(No Model.) 6 Sheets—Sheet 1.

E. WOODWARD.

SEWING MACHINE.

No. 354,499. Patented Dec. 14, 1886.

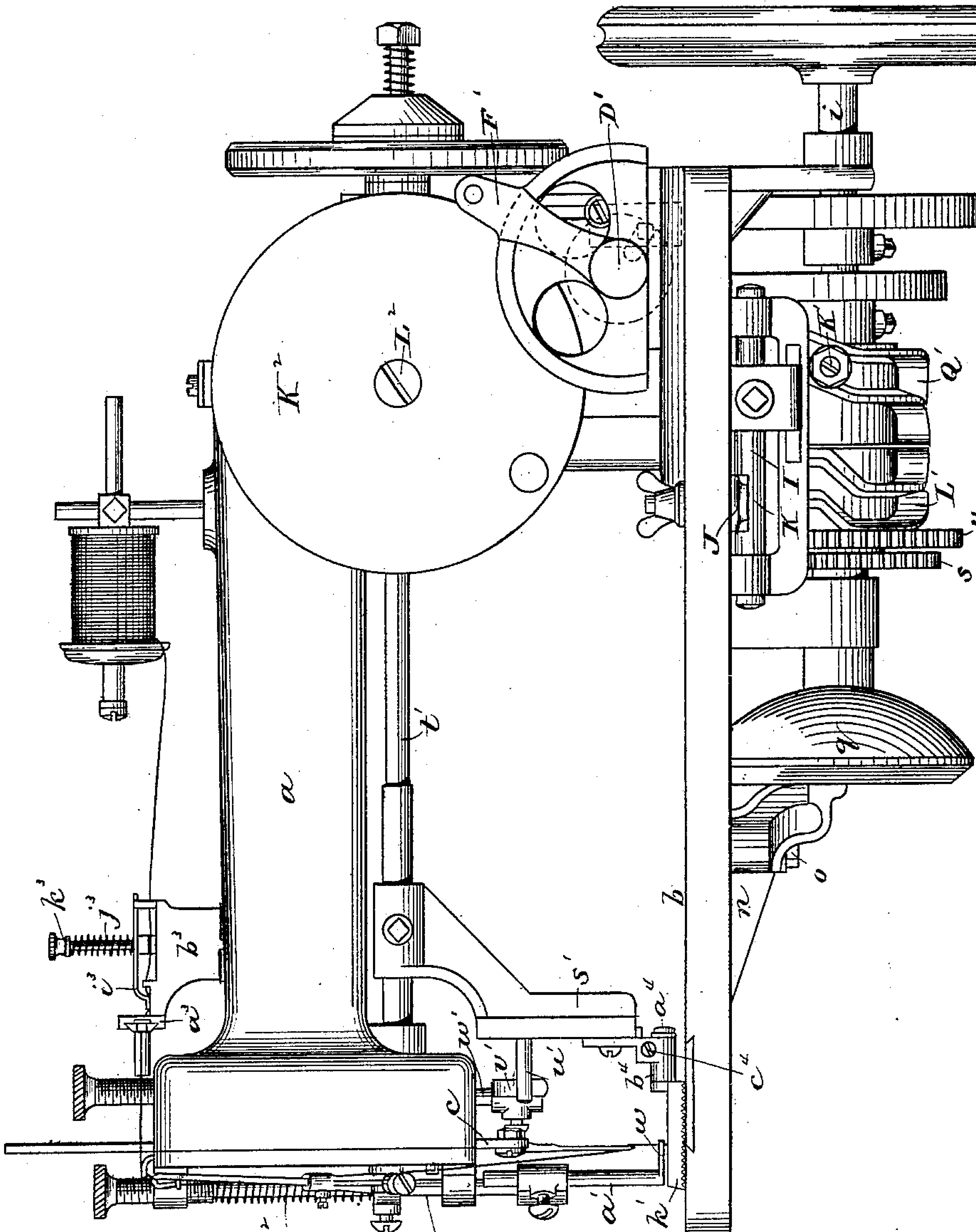

Fig. 1.

WITNESSES.

H. E. Brown.

L. H. Brown

INVENTOR.

Erastus Woodward

by Wright Brown & Crosby

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(No Model.) 6 Sheets—Sheet 2.

E. WOODWARD.

SEWING MACHINE.

No. 354,499. Patented Dec. 14, 1886.

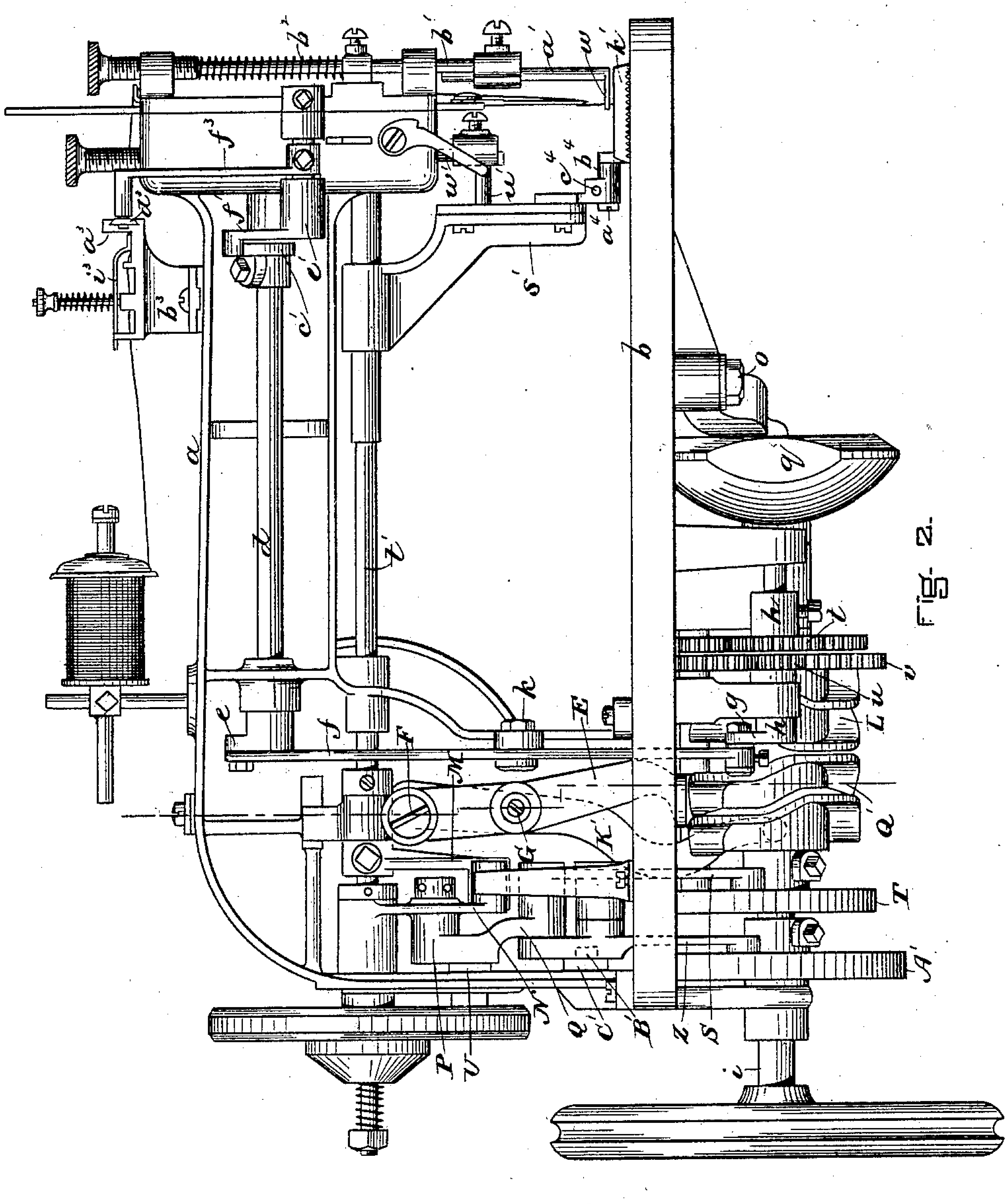

Fig. 2.

WITNESSES.
H. E. Brown.
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(No Model.)

6 Sheets—Sheet 3.

E. WOODWARD.

SEWING MACHINE.

No. 354,499. Patented Dec. 14, 1886.

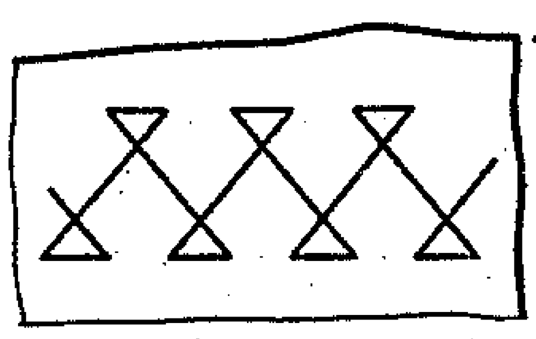

Fig. 16.

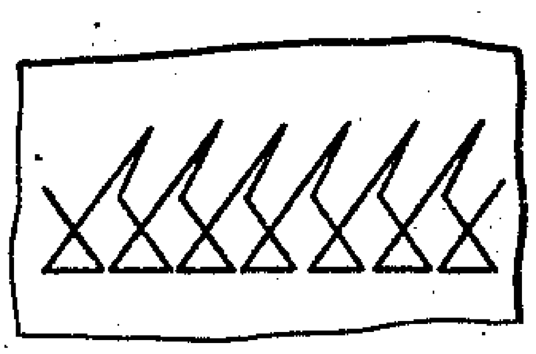

Fig. 15.

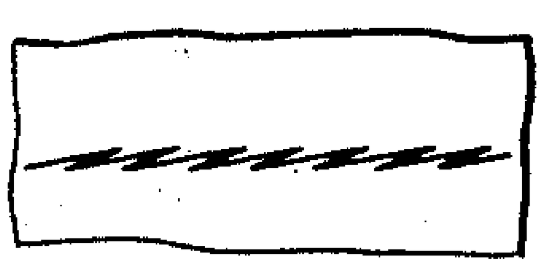

Fig. 14.

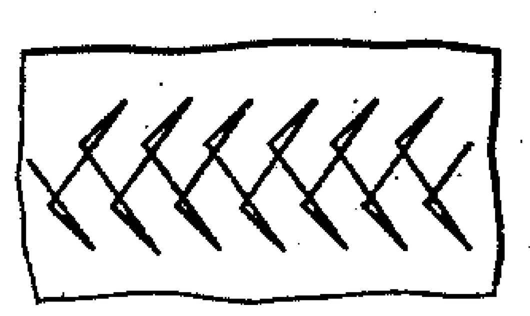

Fig. 13.

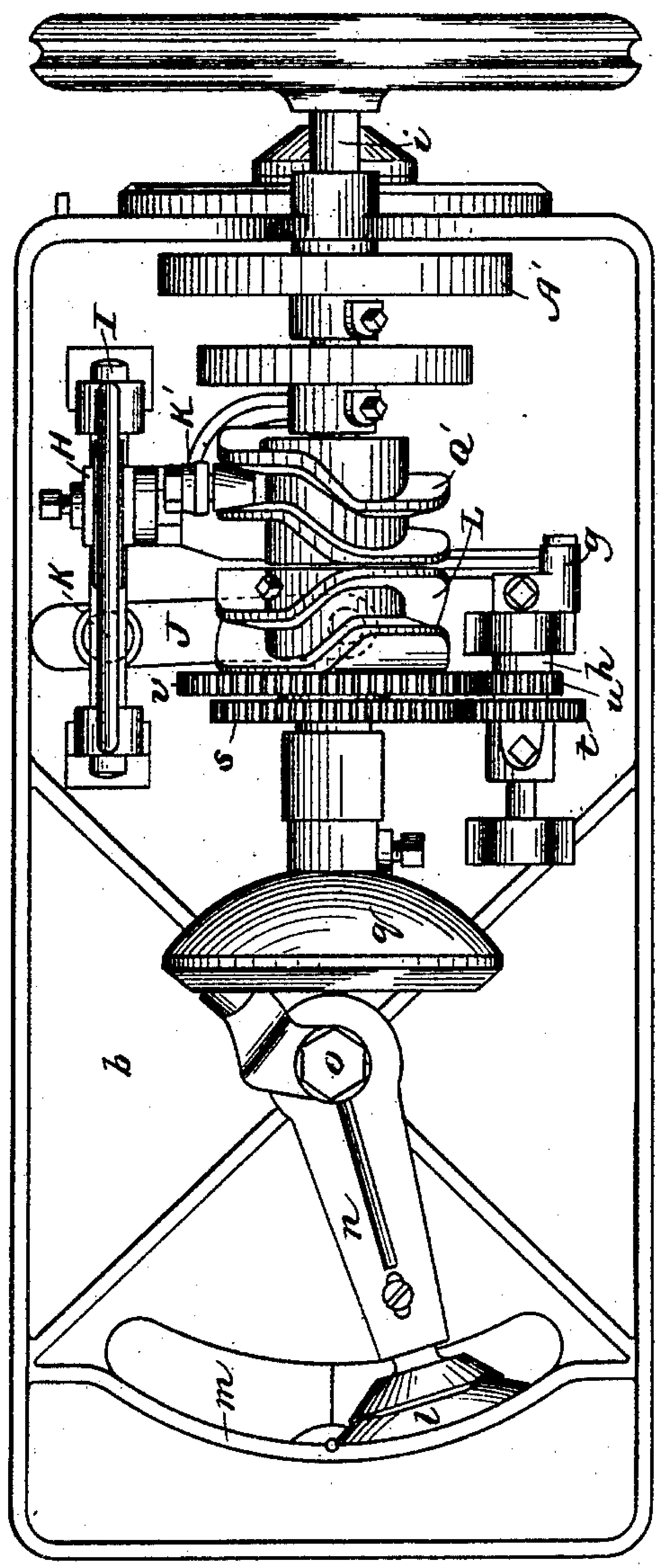

Fig. 3.

WITNESSES:

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(No Model.)

6 Sheets—Sheet 4.

E. WOODWARD.

SEWING MACHINE.

No. 354,499. Patented Dec. 14, 1886.

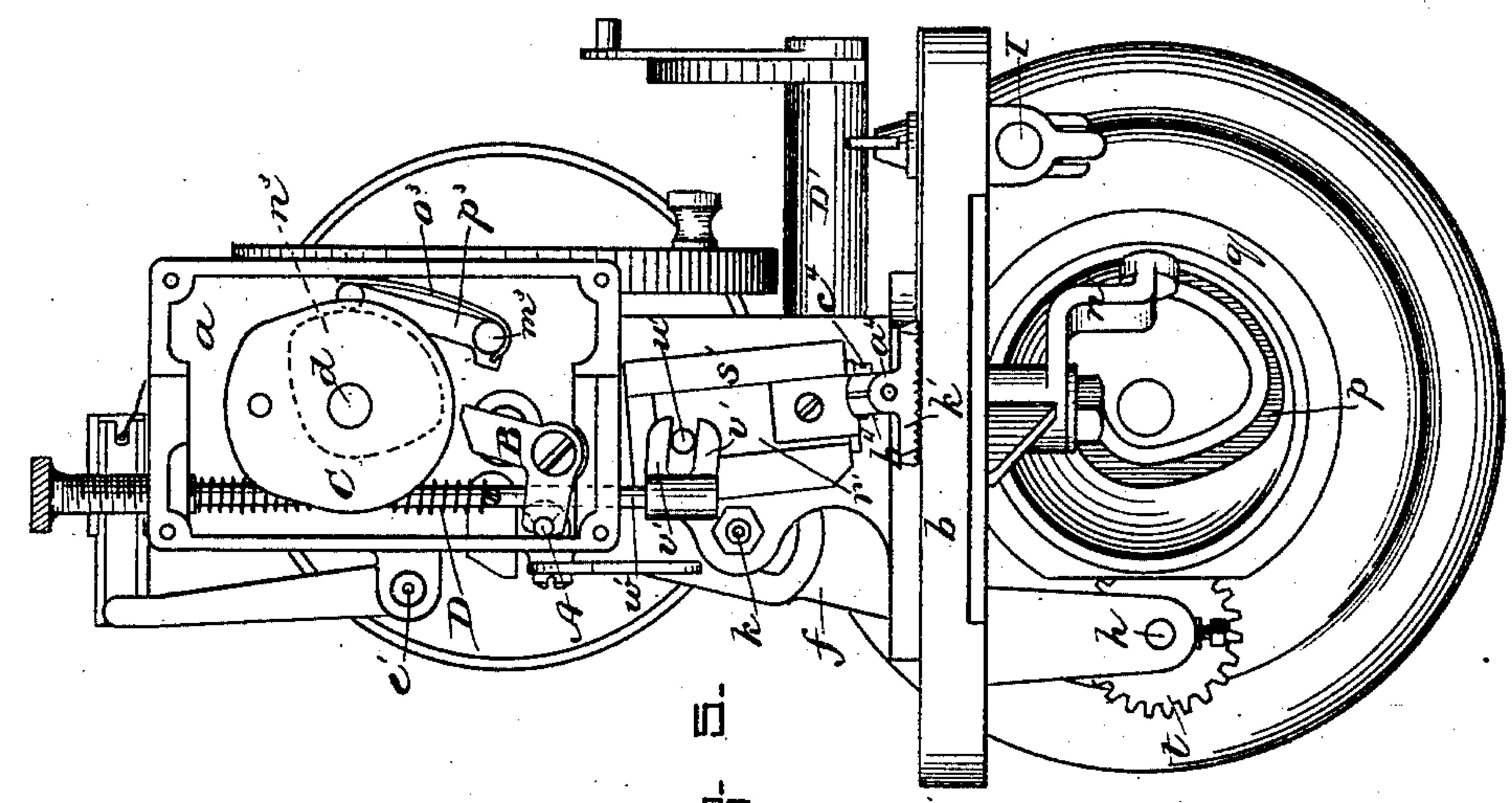

Fig. 5.

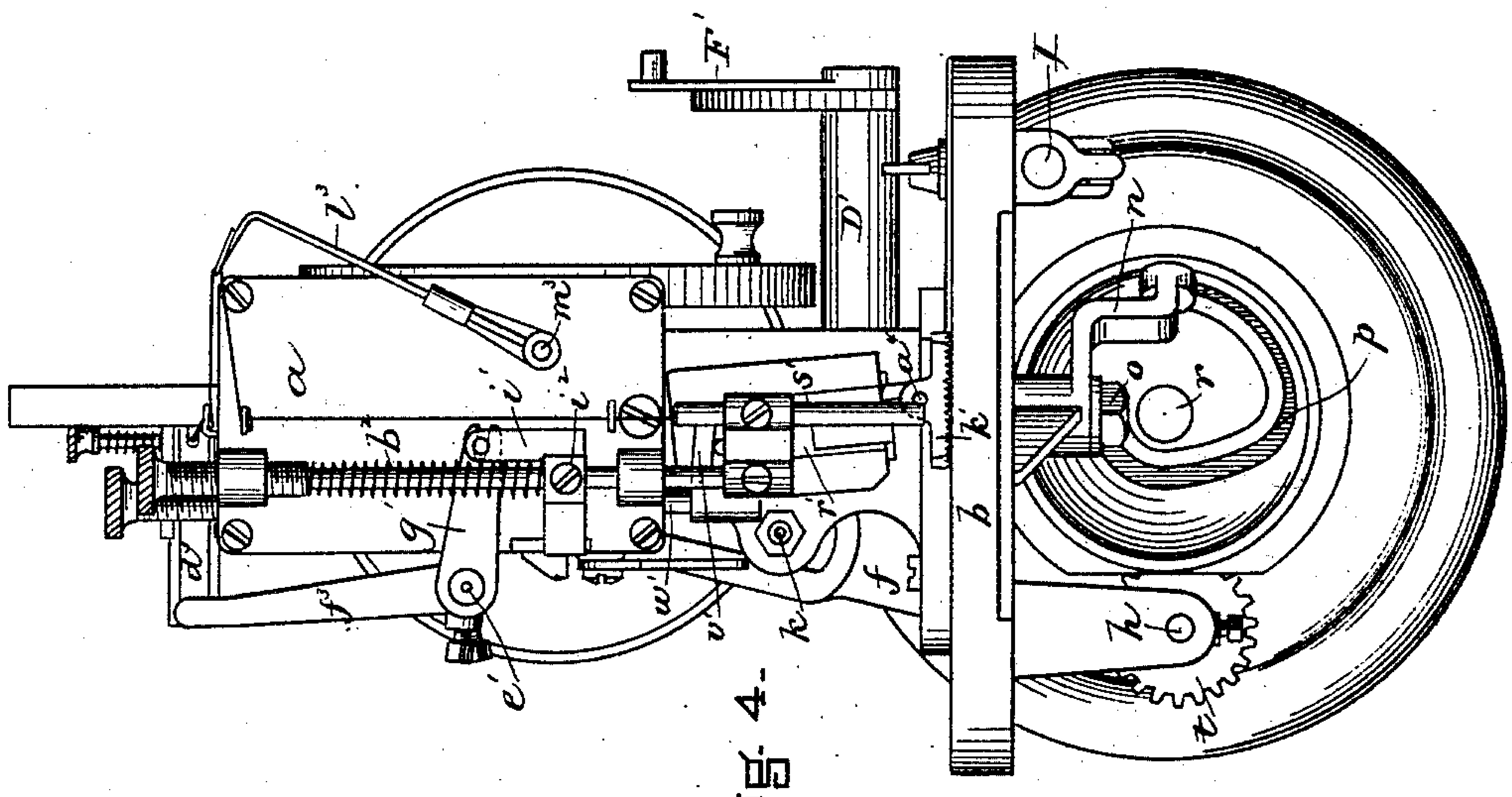

Fig. 4.

WITNESSES.

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N. PETERS. Photo-Lithographer. Washington, D. C.

(No Model.) 6 Sheets—Sheet 5.

E. WOODWARD.

SEWING MACHINE.

No. 354,499. Patented Dec. 14, 1886.

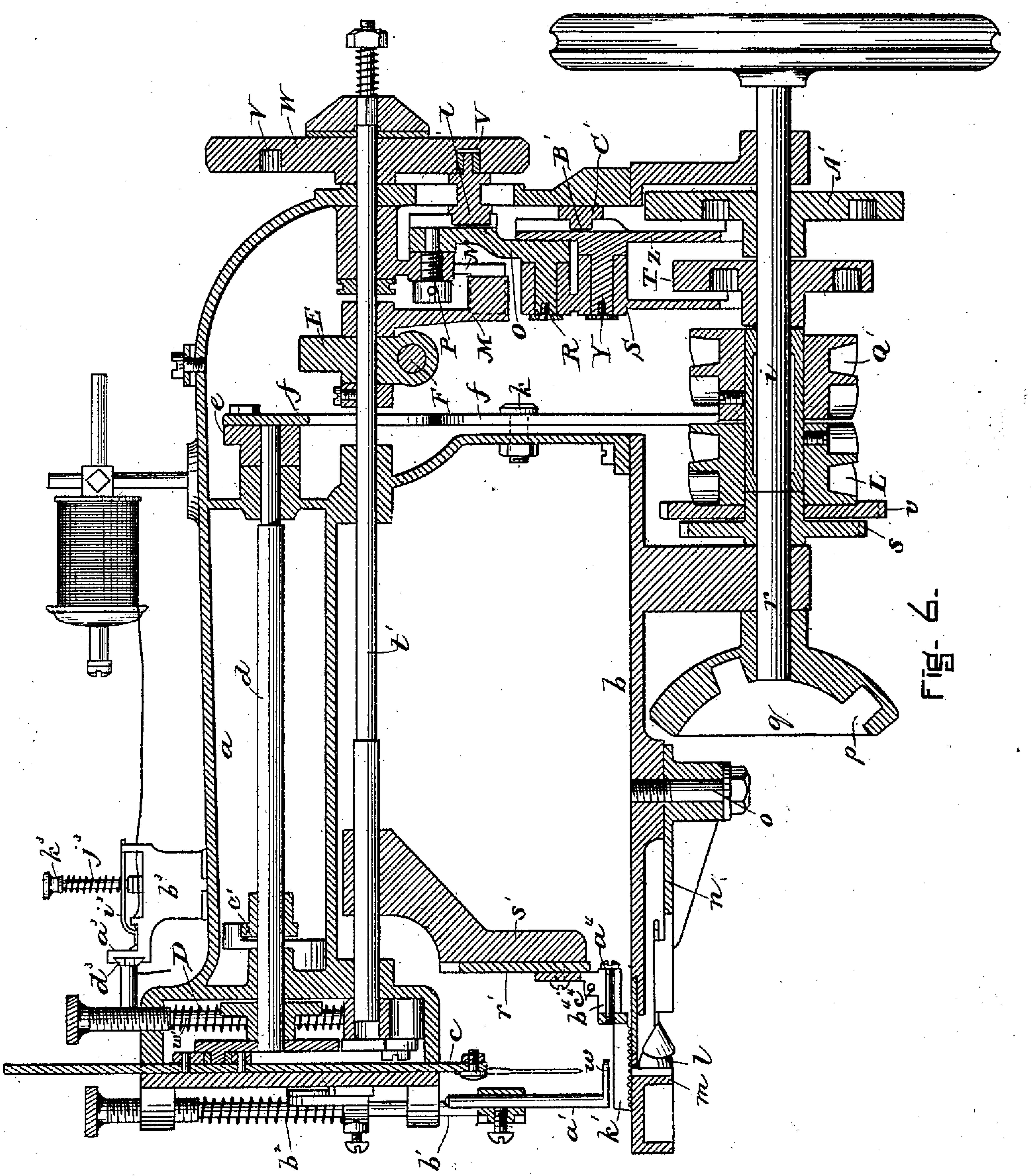

Fig. 6.

WITNESSES.

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N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.)

6 Sheets—Sheet 6.

E. WOODWARD.

SEWING MACHINE.

No. 354,499.

Patented Dec. 14, 1886.

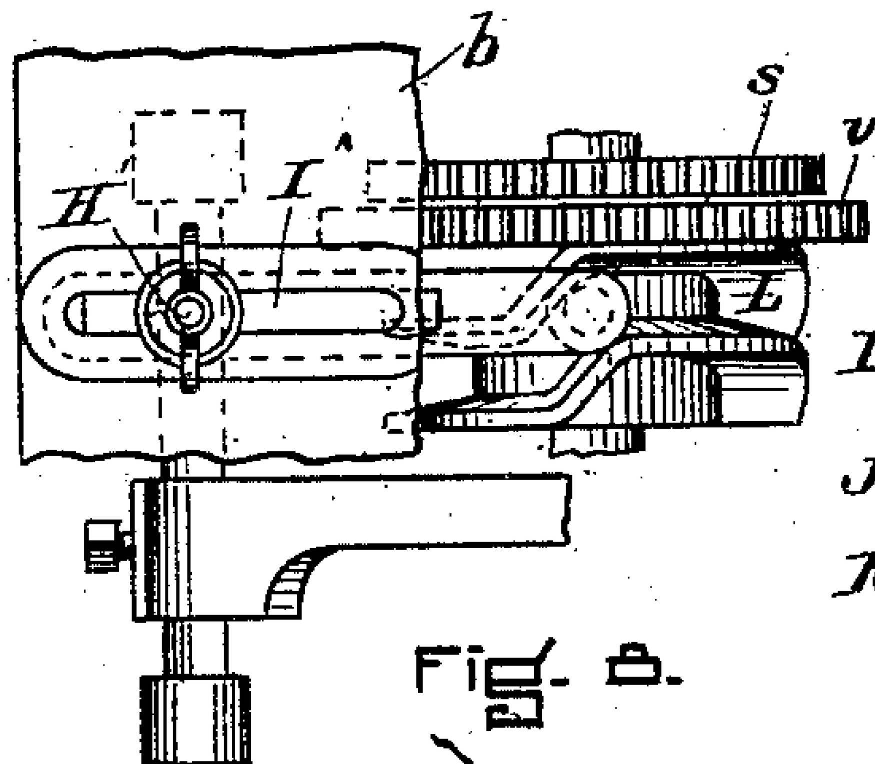

Fig. 8.

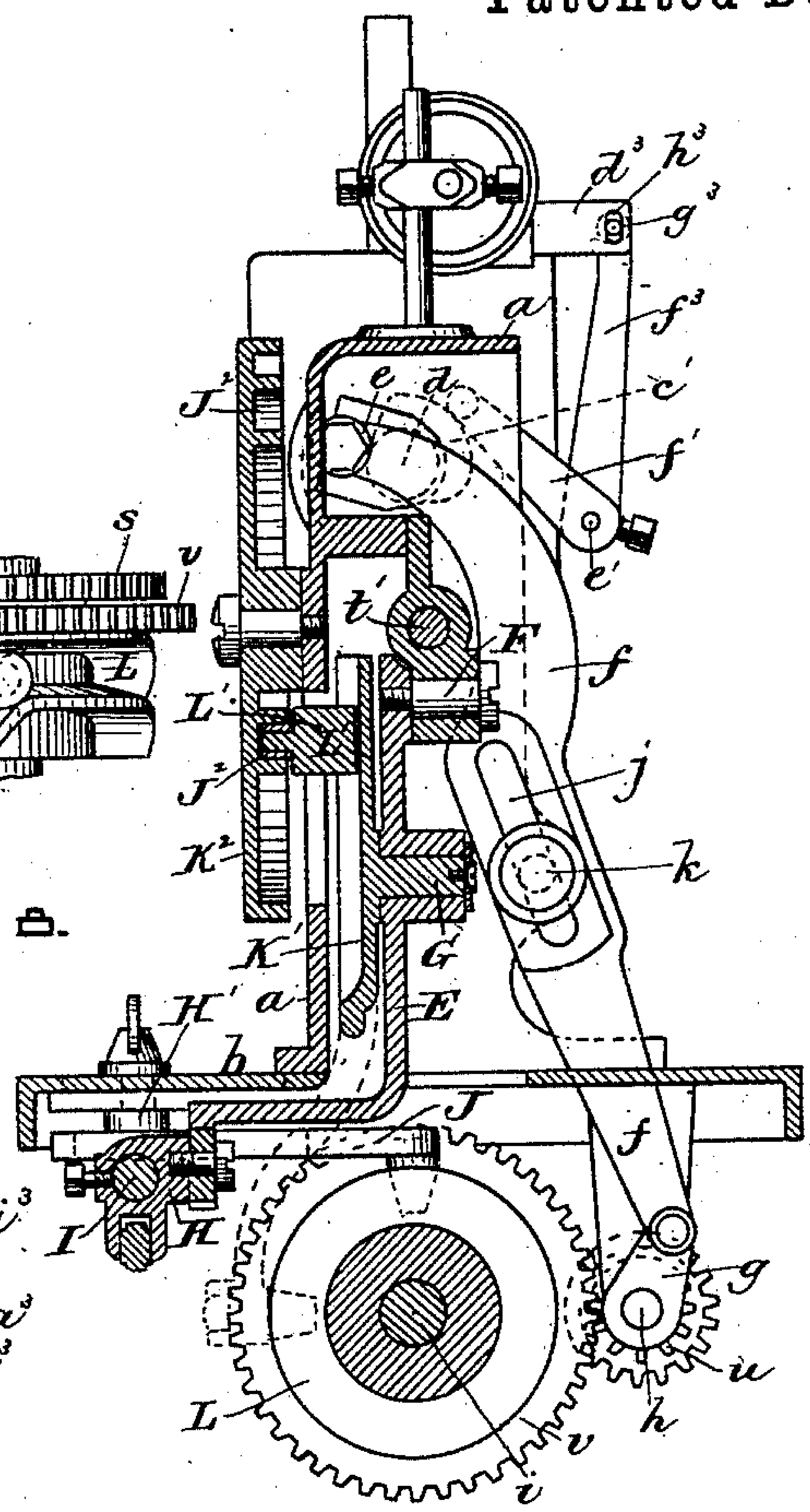

Fig. 7.

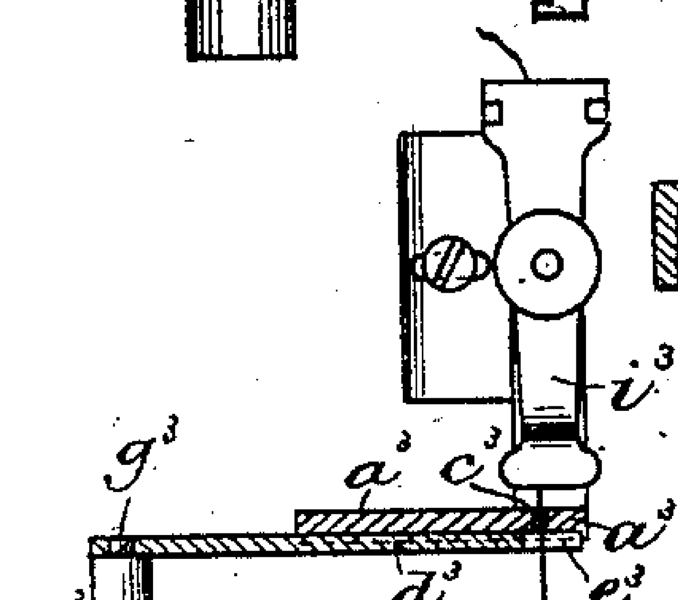

Fig. 11.

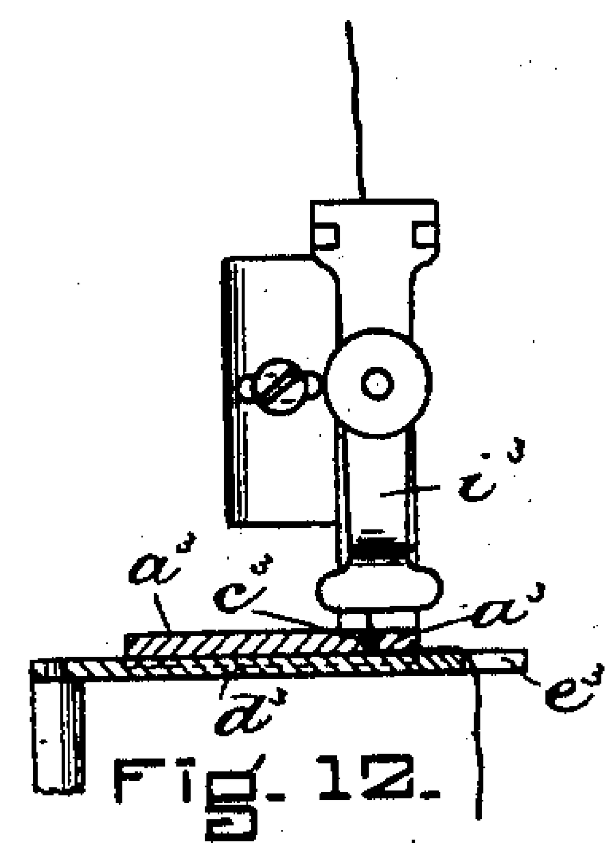

Fig. 12.

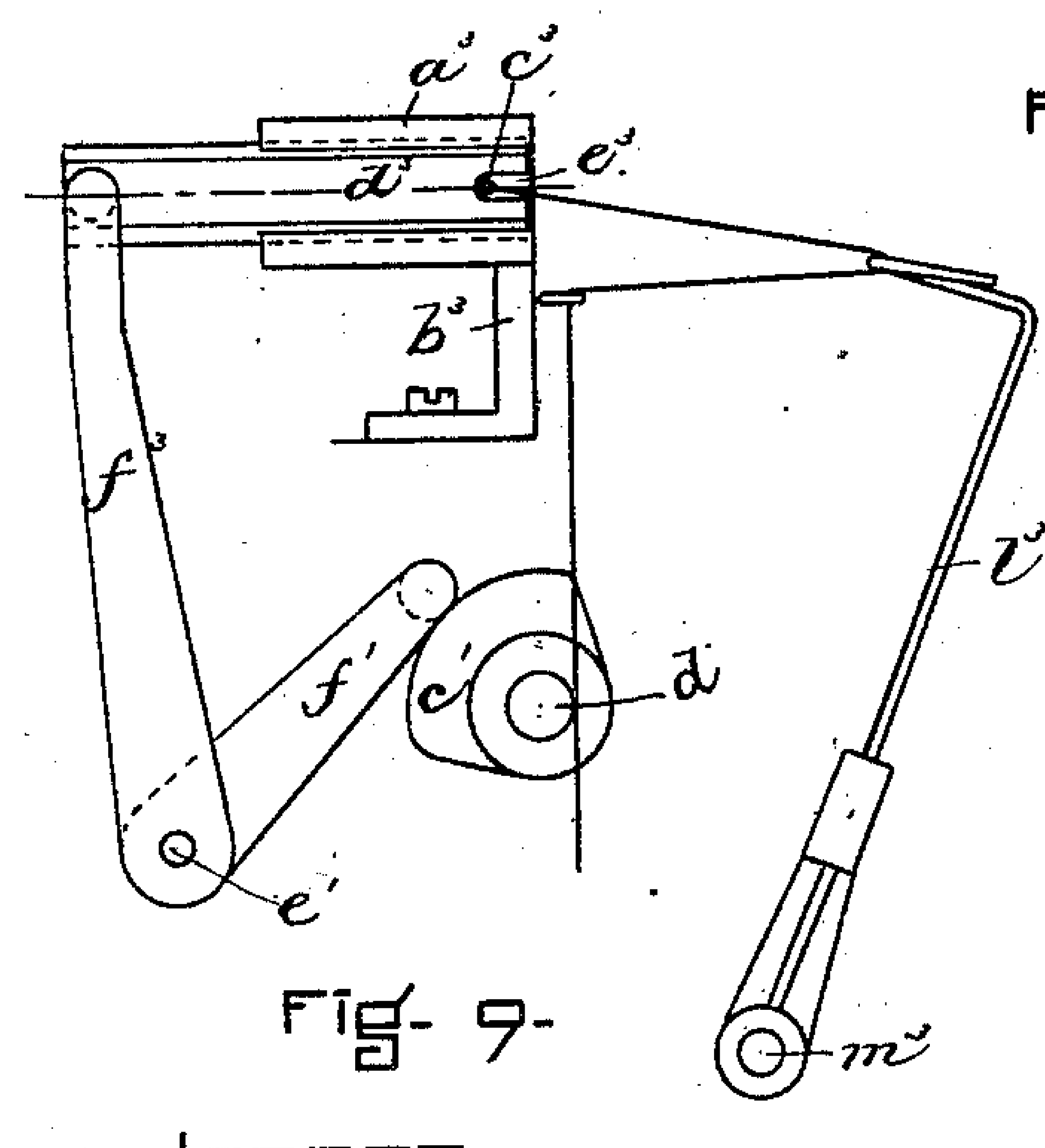

Fig. 9.

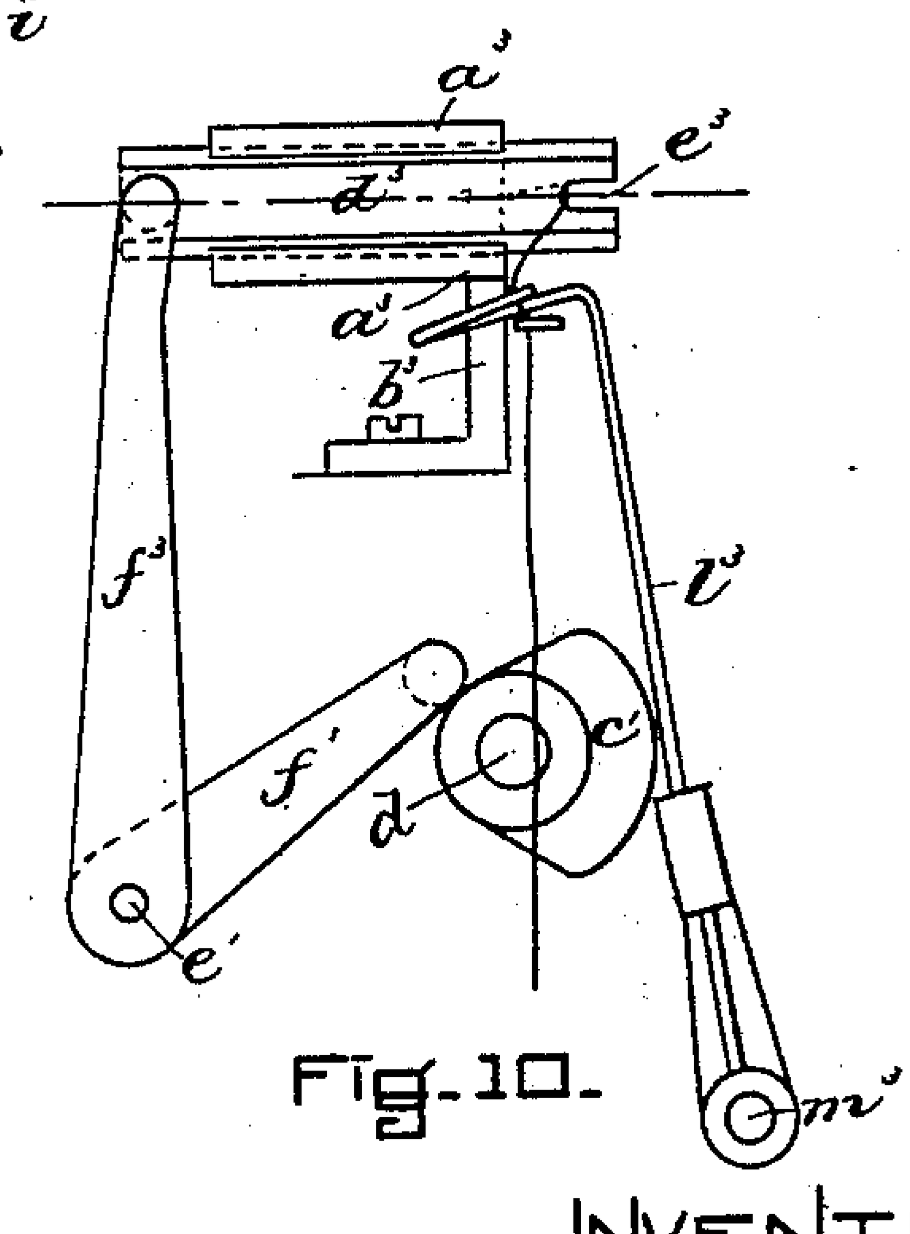

Fig. 10.

WITNESSES.

H. E. Brown

L. H. Brown

INVENTOR.

Erastus Woodward

by Wright, Brown & Crossley Attys.

N. PETERS, Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

ERASTUS WOODWARD, OF SOMERVILLE, ASSIGNOR TO THE PENTUCKET VARIABLE STITCH SEWING MACHINE COMPANY, OF HAVERHILL, MASSACHUSETTS.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 354,499, dated December 14, 1886.

Application filed February 17, 1886. Serial No. 192,227. (No model.)

To all whom it may concern:

Be it known that I, ERASTUS WOODWARD, of Somerville, in the county of Middlesex and State of Massachusetts, have invented certain new and useful 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, Figures 1 and 2 represent side elevations of a sewing-machine having my improvements. Fig. 3 represents a bottom view of the same. Fig. 4 represents an end elevation. Fig. 5 represents a similar elevation to Fig. 4, with the face-plate of the arm of the machine removed. Fig. 6 represents a longitudinal section. Fig. 7 represents a transverse vertical section on line *x x*, Fig. 2. Figs. 8, 9, 10, 11, and 12 represent detail views. Figs. 13, 14, 15, and 16 represent different arrangements of stitches which can be produced by the machine.

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*, Fig. 7, 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*, Fig. 6, 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*, affixed to 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. The shank *a'* of said presser-foot is secured to a socketed block on the presser-bar *b'*. Said bar slides in guides in the arm *a*, and is pressed downwardly by a spring, b^2, and raised intermittently by a cam, *c'*, on the shaft *d*, (see Figs. 9 and 10,) a rock-shaft, *e'*, journaled in bearings on the arm *a*, and provided with a lever, *f'*, bearing on the cam *c'*, and another lever, *g'*, engaged at its outer end with an arm, *i'*, on a block, i^2, affixed to the presser-bar. The spring b^2 presses downwardly on the block i^2, and thus depresses the presser-bar and holds the lever *f'* against the cam *c'*.

k' represents a 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. I prefer to make the feeder forked or U-shaped, 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'*, fitted to slide between guides on an arm, s', (see Figs. 4, 5, and 6,) 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', Figs. 1 and 5, 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', (see Figs. 2 and 7,) and confined between two shoulders or collars rigidly attached to said shaft. Said lever extends downwardly from the shaft t' and receives an oscillatory fulcrum-pin, G, hereinafter described, and is engaged at its lower end with a collar, H, Fig. 7, affixed to a rod, I, which is adapted to slide horizontally in bearings affixed to the bed b.

J represents a horizontal lever, pivoted at K, Figs. 1 and 3, to the rod I, and having a stud or offset at one end engaging a grooved cam, L, on the driving-shaft i. Said lever is adapted to oscillate horizontally on a fulcrum, H', (see Fig. 7,) which is adjustable horizontally toward and from the driving-shaft in a slot, I', in the bed. (See Fig. 8.) The rotation of the cam L by the driving-shaft causes it to oscillate the lever J. The result of the oscillations of said lever depends upon the position of the fulcrum H'. When said fulcrum is directly over the pivot connecting the lever J with the rod I, as shown in Figs. 7 and 8, the oscillations of the lever J have no effect; but when the fulcrum is moved inwardly, so as to locate it at one side of said pivot, the oscillations of the lever cause the rod I to reciprocate in its bearings, and thus oscillate the lever E and cause the latter to reciprocate the rock-shaft t' and the feeder k', the extent of the reciprocating movement depending on the adjustment of the fulcrum H'—that is to say, said movement increases as the distance between the fulcrum H' and the pivot connecting the lever J to the rod I is increased, and vice versa.

The fulcrum-pin G is adapted to be oscillated so as to impart an oscillating movement to the lever E, and may constitute the sole means of oscillating said lever, when the lever J is made inoperative by the described arrangement of the fulcrum H relatively to the pivot of said lever; or the fulcrum-pin may be used, in connection with the previously-described devices, for oscillating the lever E and determining the direction of the successive movements of the rock-shaft t' and feeder k'. To this end the fulcrum-pin G is affixed to a lever, K', Fig. 7, which is adapted to oscillate on a fulcrum-block, L', extending into and vertically adjustable in a groove in said lever K'. Said fulcrum-block is adapted to slide in a vertical slot in the arm a, and is supported in a cam-groove, J^2, formed in a disk, K^2, which is pivoted at L^2 to the arm a. (See Fig. 1.) By rotating the disk K^2 the fulcrum-block may be raised or lowered, as the case may be. When the fulcrum-block is in line with the pivot-pin G, the center of oscillation of the lever K' coincides with the pin G, and the latter therefore receives no oscillating movement, but is practically held stationary, so that the lever E will have a simple oscillating movement on the pin G, unmodified by any movement of the latter. The lower end of the lever K' has a roller engaging a grooved cam, Q', (see Fig. 2,) on the driving-shaft i. The rotation of said cam oscillates the lever K', and, if the fulcrum-block L' be out of line with the fulcrum-pin G, said fulcrum-pin is oscillated with the lever, and thus modifies the oscillating movements of the lever E and the reciprocating movements of the rock-shaft t' and feeder k', as hereinafter described.

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 mounted to oscillate on the rock-shaft t'. 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 cam-groove, V, in a disk, W, mounted to rotate loosely on the rock-shaft t'. 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 grooved 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 at its inner end a disk provided with a radial slot, which receives a stud on the slide C'. By turning the rock-shaft D' by means of a handle, F', 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, Q, 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 have no effect on 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 described.

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. 13, 14, and 15.

The "herring-bone stitch" 2 (shown in said Fig. 13) is produced as follows: The fulcrum H' is moved into line with the pivot of the lever J, thus making the latter incapable of oscillating the lever E. The fulcrums L' and U are respectively moved out of line with the pivots G and P, 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 depend upon the adjustment of the fulcrums L' U.

The Kensington stitch (shown in Fig. 14) is produced by first placing the fulcrum-block L' in line with the fulcrum-pin G, thus preventing the oscillations of the lever K' from moving said fulcrum-pin and the lever E, mounted thereon; and, secondly, adjusting the fulcrum H' away from the pivot K, connecting the lever J with the sliding rod I, thus enabling said lever to oscillate the lever E on the now fixed fulcrum-pin G, the fulcrums U and B' remaining as last described. The alternating longer forward stitches and shorter back stitches will then be formed as before; but the longitudinal movement of the rock-shaft and the lateral movement of the feeder produced by the oscillations of the lever E cause said stitches to lie obliquely or diagonally parallel with each other, as shown. The length of the stitches in this case depends upon the distance between the fulcrum H' and the pivot connecting the lever J to the rod I, while the degree of obliquity of the stitches depends upon the adjustment of the fulcrum U.

By adjusting the fulcrum L' as in making the herring-bone stitch and the fulcrum H' as in making the Kensington stitch, the peculiar stitch shown in Fig. 15 may be produced. By loosening one of the collars between which the lever E is confined on the rock-shaft t', so as to allow said lever a lateral slip or lost motion on the rock-shaft, the stitch shown in Fig. 16 may be produced, the machine being adjusted as in forming the herring-bone stitch. The machine may be adjusted to make various other arrangements of stitches, such as the taste of the operator may dictate.

The thread in passing from the supplying-spool to the needle is alternately held and released by devices which grasp and hold the thread tightly while the shuttle is entering and passing through the needle-loop, thus preventing the shuttle from pushing the needle-loop away and failing to enter it, the thread being released by said devices when the needle is above the work and while the latter is being moved by the feeder, so that a very light tension may be used, thus enabling the elongated stitches to lie smoothly on the work, and preventing drawing or puckering thereof by the stitches. The devices which I use for this purpose are a fixed plate, a^3, attached to a standard, b^3, affixed to the arm a, and having an orifice, c^3, Fig. 9, through which the thread passes from the supplying bobbin or spool, a plate, d^3, fitted to slide in guides on the plate a^3, and having a slot, e^3, in one end, through which the thread passes, and an arm, f^3, attached to the rock-shaft e', and having a pin, g^3, at its swinging end, entering a slot, h^3, Fig. 7, in the plate d^3. The arm f^3 is oscillated by the rock-shaft e', and reciprocates the plate d^3, causing it to alternately cover the orifice c^3 in the fixed plate a^3, as shown in Figs. 10 and 12, and uncovers said orifice, as shown in Figs. 9 and 11. When the plate d^3 covers the orifice in the plate a^3, the thread is clamped between the proximate surfaces of said plates, as shown in Fig. 12, so that it is tightly held. This occurs while the needle is in the work and the shuttle is passing through the needle-loop. When the plate d^3 is moved back, as shown in Figs. 9 and 11, the thread is released, and is free to pass through the orifice c^3 and slot e^3, this being the case while the needle is raised and during the movement of the work by the feeder. It will be seen, therefore, that only sufficient tension is required to cause the thread to lie smoothly on the surface of the work, so that a much lighter tension may be employed than could be if the tension were relied on to hold the thread while the shuttle is entering and passing through the needle-loop. The tension employed in this instance is a plate, i^3, located on the standard b^3, and pressed downwardly thereon by a spiral spring, j^3, on a rod, k^3, affixed to said standard, and passing through an orifice in the plate i^3. The thread passes between the standard b^3 and one end of the spring i^3, as shown in Figs. 1, 6, 11, and 12.

l^3 represents the take-up arm, which is affixed to a rock-shaft, m^3, journaled in the arm a, and is oscillated by a cam, n^3, on the shaft d, (see Fig. 5,) an arm, p^3, on the rock-shaft m^3, and a spring, o^3, which presses the arm p^3 against the cam n^3. The take-up is moved outwardly by the described devices when the thread is released, and is moved inwardly when the thread is clamped, as shown in Figs. 9 and 10.

The connection between the feeder k' and the slide or plate r' (see Fig. 4) is effected by means of a pin, a^4, affixed to the feeder and a split socket, b^4, (see Fig. 5,) affixed to the slide r' and holding the pin. The socket b^4 is split longitudinally, so that it can be compressed and caused to hold the pin a^4 with sufficient pressure to prevent the feeder from turning loosely in the socket. A screw, c^4, is passed through the socket above the pin a^4, and clamps the two divisions of the socket against the pin with the requisite pressure. The feeder is thus allowed to turn so as to bear squarely on the throat-plate or bed in any of the positions of the arm s', but is prevented from turning loosely, so that when it is raised above the bed it will remain parallel therewith, and will therefore strike the work squarely when it descends. If the feeder were allowed to swing loosely on its pivot, it might, when raised, swing so that in descending one of its arms would strike the work first and slightly displace the work.

The described mechanism for producing the combined longitudinal and oscillatory movements of the rock-shaft t' and feeder k' is similar to that described in Letters Patent to Woodward and Keith, No. 316,927, dated April 28, 1885, excepting the means for operating the lever E to produce the Kensington stitch. In said patent the lever E was engaged directly with an adjustable fulcrum-block corresponding to the block L', above described, and its lower end was engaged with a cam-groove on the driving-shaft.

It will be seen that by the addition of the lever K', the fulcrum-pin G, mounted thereon, and the adjustable devices for operating said lever, to the mechanism formerly used, I enable the feeder to operate in forming the Kensington stitch, as above described, in a manner not before possible.

I claim—

1. The combination of the stitch-forming mechanism, the feeder, the arm and rock-shaft carrying the feeder, the adjustable mechanism for oscillating said rock-shaft, a lever pivotally connected to the rock-shaft, a movable fulcrum for said lever, a second lever by which said fulcrum is supported, adjustable mechanism, substantially as described, whereby said fulcrum may be either oscillated or held stationary, and adjustable mechanism, substantially as described, for oscillating said lever, as set forth.

2. The combination of the stitch-forming mechanism, the feeder, the arm and rock-shaft carrying the feeder, the adjustable mechanism for oscillating the rock-shaft, the lever E, pivotally connected to the rock-shaft, the movable fulcrum G for said lever, the lever K', supporting said fulcrum, the adjustable fulcrum L' for said lever, and means, substantially as described, for oscillating said levers, as set forth.

3. The combination of the stitch-forming mechanism, the feeder, the arm and rock-shaft carrying the feeder, the adjustable mechanism for oscillating said rock-shaft, the lever E, pivotally connected to the rock-shaft, the fulcrum G and its operating mechanism, the slide I, to which the lower end of said lever is connected, the lever J, pivoted to said slide, the adjustable fulcrum for said lever, and the cam whereby said lever is oscillated, as set forth.

4. In a sewing-machine of the class described, having a universally-movable work-feeder, the combination, with the needle, shuttle, automatic work-feeder, and a tension device adapted to produce a constant tension on the thread, of automatic thread holding and releasing devices, substantially as described, whereby the needle-thread is held while the shuttle is entering the needle-loop, and released while the work is being moved by the work-feeder, as set forth.

5. The thread grasping and releasing device composed of the fixed plate having an orifice for the needle-thread and the reciprocating plate which alternately covers and exposes said orifice, as set forth.

6. The combination of the needle, the shuttle, the work-feeder, an automatic thread grasping and releasing device, and a tension device, all arranged and operating substantially as and for the purpose specified.

7. The combination, with the feeder-carrying arm or slide and the feeder loosely pivoted thereto, of a frictional connection between the said arm or slide and the pivot of the feeder, whereby the latter is prevented from swinging with too much freedom, substantially as set forth.

8. The combination, with the feeder-carrying slide r' and the feeder k', having the pin a^4 rigid therewith, of the split socket b and one or more set-screws for compressing said socket against said pin, whereby the feeder is prevented from swinging on said slide with too much freedom, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 27th day of January, 1886.

ERASTUS WOODWARD.

Witnesses:
C. F. BROWN,
ARTHUR W. CROSSLEY.