(Model.) 5 Sheets—Sheet 1.

E. WOODWARD & T. K. KEITH.

SEWING MACHINE.

No. 316,927. Patented Apr. 28, 1885.

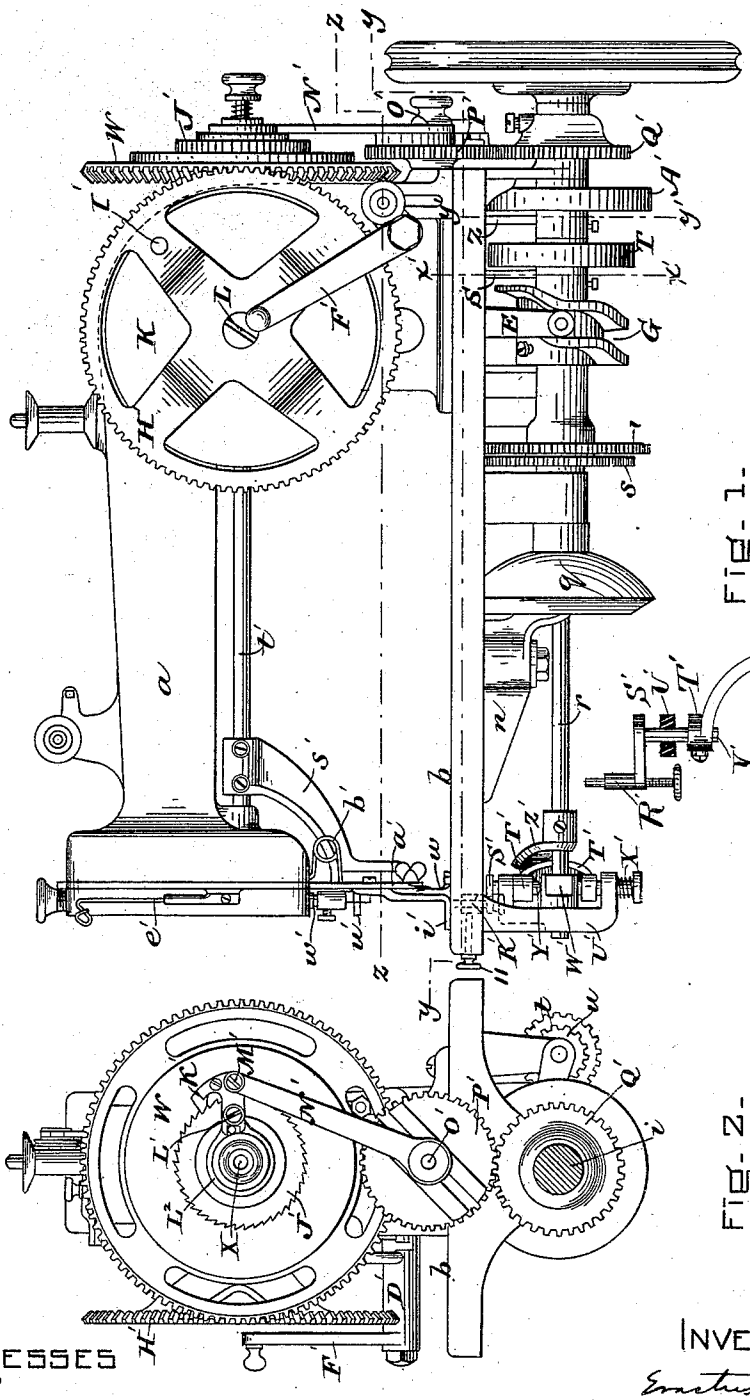

FIG. 1.

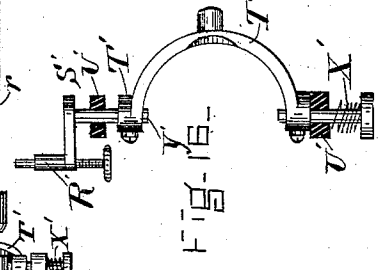

FIG. 1B.

FIG. 2.

WITNESSES

W. Rogers

A. L. White

INVENTORS

Ernestus Woodward

Thomas K. Keith

by Wright & Brown

Attys.

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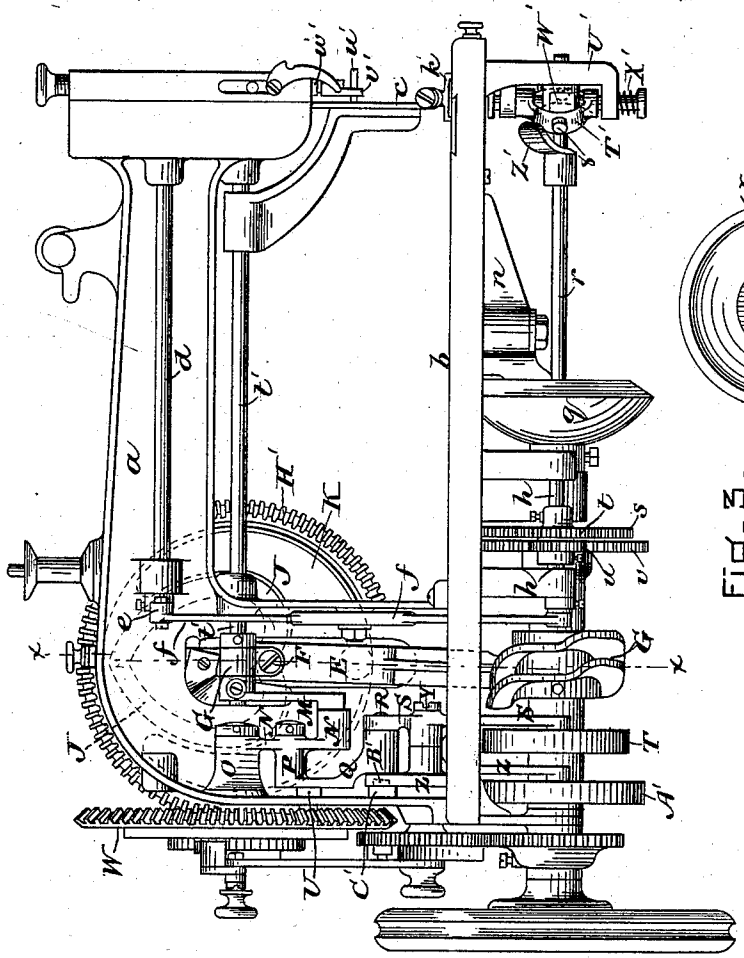

Fig. 3.

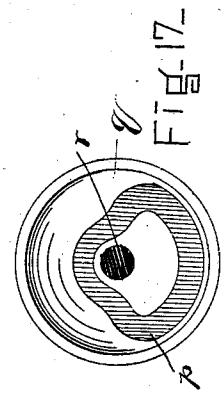

Fig. 17.

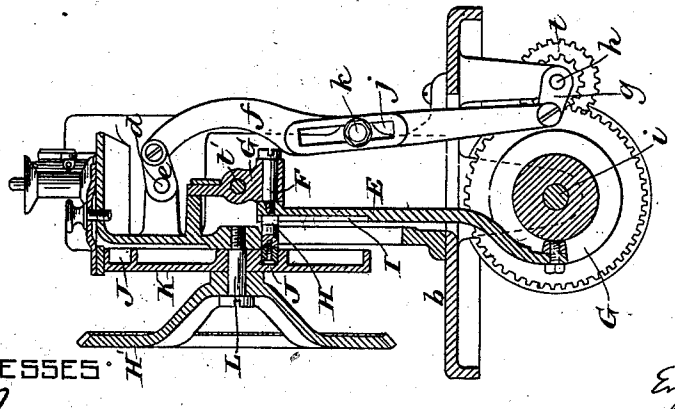

Fig. 4.

WITNESSES:

W. Rogers

A. L. White

INVENTORS

Erastus Woodward

Thomas K. Keith

by Wright Brown

Attys.

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E. WOODWARD & T. K. KEITH.

SEWING MACHINE.

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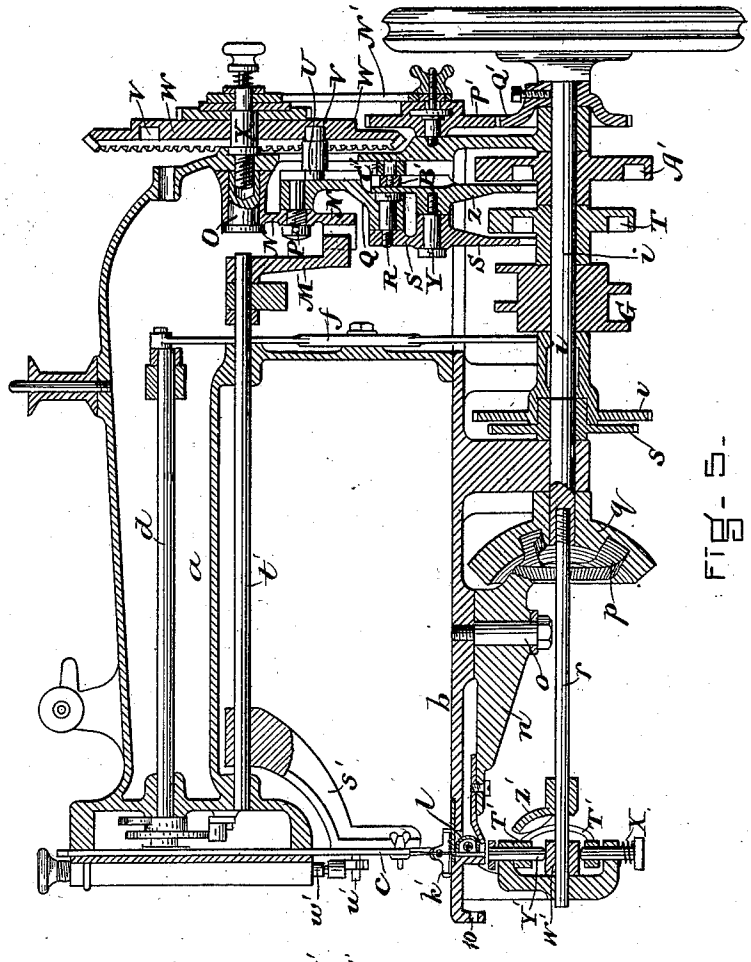

FIG. 5.

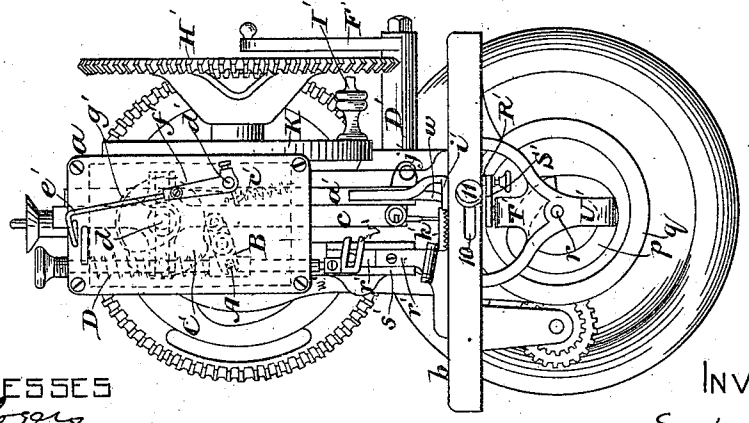

FIG. 6.

WITNESSES
A. Rogers
A. L. White

INVENTORS
Ernestus Woodward
Thomas K. Keith
by Wright Brown
Attys.

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E. WOODWARD & T. K. KEITH.

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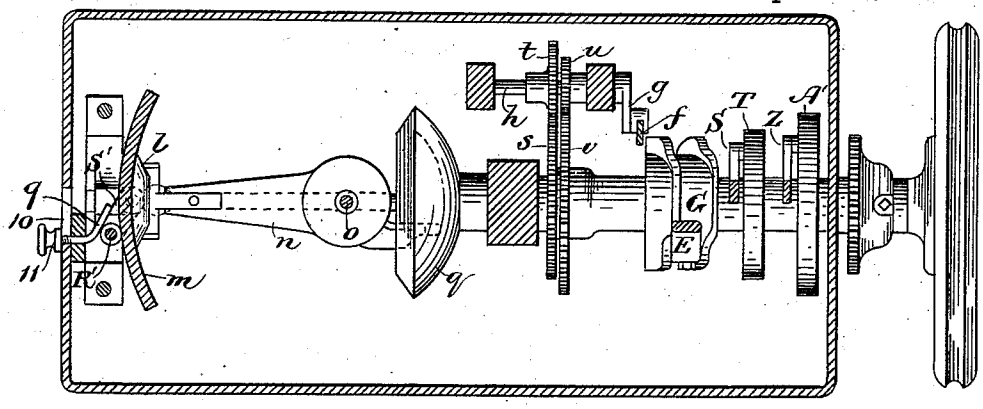


Fig. 7.

Fig. 10. a.

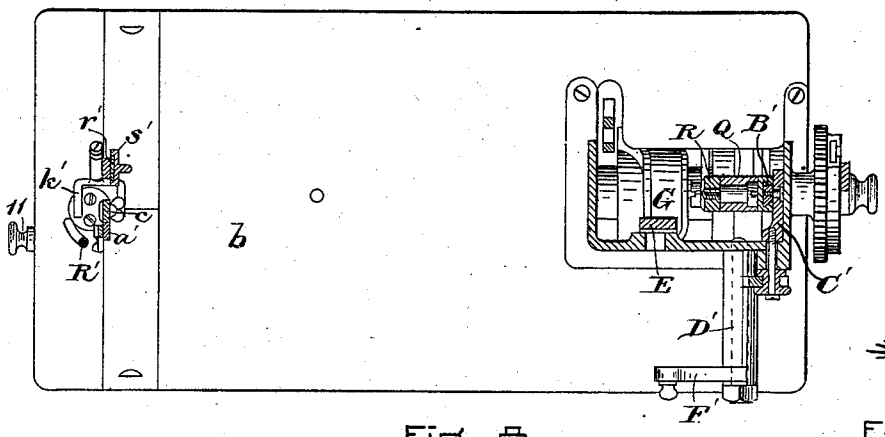


Fig. 8.

Fig. 10 b.

Fig. 9.

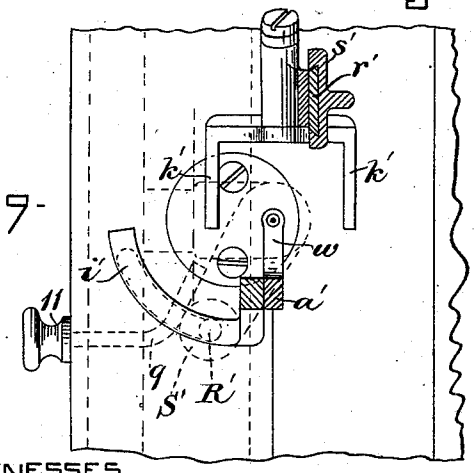
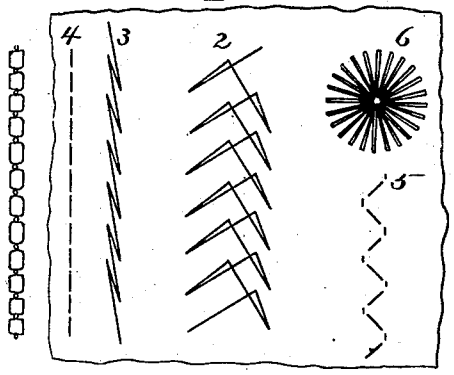


Fig. 10.



WITNESSES

W. Rogers

A. L. White

INVENTORS

Erastus Woodward

Thomas K. Keith

by Wright Brown

Attys.

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E. WOODWARD & T. K. KEITH.

SEWING MACHINE.

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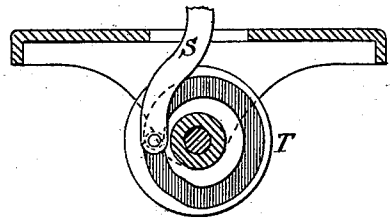

Fig. 11.

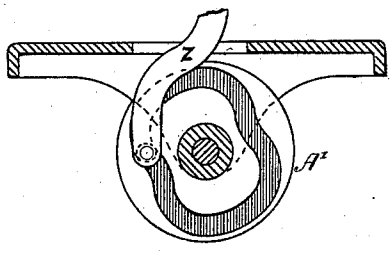

Fig. 12.

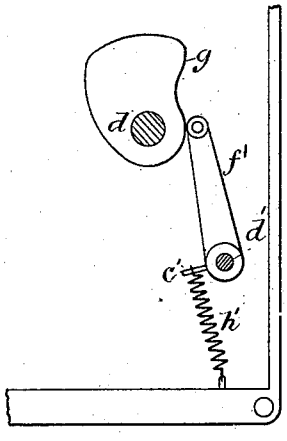

Fig. 13.

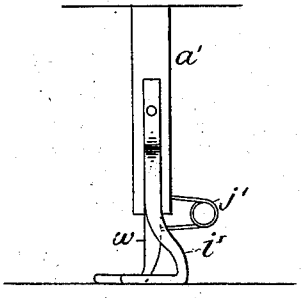

Fig. 14.

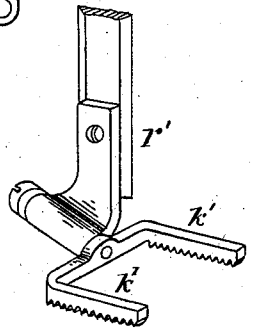

Fig. 15.

WITNESSES

W Rogers

A L White

INVENTORS

Erastus Woodward

Thomas K. Keith

by Wright & Brown

Attys.

UNITED STATES PATENT OFFICE.

ERASTUS WOODWARD, OF SOMERVILLE, AND THOMAS K. KEITH, OF HAVERHILL, MASSACHUSETTS, ASSIGNORS TO THE PENTUCKET VARIABLE STITCH SEWING MACHINE COMPANY, OF EXETER, NEW HAMPSHIRE.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 316,927, dated April 28, 1885.

Application filed November 15, 1883. (Model.)

To all whom it may concern:

Be it known that we, ERASTUS WOODWARD, of Somerville, in the county of Middlesex, and THOMAS K. KEITH, of Haverhill, in the county of Essex, and State of Massachusetts, have invented certain Improvements in Sewing-Machines, of which the following is a specification.

This invention has for its object to provide a sewing-machine capable of forming elongated stitches on the surface of material to be ornamented, and of arranging said stitches in a variety of ornamental forms; and it consists in the improved mechanism hereinafter described and claimed.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a front elevation of our improved sewing-machine. Fig. 2 represents a right-hand end elevation of the same. Fig. 3 represents a rear elevation. Fig. 4 represents a section on line *x x*, Fig. 3. Fig. 5 represents a longitudinal vertical central section. Fig. 6 represents a left-hand end view. Fig. 7 represents a section on line *y y*, Fig. 1, looking downwardly. Fig. 8 represents a section on line 2 2, Fig. 1, looking downwardly. Fig. 9 represents an enlargement of a portion of Fig. 8. Figs. 10, 10^a, and 10^b represent different arrangements of stitches. Fig. 11 represents a section on line *x' x'*, Fig. 1. Fig. 12 represents a section on line *y' y'*, Fig. 1. Figs. 13 and 14 represent detail views. Fig. 15 is a perspective view of the feeder; Fig. 16, a detail of feeding devices. Fig. 17 is a face view of globe-cam.

The same letters of reference indicate the same parts in all the figures.

In the drawings, *a* represents the overhanging arm of the machine, and *b* the bed.

c represents the needle-bar, which is operated in the usual manner by a rotating shaft, *d*, the latter being journaled in the arm *a* and provided at its rear end with a crank, *e*, which is connected by a connecting-rod, *f*, with a crank, *g*, on an arbor, *h*, which is journaled in hangers below the bed *b* and is rotated by a connection with the main driving-shaft *i*, as hereinafter described. The connecting-rod *f* is provided with a slot, *j*, through which passes a pivot-pin, *k*, affixed to the arm *a*, the rod *f* being thus adapted to oscillate, and to reciprocate longitudinally. The rotary movements of the arbor *h* are caused by the crank *g*, pivoted slotted rod *f*, and crank *e* to rotate the shaft *d* and reciprocate the needle-bar.

l represents the shuttle, which moves in a segmental shuttle-race, *m*, and is carried by an oscillating lever, *n*, the pivot *o* of which is the center of the circle of which the race *m* is a segment. The rear end of the lever *n* projects into a cam-groove, *p*, formed in a cup-shaped or concave disk, *q*, the surface of which is a segment of a hollow sphere whose center is in the vertical plane of the center of the pivot *o*. This form of the disk *q* enables its cam-groove to maintain the same relation to the lever *n* in all of the positions which the latter may assume. The cam-disk *q* is secured to a shaft, *r*, which is arranged in line with the main driving-shaft *i*, but is disconnected therefrom, and is provided with a pinion, *s*, meshing with a pinion, *t*, on the shaft *h*, above described, which operates the needle-bar shaft. Said shaft *h* is provided with a pinion, *u*, meshing with a larger pinion, *v*, on the main driving-shaft *i*. Said pinions *s t u v* are so proportioned that the needle-bar shaft *d* and the shaft *h* are rotated more rapidly than the main driving-shaft *i* to obtain the required rapidity of movement of the stitch-forming mechanism.

The work is held down upon the throat-plate of the machine by a small perforated presser-foot, *w*, through which the needle passes. Said presser-foot is carried by a presser-bar, *a'*, which is pressed downwardly by a spring, *b'*, and is raised intermittently by an arm or finger, *c'*, on the rock-shaft *d'*, which oscillates the take-up *e'*. Said rock-shaft has an arm, *f'*, bearing against a cam, *g'*, on the needle-bar shaft *d*, and a spring, *h'*, which presses said arm against the cam *g'*, said cam and spring oscilllating the rock-shaft and causing it to raise the presser-foot intermittently. The presser-bar is provided with a second presser-foot, *i'*, rigidly attached to said bar, and having a segmentally-formed bearing-surface, which co-operates with a feed-dog moving in the arc of a circle whose center is

the needle, as hereinafter described. The foot *w* is adapted to rise and fall to some extent independently of the presser-bar and of the foot *i'*, and is pressed downwardly by a spring, *j'*. The feet *i'* and *w* are thus adapted to bear at the same time on different thicknesses of work.

k' represents our universally-movable feeder, which bears on the top surface of the work, and is serrated or provided with points on its under surface, which engage with the work, so that the feeder can move the work horizontally in any direction. We prefer to make the feeder in the forked or U shape shown, its two arms or forks bearing on the work at opposite sides of the needle, although it is obvious that the form may be variously modified. The feeder *k'* is pivotally connected to a slide or plate, *r'*, adapted to slide in a dovetail slot in an arm, *s'*, on a shaft, *t'*, which is journaled in the arm of the machine substantially parallel with the needle-bar shaft *d*, and is adapted both to rock or oscillate and to move longitudinally in its bearings, and thus impart a variety of horizontal movements to the feeder *k'*. The slide *r'* has a pin, *u'*, which enters a forked arm, *v'*, on a vertical rod or bar, *w'*, which is adapted to slide vertically in the arm *a*, and is pressed downwardly by a suitable adjustable spring, D, contained in said arm, and is provided with a stud, A, projecting into the slotted end of a lever, B, pivoted within the arm *a* and bearing at its opposite end against a cam, C, on the needle-bar shaft, which cam is formed to intermittently depress the end of the lever B, bearing against it, and thus raise the opposite end with the bar *w'*, slide *r'*, and feeder *k'*, the spring D depressing said bar, slide, and feeder when the receding part of the cam C reaches the lever B. The bar *w'* is thus operated like the presser-bar in an ordinary sewing-machine; but its movements are so timed with relation to the movements of the presser-foot *w* that the bar and feeder are raised when the presser is depressed, and vice versa.

E represents a lever, which is pivoted at F to a collar or block journaled on the shaft *t t'* and confined between two shoulders or collars rigidly attached to said shaft. Said lever E projects downwardly from the shaft *t'*, and is engaged at its lower end with a grooved cam, G, on the driving-shaft *i*, said cam oscillating the lever E on its pivot.

H represents a vertically-adjustable fulcrum, which projects into a groove, I, in the rear side of the lever E, and is supported in a cam-groove, J, formed in a disk, K, which is journaled at L to the arm *a*, said cam-groove being preferably heart-shape, as shown in dotted lines in Fig. 3. By rotating the disk K the fulcrum H may be raised or lowered, as the case may be. When the fulcrum is raised so as to be in line with the pivot F, as shown in Fig. 4, the oscillations of the lever E have no effect on the rock-shaft *t'*, as will be readily seen; but when the fulcrum H is depressed below said pivot it becomes operative as a fulcrum, and causes the upper end of the lever E to oscillate, and thus reciprocate the rock-shaft *t'* longitudinally, the length of the reciprocating movement being proportioned to the vertical distance between the pivot F and adjustable fulcrum H.

M represents an arm rigidly attached to the rear end of the rock-shaft *t'* and projecting downwardly therefrom. Said arm has an offset at its lower end, which enters a slot formed in a boss or offset on a lever, N, which is pivoted at O to the arm of the machine. To the lever N is pivoted at P a second lever, Q, extending downwardly. To the lower end of the lever Q is pivoted at R a third lever, S, which extends downwardly, and has an offset-roller at its lower end entering a grooved cam, T, on the driving-shaft *i*. The second lever, Q, has a vertical groove in its back, into which projects a vertically-adjustable fulcrum, U, which is supported by a heart-shaped cam-groove, V, in a disk, W, pivoted at X to the rear end of the arm *a*. To the third lever, S, is pivoted at Y a fourth lever, Z, which projects downwardly and has an offset or roller at its lower end, which engages with a groove-cam, A', on the driving-shaft *i*. The fourth lever, Z, has a vertical groove in its back, into which projects a fulcrum, B', which is carried by a slide, C', adapted to move in vertical guides formed in the arm of the machine, and operated by a rock-shaft, D', pivoted on a stud attached to the arm of the machine, and having an arm, E', engaged with the slide C', and a handle or lever, F'. By turning the rock-shaft D' the fulcrum B' is raised or lowered, as the case may be. The third lever, S, and fourth lever, Z, are oscillated, respectively, by the cams T and A', and the second lever, G, is oscillated by its pivotal connection with the third lever, S. When the fulcrum U is below or out of line with the pivot P of the second lever, Q, said lever in oscillating also oscillates the lever N, and therefore rocks the shaft *t'* and reciprocates the feeder *k'* toward and from the operator. On the other hand, when the fulcrum U is in line with the pivot P the oscillations of the second lever, Q, have no effect on the lever N, and the feeder has no movement toward and from the operator. The cams T and A' are differently timed, so that the movements imparted by them to the levers S and Z are not wholly, although partially, in unison. When the fulcrum B' is in line with the pivot of the fourth lever, Z, the oscillations of said lever will have no effect upon the third lever, S; but when said fulcrum B' is moved out of line with said pivot the other levers, S Q N, of the system are oscillated by the oscillations of the fourth lever, Z, and their action on the rock-shaft *t'* is modified, as will be hereinafter explained.

The movements which may be given to the feeder toward and from the operator, together with the lateral movements caused by the longitudinal reciprocation of the rock-shaft *t'*, enable any desired series of feed movements to

be given to the work, causing the stitches to be laid thereon in a variety of patterns, some of which are indicated in Figs. 10, 10ª, and 10ᵇ.

The herring-bone stitch—stitch 2, shown in said Fig. 10—is produced as follows: The fulcrums H and U are both moved out of line with the pivots F and P, (each the same distance as the other,) and the fulcrum B′ is moved a short distance above the pivot Y. When the needle rises from the work, making the first stitch, the feeder is moved diagonally backward by a combination of the rocking and longitudinal movements of the shaft *t′*, causing the needle in its next descent to place an elongated diagonal stitch on the work. While the needle is down, the feeder is raised and moved directly forward by a rocking movement of the shaft *t′*, and then descends while the needle is rising. While the needle is above the work, the feeder is moved diagonally forward half the length of the stitch, more or less, according to the position of the fulcrum B′, so that when the needle again descends it forms a back stitch beside the one first formed, but of lesser length. While the needle is down, the feeder is raised and moved directly forward again, and drops on the work as the needle rises. The feeder then moves diagonally forward, and moves the work so that the needle in its next descent will make another elongated stitch in a different direction from the first. Then a shorter back stitch is made, and so on, every back stitch being shorter than the other stitches, the shortness of the back stitches being due to the neutralizing action of the lever Z on the levers S Q N, which rock the shaft *t′*, said action taking place only during the backward movements of the feeder. The angle at which these stitches are formed and the distance between them depends upon the adjustment of the fulcrums H U. Said fulcrums are preferably adjusted simultaneously by means of a bevel gear-wheel, H′, journaled on the same arbor with the disk K, and engaged with the latter by a pin or screw, I′, which is secured to the disk K, but is capable of being extended so as to enter an orifice in the wheel H′ when it is desirable to connect said disk and wheel. The teeth of the gear-wheel H′ mesh with bevel-gear teeth cut on the perimeter of the disk W. We have also made provision for adjusting said fulcrums H U automatically, and to this end have secured a ratchet, J′, to the disk W, and have provided a reciprocating dog, K′, for said ratchet. (See Fig. 2.) Said dog K′ is pivoted at L′ to a lug or collar, L², loosely mounted on the arbor of the disk W, and at M′ to one end of a rod or arm, N′, the other end of which is eccentrically pivoted at O′ to the side of a gear-wheel, P′, journaled on a bearing on the frame of the machine, and meshing with a gear-wheel, Q′, on the driving-shaft *i*. The pivot O′ is adjustable toward and from the center of the gear-wheel P′ to vary the throw of the rod or arm N′, and cause the dog K′ to slip over one or any desired number of teeth on the ratchet during its backward movement. The pivotal connection of the dog K′ to the collar L² causes said dog to swing outwardly and clear itself from the ratchet J′ during its backward movement, so that there is no clicking or other noise attending said movement. By the operation of the devices last described the herring-bone stitch may be modified or gradually reduced, as shown in Fig. 10ª.

The etching-stitch 3 (shown in Fig. 10) is produced by raising the fulcrum H, so as to prevent longitudinal movement of the shaft *t′* and lateral movement of the feeder *k′*. The alternating longer forward stitches and shorter back stitches will then be formed as before; but the absence of the lateral movement of the feeder will cause said stitches to lie in line with each other. The representation of the etching-stitch given in the drawings is exaggerated, in that it shows the stitches as forming a zigzag line. In practice the line formed would be straight.

To form the sewing-machine stitch 4, raise the fulcrum B′ as high as possible, leaving the other fulcrums as before. This adjustment of the fulcrum B′ will prevent the formation of any back stitch.

To form the zigzag-stitch 5, adjust the fulcrum H so that the shaft *t′* will reciprocate longitudinally, leaving the other fulcrums in the positions last described.

To form the eyelet or radiating stitch 6, we place the fulcrum B′ in line with the pivot Y and the fulcrum H in line with the pivot F, thus leaving only the fulcrum U operative and causing the shaft *t′* to oscillate and move the feeder *k′* equally in both directions. A vibrating feed-dog, R′, under the curved portion *i′* of the presser-foot, is then brought into action, and causes the work to rotate step by step around the needle, the latter acting as a pivot. Said feed-dog acts after the formation of two stitches—one from the starting-point and the other back to said point—and turns the work so that the next two stitches will extend in a different direction from the starting-point from the first two, and so on until a series of radiating stitches, forming a circular design, is produced. Said feed-dog R′ is attached to an arm, S′, on a vertical rock-shaft, T′, and projects upwardly into a segmental slot in the bed *b*. The rock-shaft T′ is journaled in bearings on a bracket, U′, attached to the under side of the bed *b*, and is adapted to rise and fall in said bearings with the feed-dog R′. The central portion of the rock-shaft is curved or offset, and a boss, Y′, above said offset, bears upon a cam, W′, affixed to the shaft *r*. A spring, X′, presses said boss downwardly upon said cam. These parts—viz., the cam W′ and spring X′—cause the feed-dog to rise and fall. A cam, Z′, on the shaft *r*, bears against a boss, 8, on the offset portion of the rock-shaft T′, once during each rotation of said shaft *r*, and turns the rock-shaft laterally while it is raised by the cam W′, thus causing the feed-dog R′ to move in the arc of a circle

through the slot in the bed *b*, and give the work a partial rotation on the needle. The spring X′ is adapted to turn the rock-shaft T′ laterally as well as to press it downwardly, and holds the arm S′ of said shaft in yielding contact with an adjustable stop, 9, which slides in a slot, 10, in the flange or rim of the bed-plate *b*, and is secured in any position to which it may be adjusted by a thumb-screw, 11. By means of said stop the length of the feed movement of the dog R′ may be regulated as may be desired; or said feed-dog may be thrown out of operation altogether.

By the joint use of the circular feed last described, and of the devices for automatically rotating the disk W, the radiating stitches produced by the action of the circular feed may be varied in length, as shown in Fig. 10ᵇ.

It is obvious that the stitches or arrangement of stitches above described may be indefinitely modified, and that various minor attachments may be added to the machine capable of modifying its results without departing from the spirit of our invention.

We claim—

1. In a sewing-machine, the combination of the stitch-forming mechanism, the presser, the the feeder pivoted to a slide or plate, the rock-shaft having an arm containing a guide for said plate, operating mechanism for said rock-shaft, the feeder-bar adapted to slide vertically in the head or arm of the machine and engaged, as described, with the feed-carrying slide, and mechanism, operated by the needle-actuating shaft, whereby the presser-bar and feeder-bar are alternately raised and lowered, as set forth.

2. In a sewing-machine, the combination of the stitch-forming mechanism, the feeder adapted to bear on the upper surface of the work, mechanism whereby upward and downward movements are imparted to the feeder, mechanism for moving the feeder forward and backward, a feed-dog adapted to bear against the under surface of the work, mechanism for raising and lowering said feed-dog, and mechanism for moving said feed-dog in the arc of a circle about the needle, as set forth.

3. The combination, in a sewing-machine, of the stitch-forming mechanism, a feed-dog adapted to bear against the under surface of the work, mechanism for raising and lowering said feed-dog, mechanism for moving said feed-dog in the arc of a circle about the needle, and a presser-foot formed to cover the arc through which the foot-dog moves, as set forth.

4. The combination, in a sewing-machine, of the stitch-forming mechanism, a feed-dog adapted to bear against the under suface of the work, mechanism for raising and lowering said feed-dog, mechanism for moving said feed-dog in the arc of a circle about the needle, and an adjustable stop whereby the length of said arc may be adjusted, as set forth.

5. In a sewing-machine, the combination, with the stitch-forming and rectilinear feeding mechanisms, of the arc feeding mechanism, composed of the vertical rock-shaft T′, having the arm S′ and feed-dog R′, the cam W′, adapted to intermittently elevate said rock-shaft and dog, the cam Z′ whereby the rock-shaft and dog are turned or moved laterally, and a spring or springs whereby the rock-shaft is pressed against and caused to follow said cams, as set forth.

6. The combination of the stitch-forming mechanism, the rock-shaft T′, having the arm S′ and feed-dog R′, means for raising and lowering and oscillating said rock-shaft, arm, and dog, and the adjustable-stop 9, adapted to slide in a slot formed in the flange of the bed-plate, and provided with means for positively holding it in any position to which it may be adjusted, as set forth.

7. The combination, with the reciprocating needle and shuttle, of the pivoted shuttle-carrying lever *n*, the globe-cam having a cam-groove receiving the shorter end of said lever and formed in a surface which is the segment of a hollow sphere whose center is the vertical plane of the pivot of lever *n*, and the variable mechanism (as gears *s t u v* and shaft *n*) whereby the globe-cam is driven, substantially as set forth.

8. In a sewing-machine, the combination of the stitch-forming mechanism, the feeder, the rock-shaft having an arm connected, as described, with the carrier of the feeder, the lever E, pivoted to a block journaled on said shaft, means for oscillating said lever by the power of the machine, and the adjustable fulcrum H, whereby the oscillations of the lever may be caused to reciprocate the rock-shaft lengthwise, as set forth.

9. The combination, with the stitch-forming mechanism and the feeding mechanism of a sewing-machine, of the rock-shaft, the lever E, means for oscillating said lever, the vertically-adjustable fulcrum H, and the journaled disk K, having a cam-groove, J, whereby said fulcrum may be adjusted, as set forth.

10. In a sewing-machine, the combination of the stitch-forming mechanism, the feeder, the rock-shaft [having an arm connected, as described, with the carrier of the feeder, and provided with an arm, M, the lever N, pivoted to the frame of the machine and engaged, as described, with the arm M, the system of levers Q S Z, arranged as shown, the cams T A′ on the driving-shaft, engaged, respectively, with the levers S Z, and the adjustable fulcrums U B′, engaged with the levers Q Z, all arranged and operating to oscillate the rock-shaft, as set forth.

11. The combination of the stitch-forming mechanism, the feeder, the rock-shaft having at one end an arm connected, as described, with the carrier of the feeder, and at the other end an arm, M, the lever E, pivoted to a block on the rock-shaft, means for oscillating said lever, the adjustable fulcrum H for said lever, the lever N, pivoted to the frame of the machine and engaged, as described, with the arm M of the rock-shaft, the system of

levers Q S Z, means for reciprocating the levers S Z, and the adjustable fulcrums U B′, engaged with the levers Q Z, all arranged and operating substantially as described.

12. The combination, with the stitch-forming and the feeding mechanism of a sewing-machine, and rock-shaft *t′* and its operating-levers N Q S Z, of the adjustable fulcrum U, and cam V, whereby said fulcrum may be adjusted, as set forth.

13. The combination, with the stitch-forming mechanism, the feeder and its immediate connections, and rock-shaft *t′* and its operating-levers N Q S Z, of the adjustable fulcrum B′ and devices, substantially as described, for adjusting said fulcrum, as set forth.

14. The combination, with the stitch-forming mechanism, the feed mechanism, and rock-shaft *t′* and its operating-levers N Q S Z, of the adjustable fulcrums U B′ and their operating devices, as set forth.

15. The combination, with the stitch-forming mechanism, the feed mechanism, and rock-shaft *t′* and its system of operating-levers, of the adjustable fulcrums H U, the cams J V for adjusting said fulcrums, and connecting devices whereby said cams may be simultaneously rotated.

16. The combination of the stitch-forming mechanism the feeder *k′*, the circular feed-dog R′ and its operating mechanism, the rock-shaft *t′*, having the arm M, the operating devices N Q S Z, the adjustable fulcrum U, and mechanism, substantially as described, for adjusting said fulcrum automatically, and thereby automatically varying the length of the radiating stitches, formed by the joint action of said feeder and dog, as set forth.

17. The combination, with the stitch-forming mechanism, the feeder, and the rock-shaft and its system of operating-levers, of the adjustable fulcrums H U, the cams J V for adjusting said levers, connecting devices whereby said cams are caused to rotate simultaneously, and mechanism, substantially as described, for rotating said cams automatically, and thereby varying the length of spacing of the herring-bone stitches, as set forth.

18. The combination, with the stitch-forming mechanism, the feeder, and the rock-shaft and its system of operating-levers, of the adjustable fulcrums H U, the cams J V for adjusting said levers, connecting devices whereby said cams are caused to rotate simultaneously, the ratchet J′, affixed to the back of the disk containing the cam V, a dog, K′, and operating mechanism therefor, whereby said ratchet and disk are rotated step by step, and means for varying the throw of said dog, as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, the 9th and 10th days of November, 1883.

ERASTUS WOODWARD.
THOMAS K. KEITH.

Witnesses as to signature of Erastus Woodward:

C. F. BROWN,
A. L. WHITE.

Witnesses as to signature of Thomas K. Keith:

ROSWELL CARLETON,
FRANCIS H. PEARL.