing, in sewing a "back-stitch." This lateral movement also, in connection with the feeding of the cloth from or toward the driving-shaft, will cause the needle to pass alternately through the cloth and outside of its edge, thus producing an "over-and-over" or "whip" stitch. As the feed is continuous, it would also seem necessary to impart a lateral movement to the needle while it is passing through the cloth, so as to cause it to move with the cloth, and thus prevent the latter from wrinkling against it or from straining the needle by its pressure against it; but in practice the passage of the needle through the cloth is so instantaneous that a lateral movement for this purpose is not found necessary. There remains, therefore, only the lateral movement required to sew back-stitch and whip-stitch, or sewing of these descriptions, to be provided for in the machine, and this

lateral motion must be reciprocating in order that the needle may pierce the cloth alternately at the same points beneath the presser-foot. In order to effect this reciprocating lateral movement of the needle, the rock-shafts *F F'* of the arms of the nippers are mounted in a frame, *R*, which oscillates upon two pivots, *s s*, so that by turning this frame upon its pivots the nippers are caused to move horizontally over the table. The turning of the oscillating frame in one direction is effected by means of a cam, *T*, upon the driving-shaft, which acts upon a stud or wiper, *i*, secured to one side of the oscillating frame. This wiper is pressed against the periphery of the cam by means of a spring, *u*, which acts in opposition to the cam, and thus moves the oscillating frame in one direction, while the cam moves it in the other. By these two movements the nipper-arms are caused to vibrate to and fro over the table, and the extent and character of the vibrations are governed by the form of the cam *T*.

A regulating-screw may also be attached to the frame *R*, to bear against some stationary portion of the machine before the wiper reaches the lowest portion of the cam, and thus limit the movement of the frame *R* under the action of the spring *u*, so that the projection of the most protuberant portion of the cam will determine the movement of the frame in one direction, and the adjustment of the regulating-screw will determine the movement in the opposite direction. In back-stitching the form of the cam is such that after the needle has been passed through the cloth it is carried laterally a short distance in the direction in which the cloth is moving, but at a faster rate, so that when the needle returns through the cloth it has carried the thread over a portion of the seam already formed, and after the needle has returned entirely through the cloth the cam causes the needle to be carried back in an opposite direction to the feed to the place where the needle first pierced the cloth. In order to permit of this lateral movement of the needle, the hole in the boss *q* through which it passes is elongated, and the hole in the presser-foot *B* is elongated in a similar manner.

When the machine is to be used, the driving-shaft *H* is turned by means of its crank-handle *V* in the direction indicated by the arrow applied thereto until the upper nippers is at its farthest distance from the surface of the table. A threaded needle is then applied to the upper nippers by drawing back its movable jaw by hand and allowing it to close upon the needle placed between it and the hollow jaw. The needle must be applied in such manner that its lower point is a sufficient distance above the feed-disk to permit a free movement of the cloth, and the thread passed through the eye of the needle must not be longer than twice the distance to which the finger *a* is moved from the lower face of the cloth. In threading the needle the thread is only passed a short distance through the eye—say about

an inch and a half—and the sewing is commenced with the part of the thread which is nearest the eye of the needle, instead of with the opposite end thereof, as in hand-sewing. Moreover, in applying the needle to the nippers, this short end of thread must be at that side of the needle which is farthest from the operator. The cloth to be sewed is inserted between the presser-foot and the feed-disk, and the finger of the operator is pressed lightly upon the short end of thread in the needle to keep it from being drawn through the cloth, while the various parts of the machine are put in motion by turning the driving-shaft *H* either by hand, by means of a treadle driven by the foot of the operator, or by motive power. As the driving-shaft turns, the cams upon it, in connection with the various springs which act in opposition to the cams, impart motion to the various operating members of the machine. The needle is forced downward through the cloth, carrying the thread with it in its eye. As the needle-point passes through the cloth it enters the jaws of the lower nippers, which are opened to receive it by the action of the cam operating upon the rod of the movable jaw appertaining to these nippers. As soon as the upper nippers arrive at the lowest point of its stroke the lower nippers close upon the needle, and when this is effected the upper nippers are opened by the operation of their appropriate cam. When the needle has thus been transferred from the upper nippers to the lower, the latter are moved from the cloth and draw the needle therefrom. While the lower nippers are thus moving away from the cloth the finger *a* is being moved toward the cloth by the turning of the crank *m* and its connection with the rock-shaft and arm of the finger, and the motion of the finger is so timed with reference to that of the lower nippers that it is just ready to descend when the nippers have withdrawn the needle to its farthest limit. After the needle has reached its lowest point it is moved, as before mentioned, slightly toward the cloth, to open the bight of thread in its eye, and as the finger descends after the bight is thus opened, and as it is at the same time moved laterally by the operation of the spring-plate *c* and the inclined guide *n*, the point of the finger engages in the bight of thread close to the needle. The machine is arranged in such manner that the finger passes on that side of the needle along which the longer portion of the thread extends; hence as the finger is moved downward it first elongates the loop, thus tightening the stitch, and finally draws the slack entirely through the cloth. During this movement of the thread the lower nippers and the needle therein are moved laterally from right to left by the oscillation of the frame *R*, which is effected at this time by the action of the spring *u* as the cam *T* is turned with the driving-shaft, and the least projecting portion of its rim comes opposite the wiper *i*, and they reascend after the finger has completed its downward stroke.

By this upward movement the needle is caused to perforate the cloth a second time, and, passing upward, is gripped by the upper nippers. The lower nippers now release the needle, which is withdrawn in an upward direction from the cloth by the upward movement of the upper nippers, and as soon as the needle has cleared the cloth the revolution of the driving-shaft causes the most projecting portion of the cam T to bear against the wiper *i* and move the frame R, so that the nippers and needle are moved laterally from left to right by the returning oscillation of the frame R. The needle is then in the position whence it first started, and the driving-shaft has completed a whole revolution, so that its further movements are succeeded by a repetition of the above-mentioned operations. As the feeding-disk has been turned by the band leading from the driving-shaft while the needle has been traveling to and fro, as above mentioned, and as the cloth has been pressed upon by the finger of the operator, a new portion of the cloth has been brought within range of the needle, to be traversed in turn by the needle and thread.

As there is but one drawing-finger in the machine thus described, and as it is situated beneath the table, the slack end of the thread is pulled through the cloth only at each alternate passage of the needle when the latter is at the lower side of the cloth. Experience has demonstrated to me that this is sufficient for ordinary sewing; but it is evident that a second finger may be arranged above the table, to operate in connection with the needle when it is withdrawn by the upper nippers, in which case the slack end of the thread would be pulled through the cloth at each passage of

the needle. As fast as the thread in a needle is exhausted a fresh threaded needle is applied to the machine, or the one in it is rethreaded; and in order that the nippers may hold the needle firmly and prevent it from turning laterally in their jaws, the needle has two recesses or indentations formed in it, the one above and the other below its eye, in which the jaws of the nippers can engage.

The apparatus I have thus described for carrying out my invention is susceptible of modification, and may be changed in various ways to adapt it to different kinds of work or to suit the peculiar views of different constructors. Thus, for example, an intermittent feed-motion may be employed to feed the cloth. So, also, the finger which draws out the thread may be connected with apparatus which revolves continuously. The method of opening the bight of thread at the eye of the needle may also be modified by causing the needle to move laterally in the direction of the length of the finger-arm, by which means an opening will be presented between the needle and the thread for the insertion of the finger, as shown at Fig. 4^a, while the thread is under tension.

Having thus described my improved sewing-machine, what I claim as my invention, and desire to secure by Letters Patent, is—

Drawing the thread through the cloth by means of a finger or its equivalent acting in connection with mechanism which passes the needle through the cloth, substantially as herein set forth.

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Witnesses:

W. H. PLUMMER,
CHARLES B. NORTON.