3 Sheets—Sheet 1.

J. W. TUTTLE & T. K. KEITH.

Sewing-Machine for Embroidering.

No. 219,782. Patented Sept. 16, 1879.

Fig. 1.

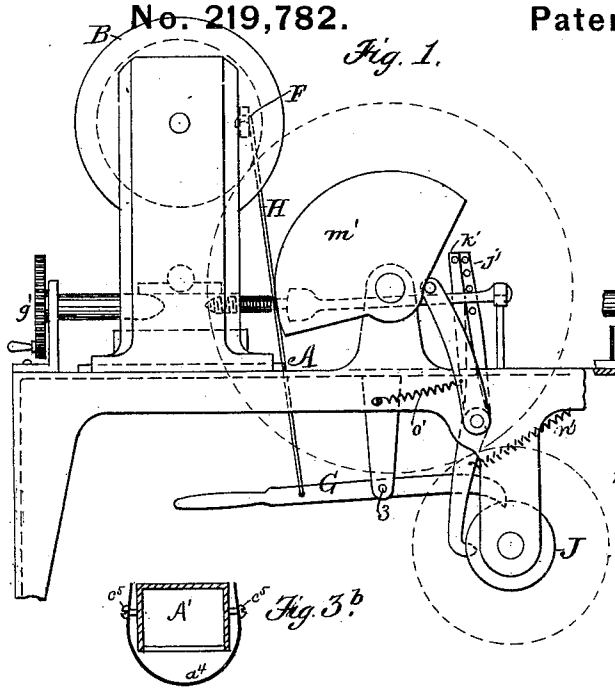


Fig. 3a.

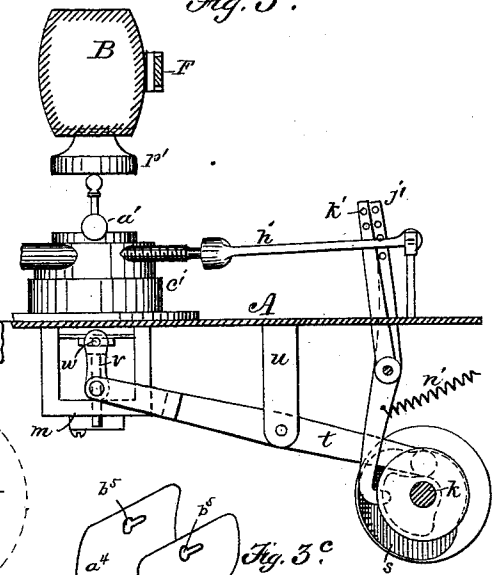


Fig. 3b.

Fig. 3c.

Fig. 2.

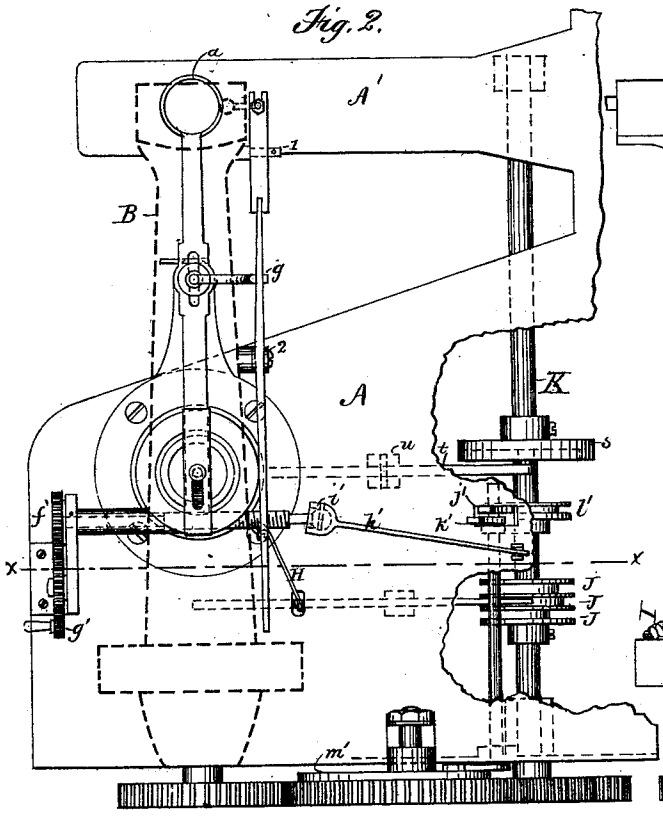
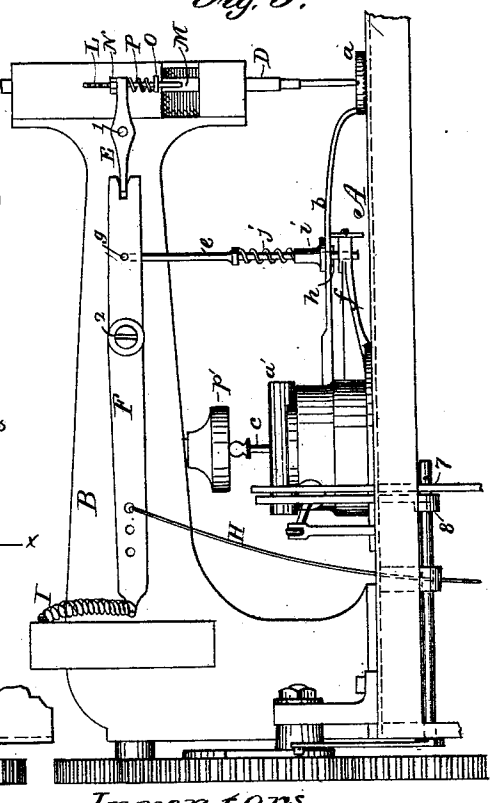


Fig. 3.



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Sewing-Machine for Embroidering.

No. ~~219,782~~. Patented Sept. 16, 1879.

Fig. 4.

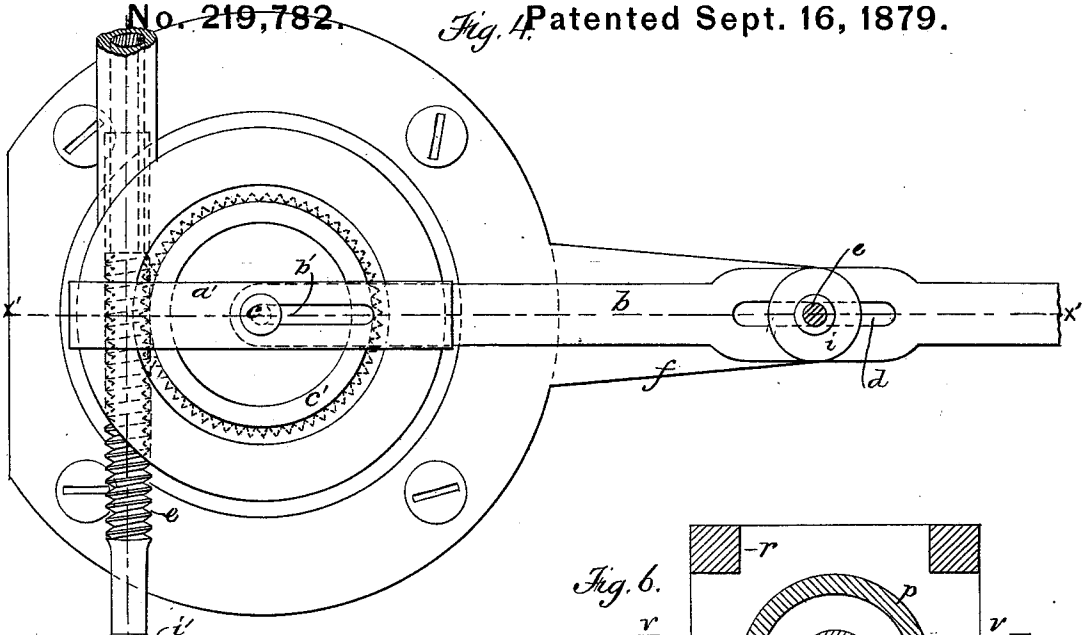

Fig. 6.

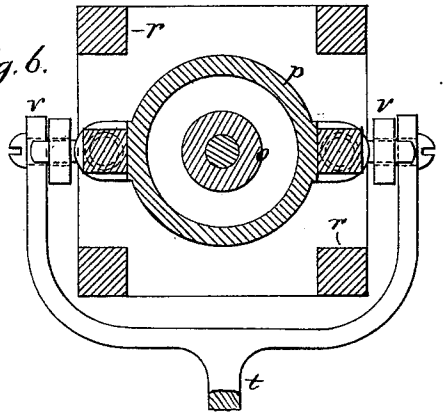

Fig. 5.

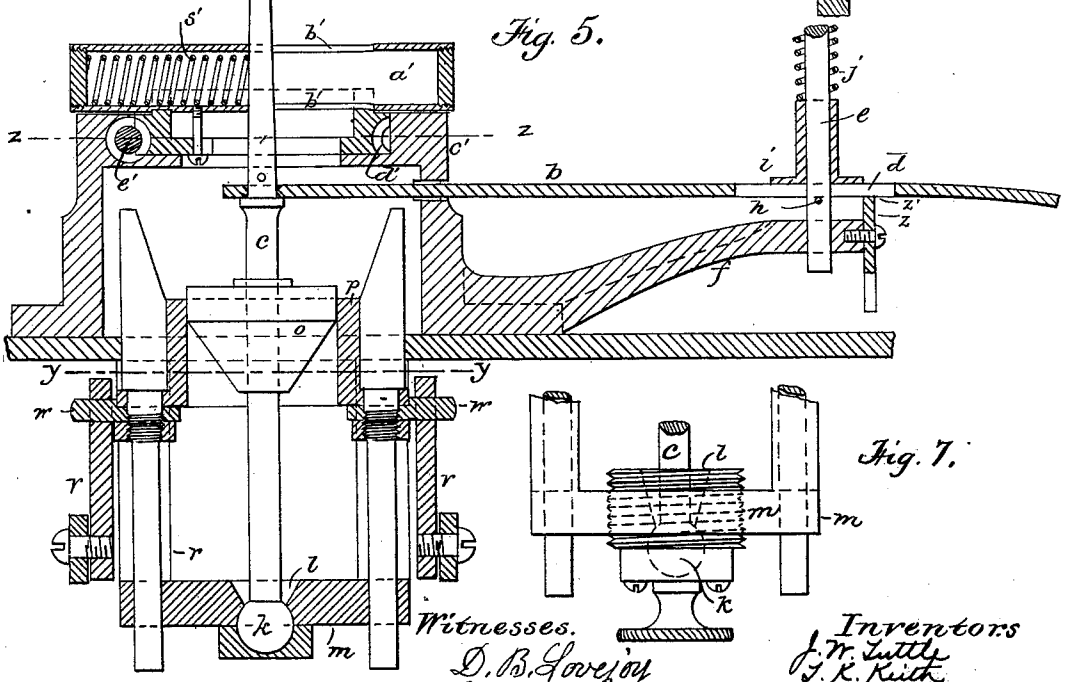

Fig. 7.

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3 Sheets—Sheet 3.

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Sewing-Machine for Embroidering.

No. 219,782. **Patented Sept. 16, 1879.**

Fig. 8.

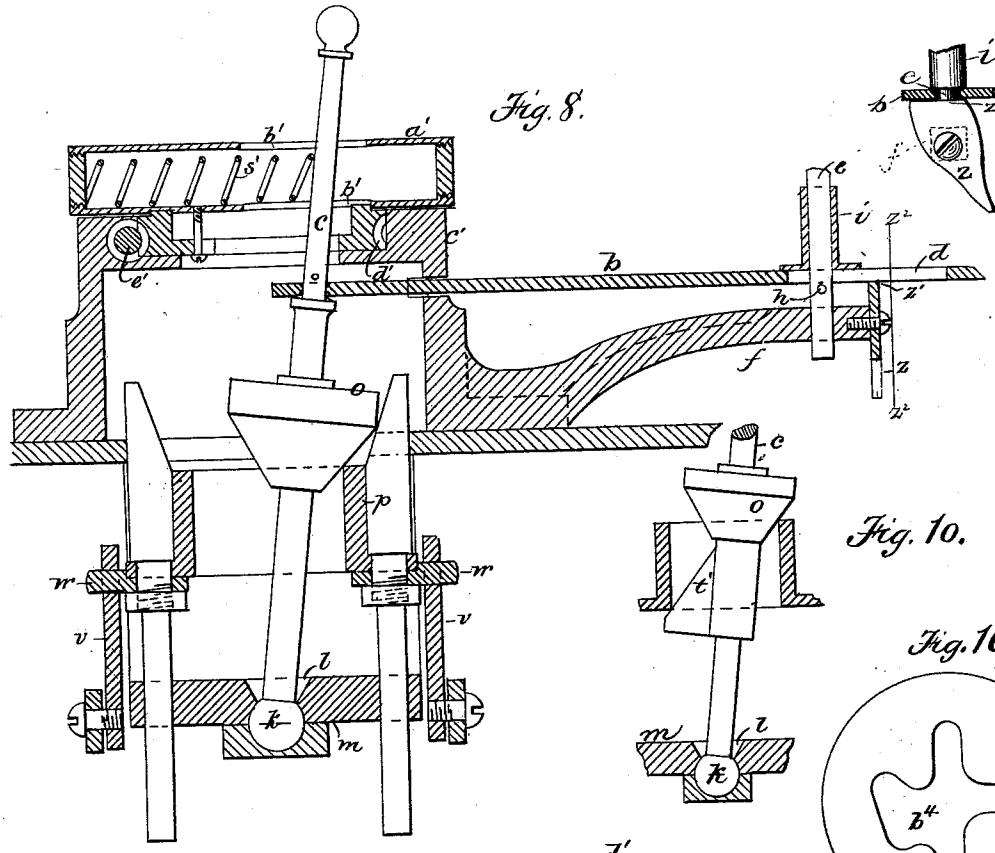


Fig. 8ª.

Fig. 10.

Fig. 16.

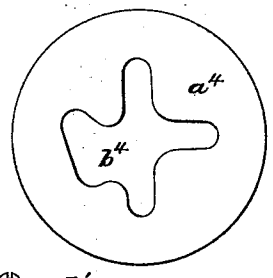


Fig. 9.

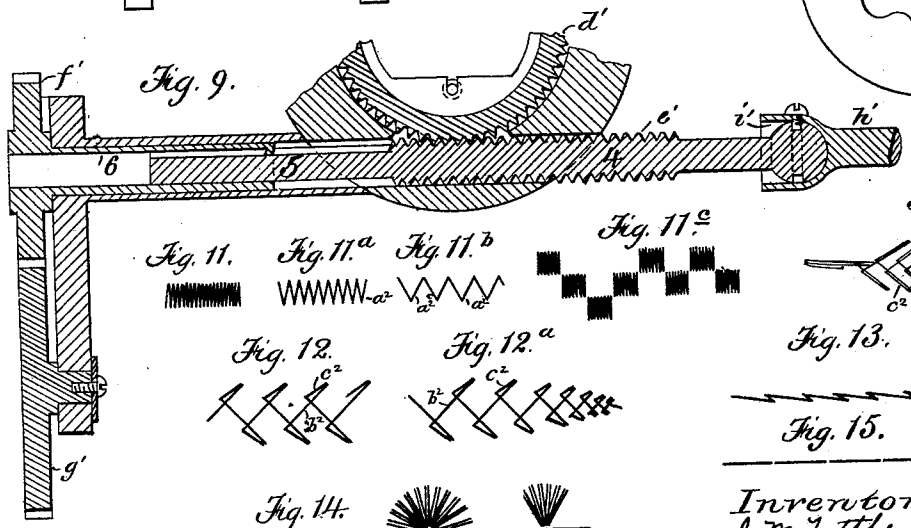


Fig. 11.

Fig. 11ª.

Fig. 11ᵇ.

Fig. 11ᶜ.

Fig. 12ᵇ.

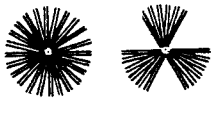
Fig. 12.

Fig. 12ª.

Fig. 13.

Fig. 15.

Fig. 14.



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UNITED STATES PATENT OFFICE.

JOHN W. TUTTLE, OF WATERTOWN, AND THOMAS K. KEITH, OF HAVERHILL, ASSIGNORS OF ONE-THIRD OF THEIR RIGHT TO ISAAC FARWELL, JR., OF NEWTON, MASSACHUSETTS.

IMPROVEMENT IN SEWING-MACHINES FOR EMBROIDERING.

Specification forming part of Letters Patent No. **219,782**, dated September 16, 1879; application filed May 12, 1879.

To all whom it may concern:

Be it known that we, JOHN W. TUTTLE, of Watertown, in the county of Middlesex, and THOMAS K. KEITH, of Haverhill, in the county of Essex, both in the State of Massachusetts, have invented certain Improvements in Sewing-Machines for Embroidering, of which the following is a specification.

This invention relates to that class of sewing-machines in which the material being stitched is given a horizontal movement of more than the ordinary length, so that the stitches are elongated to produce ornamental effects.

The object of the present invention is to provide certain improvements in machines of the class named, whereby a large variety of ornamental stitches may be produced.

To this end the invention consists in the improvements which will now be described and claimed.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents an end view of a portion of a sewing-machine provided with our improvements. Fig. 2 represents a plan view of the same. Fig. 3 represents a side view of the same. Fig. 3^a represents a section on line *x x*, Fig. 2. Figs. 3^b and 3^c represent a device used in connection with the machine for a special kind of work. Fig. 4 represents a top view of a portion of the mechanism embodying our improvements. Fig. 5 represents a section on line *x' x'*, Fig. 4. Fig. 6 represents a section on line *y y*, Fig. 5. Fig. 7 represents a modification. Fig. 8 represents a section similar to Fig. 5, with some of the parts in different positions. Fig. 8^a represents a section on line z^2 z^2, Fig. 8. Fig. 9 represents a partial section on line *z z*, Fig. 5. Fig. 10 represents a modification. Figs. 11, 11^a, 11^b, 11^c, 12, 12^a, 12^b, 13, 14, and 15 represent stitches formed by the machine. Fig. 16 represents another modification.

Similar letters indicate like parts in all the figures.

In the drawings the invention is shown applied to a Howe sewing-machine, although it is applicable to other lock-stitch machines, which need not be here named.

Referring to said drawings, A represents the bed or table of the machine. B represents the goose-neck, having a vertically-reciprocating needle-bar, which operates as usual in machines in which the needle has no lateral movement. The machine is provided with suitable lock-stitch-forming mechanism. (Not shown in the drawings.)

D represents the presser-foot, which is preferably formed at its lower end to occupy as little space as possible on the material being stitched.

For convenience of description we will hereinafter call the material being stitched the "work."

The presser-foot is raised and lowered by suitable mechanism to release and hold the work at periods of time which are capable of definite adjustment.

To operate the presser-foot, we prefer to employ a system of levers, E F G, a connecting-rod, H, a spring, I, and a cam, which is one of a series or gang of cams, J J J, each of which differs from the others, and either of which is adapted to operate the presser-foot, as hereinafter described.

The levers E F are pivoted at 1 2 to the goose-neck, and are jointed together or otherwise loosely connected at their proximate ends. The lever E is connected at one end to an arm, L, which is rigidly attached to the presser-bar M. Said lever E is preferably slotted or perforated, so that the arm L can move freely through the lever, and the arm is provided with two stops, N O, above and below the lever. The stop N bears upon the upper side of the lever, and the stop O supports a spring, P, which bears against the under side of the lever.

The lever G is connected at 3 to a stud or support under the bed A, and is connected to the lever F by the rod H. The spring I is connected to one end of the lever F and to the goose-neck, and its effect is to hold the lever G in yielding contact with one of the cams J, and to raise the presser-foot whenever the position of the cam will allow.

The cams J are located on a shaft, K, which is journaled in suitable bearings under the

bed A, and is rotated by suitable connections with the operating mechanism of the machine. Each cam is so formed that when it is in position to hold the lever G as far as possible from the shaft K the presser-foot will be held down upon the work by the cam and the intervening mechanism described, and when the cam is in position to permit the nearest approach of the lever G to the shaft K the presser-foot will be raised from the work by the spring I.

When the presser-foot is forced down, the spring P gives it a yielding pressure, which prevents it from injuring the work

The lever G is adapted to be engaged with either of the cams J, and to this end the lever may be pivoted to swing horizontally, so that its end may be shifted from one cam to another, or the cams may be adapted to slide on their shaft.

The cams J may be of any desired number and form, to time the movements of the presser-foot and the feed-dog, next described, according to the nature of the work being performed.

a represents a device which serves both as a feed-dog and a presser-foot. This feed-dog is located above the bed of the machine, and is operated, as hereinafter described, to bear upon the work, when the presser-foot is raised, and to give the work a horizontal movement in any desired direction and of any desired length. The feed-dog *a* is preferably in the form of a horizontal ring, which surrounds the needle and presser-foot, and is notched at its lower edge, so as to hold and move the work. This form of the dog is not essential, however, as it may be straight or of other form.

The feed-dog *a* is located on the end of a substantially horizontal lever, *b*, which is connected at its opposite end to a lever or spindle, *c*, which is operated by the driving mechanism of the machine to move the lever *b* horizontally, as hereinafter described.

The lever *b* is provided at or near its center with a longitudinal slot, *d*, through which passes a laterally-immovable cylindrical rod, *e*. The diameter of the rod *e* is nearly equal to the width of the slot *d*, and said rod serves as a pivot on which the lever *b* may oscillate horizontally, and as a guide on which said lever may move longitudinally, the slot permitting such movement without a corresponding movement of the rod *e*.

f represents an arm or projection rigidly attached to the bed A, and containing a socket, which receives the lower end of the rod *e*, and permits the rod *e* to move vertically. The rod *e* is connected at *g* to the lever F, and raised and lowered by said lever, the movements thus imparted to the rod being simultaneous with and in opposite directions to the movements of the presser-foot, the rod *e* rising when the presser-foot is falling, and vice versa.

The rod *e* is connected to the lever *b*, so that its movements are imparted to the latter, a rigid pin or collar, *h*, on the rod *e*, below the lever *b*, serving to lift said lever when the rod is raised, and a collar, *i*, adapted to slide on the rod and forced against the upper surface of the lever by a spring, *j*, serving to depress the lever when the rod is lowered, and hold the dog *a* with a yielding pressure against the work, and thus prevent the dog from injuriously indenting the work.

It will be seen that the feed-dog and presser-foot alternate with each other in bearing on the work. The spindle *c*, which imparts a horizontal movement to the lever *b*, passes loosely through an orifice in the end of said lever, and has a rounded lower end, *k*, which fits in a corresponding socket, *l*, in a support, *m*, rigidly attached to the bed of the machine, said end *k* and socket *l* forming a ball-and-socket joint, which enable the spindle *c* to vibrate in all directions from a vertical or nearly vertical position. The spindle *c* may be vibrated by any suitable mechanism. We prefer to employ for the purpose a collar, *o*, which is an inverted frustum of a cone, rigidly attached to the spindle, and a horizontal ring, *p*, whose internal diameter is just sufficient to enable it to receive and slide easily on the base of the collar *o*. The ring *p* is adapted to slide vertically in a suitable guiding-frame, *r*, rigidly attached to the bed of the machine, and is raised and lowered by a face-cam, *s*, on the shaft K, and a lever, *t*, engaged with said cam, pivoted to a stud or hanger, *u*, and connected by links *v v* to trunnions *w w* on the ring *p*. When the ring is lowered it is below the larger end of the collar *o*, and allows the spindle to assume an inclined position, as shown in Fig. 8; but when said ring is raised it bears upon the conical portion of the collar until it reaches and incloses the larger end of the collar, as shown in Fig. 5, thus causing the spindle to assume a vertical position, in which it is held rigidly by the ring.

Suitable means are provided whereby the spindle is forced into an inclined position when the ring *p* is depressed. For this purpose we prefer to employ a spring, *s'*, arranged to press outwardly on the upper portion of the spindle in any desired direction, as hereinafter described.

Instead of the spring, positive means may be employed to move the spindle outwardly. For instance, an inclined wing, *t'*, may be rigidly affixed to the spindle *c*, as shown in Fig. 10, said wing being in such position that the ring *p*, in descending, will bear against its inclined surface, and thereby force the spindle outward.

It will be seen that any movement of which the spindle is capable will result in a horizontal movement of the lever *b* in a direction corresponding to the direction in which the spindle moves.

To govern the direction of movement of the spindle we employ a guide, which consists of a bar or tube, a^1, having a longitudinal slot, b^1, formed therein, through which slot the spindle *c* passes. This bar or tube is supported and adapted to rotate horizontally on a projection,

c^1, rigidly attached to the bed of the machine. Said projection is provided with a circular recess or seat, which receives a spirally-toothed wheel, d', rigidly attached to the bar or tube a^1, and permits said wheel to rotate. The bar or tube a^1 extends across the center of the wheel, and the slot b^1 is always radial with the wheel. The spindle c, when in its vertical position, is in the center of the wheel, and when said spindle is moved by the means described it is guided by the slot b^1.

The spring s', before mentioned, is located in the tube a^1, as shown in Figs. 5 and 8, so that it moves with the tube, and is always in position to force the spindle outward in the direction of the length of the slot b^1.

The wheel d' and bar or tube a^1 are rotated, to cause the slot b^1 to extend in any desired direction, by a screw-shaft, e', which meshes with the wheel d', the two constituting a worm and gear.

The rotation of the shaft e' is effected preferably by means of a pinion, f', on the end of the shaft, and a cog-wheel, g', meshing with said pinion and journaled in a suitable bracket or support on the bed A.

The wheel g' is provided with a suitable handle, and is located in convenient position to be turned by the operator. The screw-shaft e' is so constructed that it can be moved longitudinally to rotate the wheel rapidly as a rack rotates a pinion. To this end the shaft e' is composed of a threaded portion, 4, and a reduced smooth portion, 5, tooth formed in one piece, and a tubular portion, 6, formed in a separate piece and rigidly attached to the pinion f. The reduced portion 5 is adapted to slide in the tubular portion, and is provided with a longitudinal groove, into which projects a pin rigidly affixed to the tubular portion 6. Said pin and groove insure the rotation of the portions 4 5 by the portion 6, and permit them to slide independently of the latter. The longitudinal movement of the screw-shaft is effected by a connection of the same with the operating mechanism of the machine, such connection being effected by means of a connecting-rod, h', (which is connected to the shaft e' by a ball-and-socket joint, i',) and either of two levers, j' k', which are pivoted, respectively, at 7 8, and are adapted to be oscillated at different times and rates of speed by cams l' m', rotated by the machine, and springs n' o', which hold said levers in contact with said cams.

The levers j' k' have different movements, and each is adapted to be connected to the rod h', so as to reciprocate the latter longitudinally in the manner and for the purposes hereinafter explained. The rod h' is adapted to be attached to the levers j' k' at different distances from the pivots of said levers, so that the throw or longitudinal movement of the shaft e' can be adjusted.

We have provided means for regulating the length of the described vibrations of the spindle, and to this end we prefer to employ a nut, p', which is adapted to work on a vertical threaded shank, q', depending from the goose-neck. The under surface of the nut p' is provided with a conical recess, r', the apex or highest point of which is in line with the center of the shank q', and with the spindle c when the latter is in a vertical position. This recess forms a stop or abutment for the upper end of the spindle and limits its outward movement in any direction, as shown in Fig. 5.

The length of movement of the spindle is regulated by adjusting the nut p' vertically, the movement of the spindle increasing as the nut is raised, and vice versa.

An equivalent is shown in Fig. 7, in which the socket that supports the spindle c is vertically movable, so that the spindle can be raised and lowered to alter the position of the collar o with relation to the ring p, so that when the latter is lowered it will act as an abutment to the inclined portion of the collar, and permit a greater or less movement of the spindle, according to the elevation of the latter.

In the operation of a sewing-machine having the described improvements, the feed-dog a is moved by the means described to carry the work horizontally in any desired direction while the needle is raised, and thereby feed the work so as to cause elongated stitches of any desired length to be formed thereon, extending in any desired direction or directions.

The machine is capable of producing a variety of stitches, each involving some difference in the mode of operation and in the adjustment of parts; hence we will describe separately the operations involved in making the stitches represented in Figs. 11, 11^a, 11^b, 11^c, 12, 12^a, 13, 14, and 15, these being the principal varieties which the machine is adapted to produce.

Figs. 11, 11^a, 11^b, and 11^c represent a zig-zag stitch, which may be modified from the solid column shown in Fig. 11 to the angular stitch shown in Fig. 11^b. When the machine is adjusted to form said stitch the shaft h' is connected to the lever j', and the lever G is connected with a cam, J, which is timed to raise the feed-dog at every alternate descent of the needle and depress the feed-dog before the next ascent of the needle, the movements of the presser-foot being always the reverse of the vertical movements of the feed-dog, so that when the work is held by one it is released by the other. After one ascent of the needle the spindle c is operated to move the lever b and its feed-dog a horizontally in one direction, and after the next ascent said parts are moved in the opposite direction. These movements of the feed-dog may be called the "stitch motions." They occur while the feed-dog is on the work, and move the work so as to regulate the distance between the point from which the needle leaves the work and the point where it next enters the work. The direction of the stitch motions corresponds to the direction of the slot b^1. If said slot is parallel with the lever b, the movement of the feed-dog is produced entirely by the longitudinal

movement of the lever. If the slot b^1 is at right angles with the lever, the movement of the feed-dog is produced entirely by the oscillation of the lever on its pivot c; and if the slot b^1 is diagonal to the lever, the movement of the feed-dog is produced partly by the longitudinal and partly by the oscillating movement of the lever, as will be readily seen. The feed-dog is thus adapted to move in all directions horizontally.

The effect of the stitch-motions described is to produce elongated stitches a^2 a^2 upon the work, first in one direction and then in another, the length of the stitches depending upon the length of the feed motions, which are regulated by the described means for limiting the vibrations of the spindle.

The feed-dog has two other motions in opposite directions and at right angles with the stitch motions. Said motions regulate the divergence of each stitch from the stitch previously formed, and may be called the "feed motions." They are produced by the rotation of the tube or bar a^1, effected by the lever j', connecting-rod h', and worm and gear e' d'. Both of the feed motions take place while the spindle c is inclined, and therefore released by its ring p. One of the feed motions occurs while the feed-dog is raised, and it moves the feed-dog forward or toward the portion of the work in advance of the stitches already formed. The other feed motion takes place while the needle is raised, and immediately in advance of one of the stitch motions, and it moves the work back, so that the stitch laid by the next descent of the needle will diverge at the desired angle from the stitch last formed. The length of the feed motions is regulated by the connection of the rod h' to the lever j', said motions being shortened by decreasing the distance between the pivot of the lever and the point where the rod is connected. By sufficiently shortening the feed motions the stitches can be laid so close together as to produce the solid-column or clock stitch shown in Fig. 11, while by lengthening said motions the stitches can be made zigzag or open, as shown in Figs. 11^a and 11^b.

The direction of the feed motions is determined by the position of the tube or bar a^1, and the operator is enabled, by rotating said tube or bar by the wheel and pinion, to give any desired direction to the slot b^1, so as to cause the stitches a^2 to lie in any desired direction on the work. By rotating the tube or bar while the machine is operating the line of stitches can be curved or turned in any direction at the will of the operator. The continuity of the line of stitches can be broken and sections can be offset, as shown in Fig. 11^c, by holding up the lever b and the feed-dog, after the completion of one stitch, while another is being taken, and then allowing the lever b and the feed-dog to operate as usual. By this operation the line of stitches can be moved to either side, as will be readily seen.

To hold the lever in an elevated position we provide a lever, z, pivoted to the end of the arm f. This lever is provided with a shoulder, z', which, when the lever z is turned upward, bears against the lower side of the lever b, and raises the latter and holds it up from the work.

The solid-column stitch shown in Figs. 11 and 11^c is adapted for ornamenting stockings, and is known as "clocking." To apply this or any stitch to a stocking or other tubular fabric, a machine should be employed having the portion of the bed under the needle-bar and presser-foot in the form of a narrow arm, A′, adapted to be surrounded by the fabric. To stretch the portion of the fabric that receives the stitches, we employ a U-shaped spring, a^4, (shown in Figs. 3^b and 3^c,) adapted to be inserted in the fabric, and hold a portion of it in a smooth, flat, distended condition.

In adapting the machine to form the herring-bone or cat stitch, (shown in Fig. 12,) the lever G is engaged with another of the cams J, which cam is timed to lift the feed-dog just before every alternate descent of the needle, and lower the dog while the needle is depressed, and hold said dog on the work while one entire stitch motion and a part of another is being made.

The connecting-rod h' is connected to the lever k', which is operated by its cam to give a partial rotation, first in one direction and then in another, to the tube or bar a^1, each rotation being made while the spindle c is vertical, so that there is no feed movement given to the spindle by the rotation of the tube or bar a^1, the only motions of the spindle being the outward and inward stitch motions guided by the slot b^1. These motions may be at any desired angles with each other, according to the movements given the tube, and therefore cause the feed-dog to move the work in corresponding directions, so as to cause the stitches to lie at corresponding angles, as shown.

In forming the stitch the feed-dog is in contact with the work during the outward movement of the spindle c, so that the work will be moved a distance corresponding to the length of the movement of the spindle, and a stitch, b^2, of a corresponding length will be formed on the work.

During the next inward movement of the spindle c the feed-dog is lifted from the work before the entire movement is completed, so that the work is given only a partial movement, the result being a shorter stitch, c^2, nearly parallel with the stitch b^2.

The movement of the feed-dog is completed while the dog is lifted, and the dog descends after the completion of the short stitch, and gives the work a full movement after the next ascent of the needle to form the next full stitch b^2.

It will be seen that the difference between the shorter and longer movements of the work produces a progressive movement in one direction, which amounts to a feed motion.

By operating the nut p', or its equivalent,

to reduce the length of the outward and inward movements of the spindle *c* while forming the stitch last described, the stitches can be gradually shortened, so as to produce a leaf-like design, as shown in Figs. 12^a and 12^b. If desired, means may be provided for rotating the nut *p'* by a treadle worked by the foot of the operator.

In adapting the machine to form the back-stitch shown in Fig. 13, the only change from the adaptation last described is to connect the connecting-rod *h'* to the rigid post or support, as shown in Fig. 2, so that there will be no automatic rotation of the tube or bar a^1, and the longer and shorter stitches, b^2 c^2, will be nearly parallel with each other, as shown, the result being a thick heavy vine-like stitch.

In adapting the machine to form the rosette shown in Fig. 14, the only change from the last-described adaptation is to disconnect the lever G from the cams J, and allow the presser-foot to be raised from the work and remain inoperative, and the feed-dog to remain in continued contact with the work. The feed-dog therefore has only two motions in opposite directions when the machine is operated, and carries the work back and forth in the same line.

The operator rotates the bar or tube a^1 slowly as the machine is operated, and thus causes the stitches to radiate until the figure is formed. A fan-shaped figure or a section of the rosette may be formed in the same manner, and two or more of such figures may be formed and connected by the back-stitch shown in Fig. 13, or any other suitable stitch which the machine can form.

The stitch shown in Fig. 15 is formed by adapting the feed-dog to move the work in one direction only after each alternate ascent of the needle.

If desired, the slotted tube or bar a^1 may be removed, and the spindle may be moved outward, and guided in all of its movements by the fingers of the operator, to cause the stitches to extend in any desired direction and produce various fanciful and irregular designs; or a plate having an orifice of any desired outline may be substituted for the tube or bar a^1. Such a plate is shown in Fig. 16, a^4 being the plate, and b^4 the orifice. This plate is placed in a suitable support, so that the spindle *c* will pass through the orifice. The operator pushes the spindle outwardly into the different recesses of the orifice while the machine is in operation. The movements given to the spindle by the operator correspond to those given by the spring *s'*, as above described, and the orifice b^4 enables the successive motions of the feed-dog to be varied as desired, according to the form of the orifice.

We claim—

1. In a sewing-machine, the combination of a feed-dog, *a*, arranged to bear upon the top of the work, a lever, *b*, supporting the feed-dog and capable of longitudinal and vibratory motions, a vibratory spindle, *c*, engaged with one end of said lever, means, substantially as described, for vibrating the spindle, and a rotary guide inclosing the spindle, and adapted to guide the latter in any desired direction when it is vibrated, as set forth.

2. The combination of a feed-dog, *a*, a lever, *b*, a vibratory spindle, *c*, means, substantially as described, for vibrating the spindle, a guide for directing the movements of the spindle, and means, substantially as described, whereby the position of the guide is automatically changed while the machine is in operation, as set forth.

3. The combination of a feed-dog, *a*, a lever, *b*, a vibratory spindle, *c*, means, substantially as described, for vibrating the spindle, a guide for directing the movements of the spindle, a rotary toothed wheel supporting the guide, and means whereby said wheel may be rotated by the operator to change the position of the guide, as set forth.

4. In combination with the lever *b* and feed-dog *a*, the spindle *c*, having a collar, *o*, and the vertically-movable ring *p* and spring *s'*, or its equivalent, whereby the spindle is oscillated, as set forth.

5. In combination with the lever *b* and feed-dog *a*, the vibratory spindle *c*, means, substantially as described, for vibrating the spindle, and means, substantially as described, whereby the length of movement of said spindle is regulated, as set forth.

6. In combination with the lever *b* and feed-dog *a*, the spindle and its rotary slotted guide, relatively arranged as described, and means, substantially as described, whereby the guide is rotated automatically and caused to move the spindle when the latter is in an inclined position, as and for the purpose specified.

7. In combination with the spindle-guide, the mechanism whereby said guide is rotated, consisting of the spirally-toothed rotary wheel *d'*, and a screw-shaft, the threaded portion of which is adapted both to rotate and reciprocate longitudinally, whereby said wheel and shaft are adapted to operate either as a worm-gear or as a rack and pinion, as set forth.

8. In combination with the spirally-toothed wheel *d'*, the extensible screw-shaft *e'*, provided at one end with means whereby it may be rotated by the operator, and detachably connected at the other, by means substantially as described, with the operating mechanism of the machine, as set forth.

9. In combination with the rotary spindle-guide, the rotary toothed wheel *d'*, the extensible screw-shaft *i*, and means whereby said shaft is connected to a fixed point, to prevent the rotation of the guide by the operating mechanism of the machine, as set forth.

10. In combination with the rotary spindle-guide, means, substantially as described, whereby the automatic rotation of the guide is regulated as to time and length of movement, as set forth.

11. In a sewing-machine, the combination of a gang of differently-timed cams, J, with the presser-foot and feed-dog, and mechanism whereby the movement of the cams is transmitted to the presser-foot and feed-dog, said mechanism consisting of a pivoted lever, G, adapted to be engaged with either of said cams, and intermediate parts, substantially as described, connecting said lever with the presser-foot and feed-dog, as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, this 10th day of May, 1879.

JOHN W. TUTTLE.
THOMAS K. KEITH.

Witnesses:
GEORGE W. PIERCE,
C. F. BROWN.