

(No Model.)

8 Sheets—Sheet 1.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.

Fig. 1.

Fig. 1<sup>c</sup>

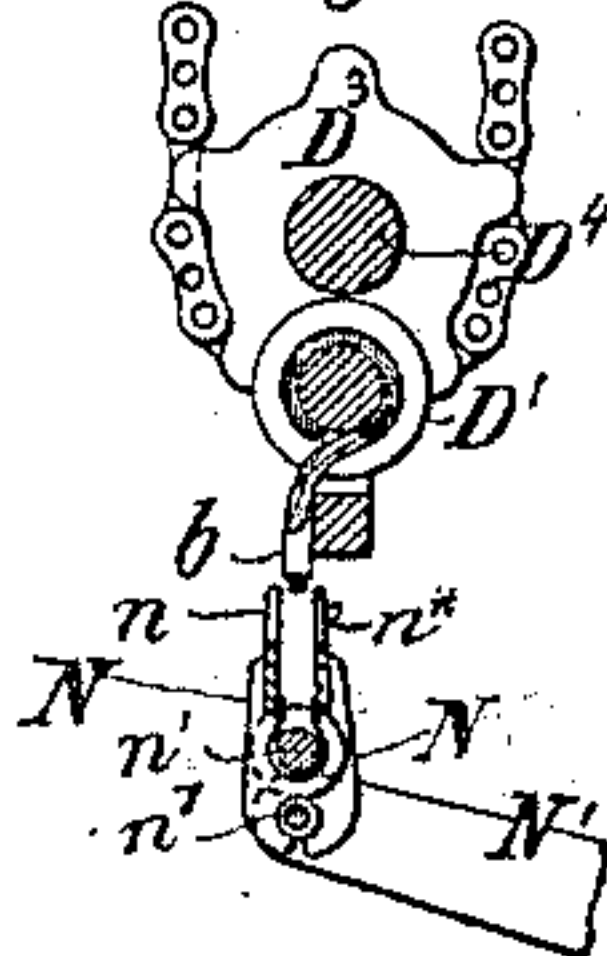


Fig. 1<sup>a</sup>

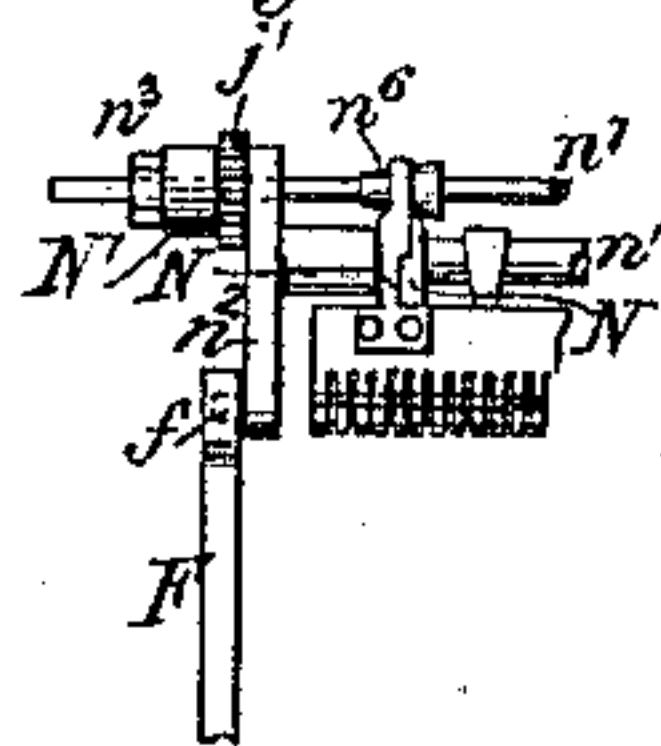
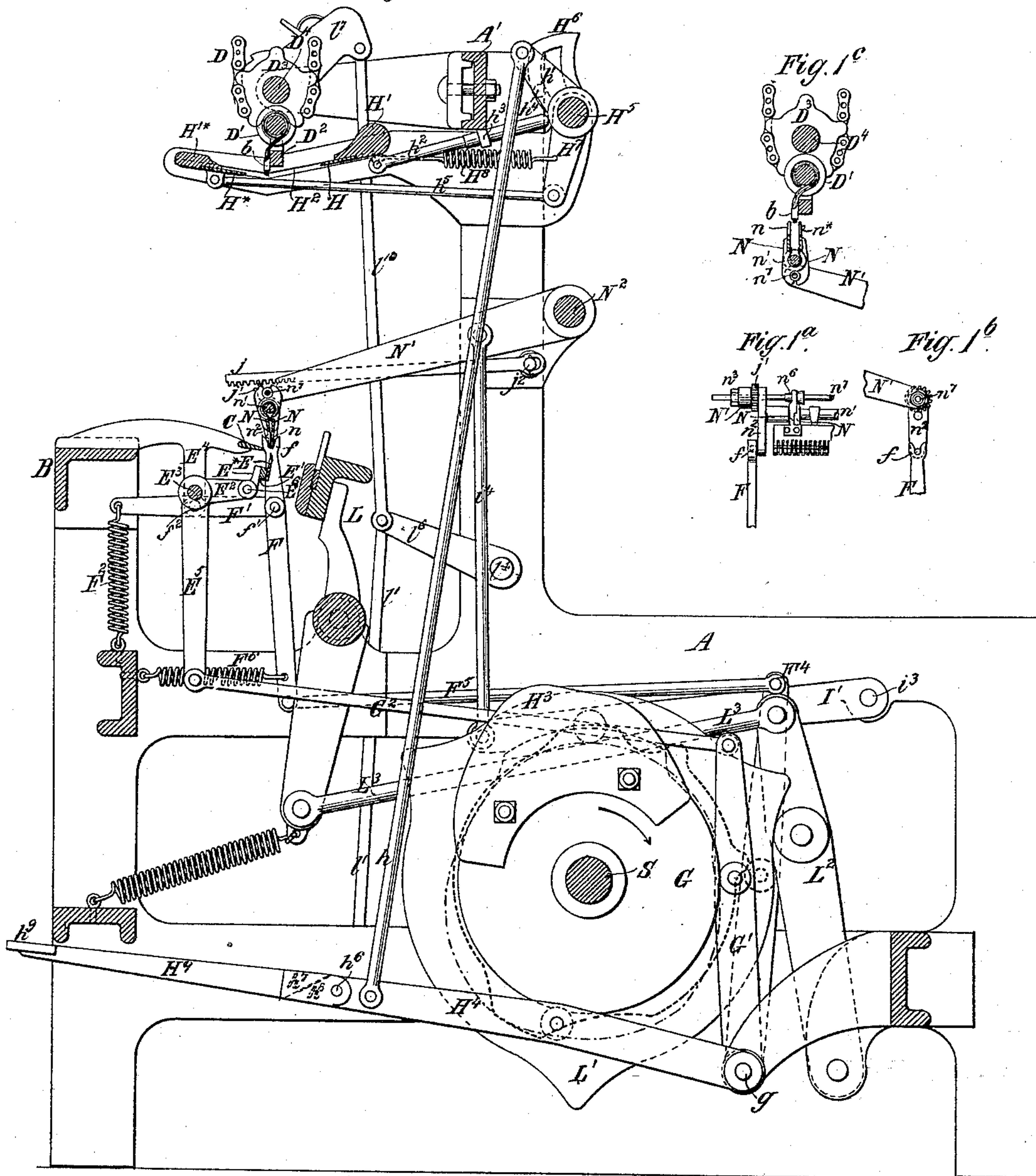
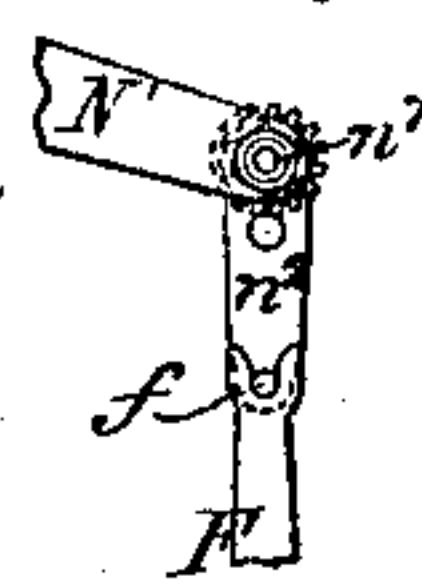


Fig. 1<sup>b</sup>



Witnesses:

Matthew Pollock  
Fred Wayne

Inventor:

Albert C. Skinner  
by his Atty.  
Brown & Hall

(No Model.)

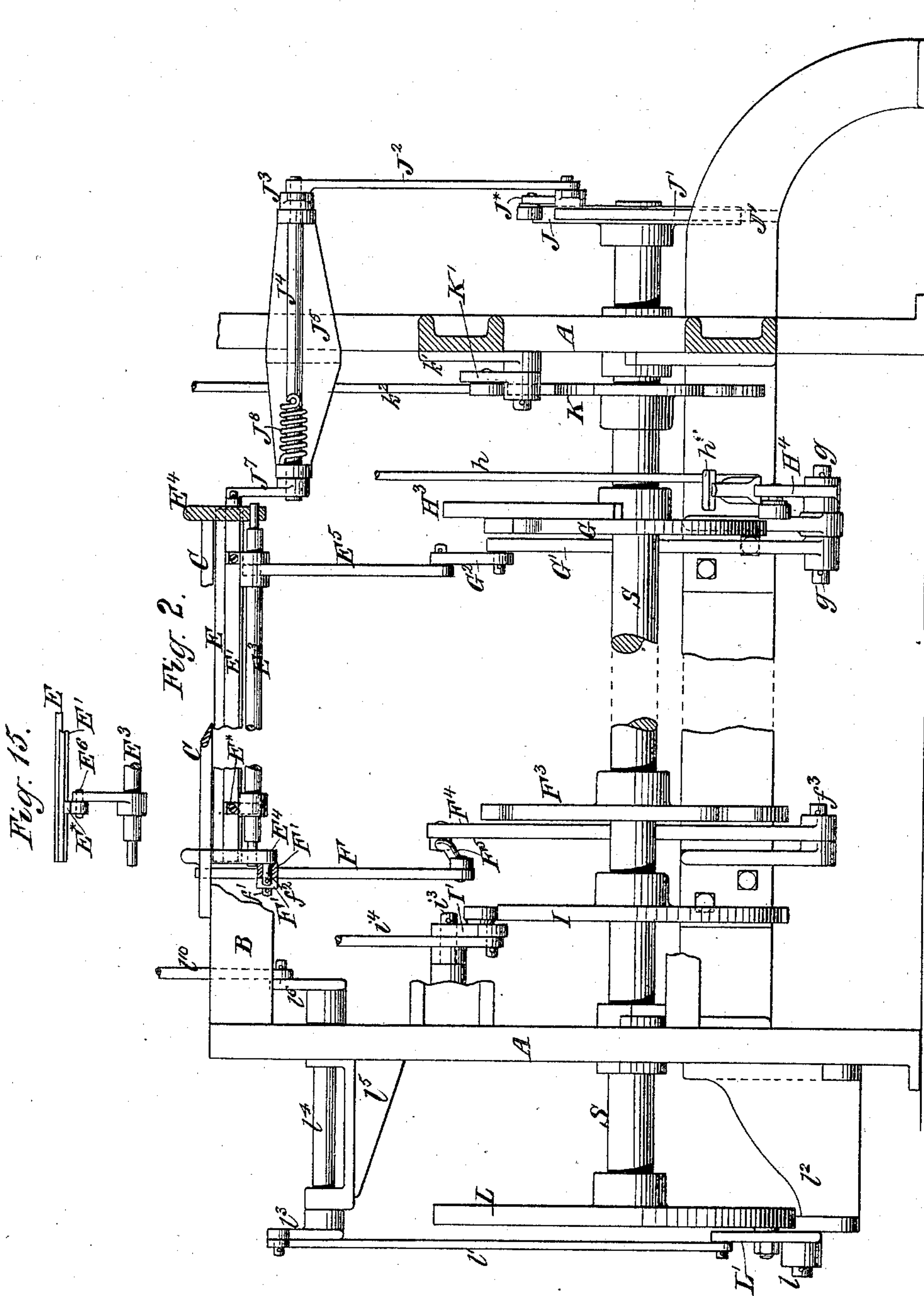
8 Sheets—Sheet 2.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.



Witnesses:  
Matthew Pollock  
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(No Model.)

8 Sheets—Sheet 3.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

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Patented Nov. 10, 1885.

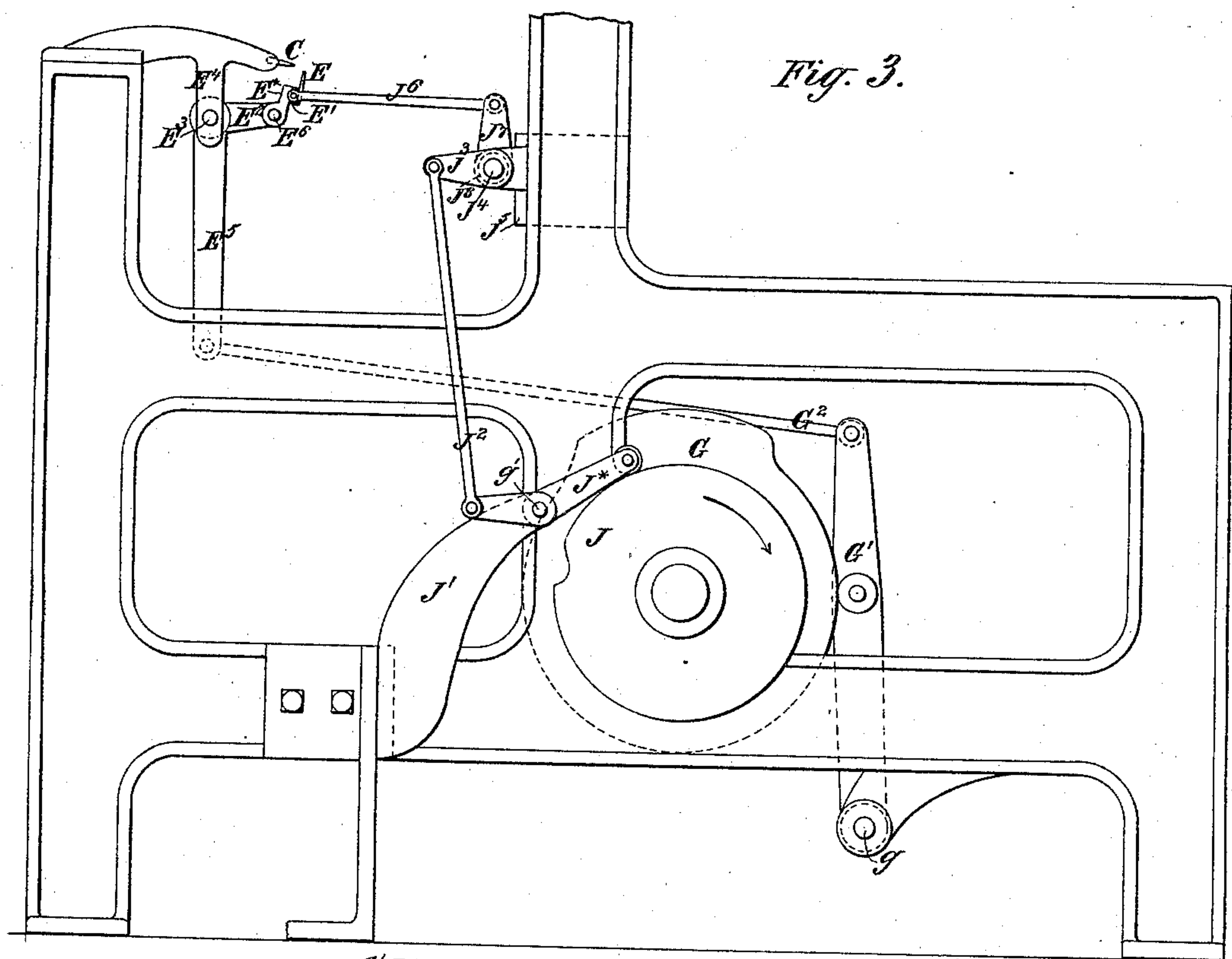


Fig. 3.

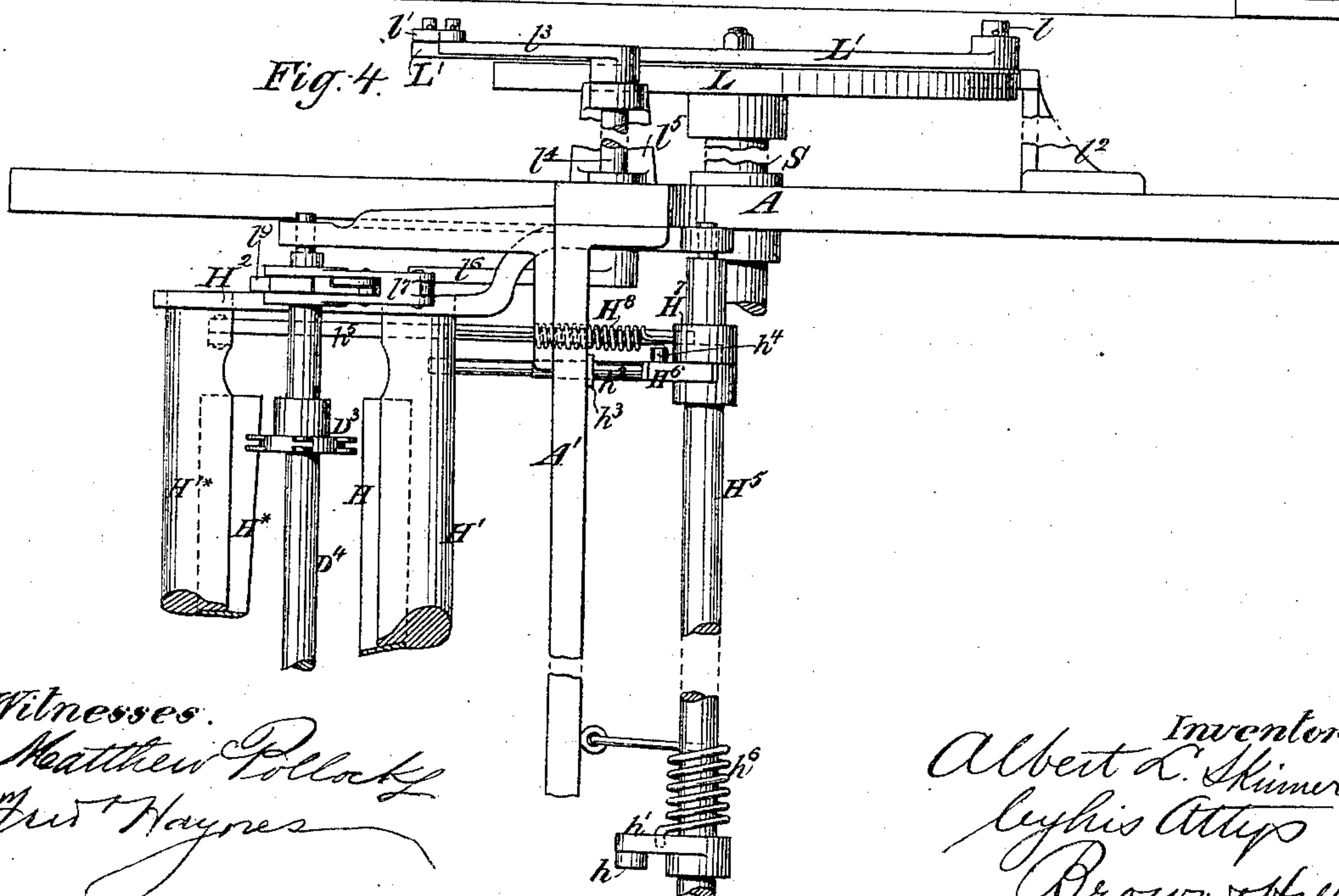


Fig. 4.

Witnesses.  
Matthew Pollak  
Jas. Haynes

Inventor:  
Albert L. Skinner  
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Brown & Hall

(No Model.)

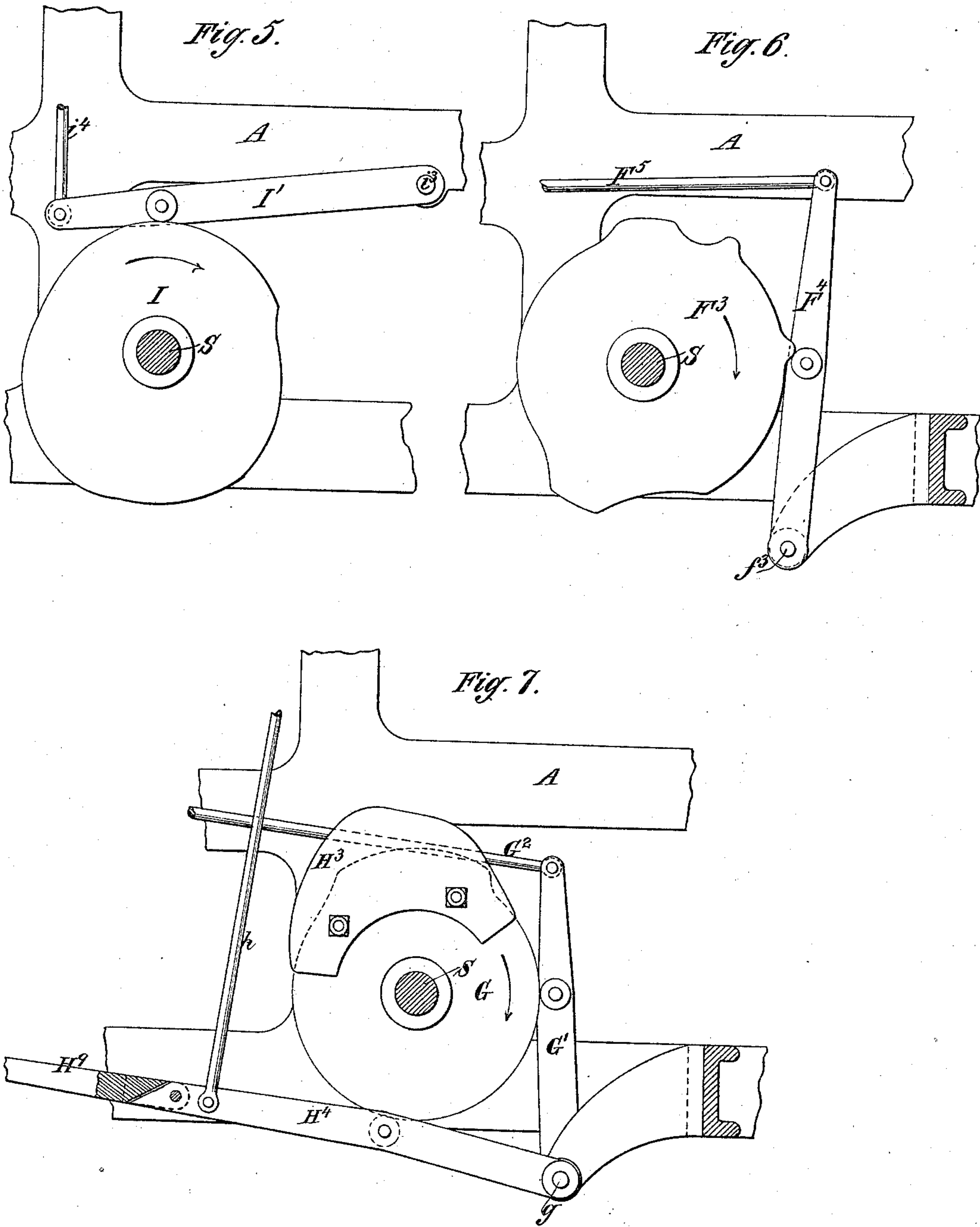
8 Sheets—Sheet 4.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.



Witnesses:  
Matthew Pollock  
Fred Haynes

Inventor:  
Albert L. Skinner  
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Brown & Hall

(No Model.)

8 Sheets—Sheet 5.

A. L. SKINNER.

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Fig. 10.

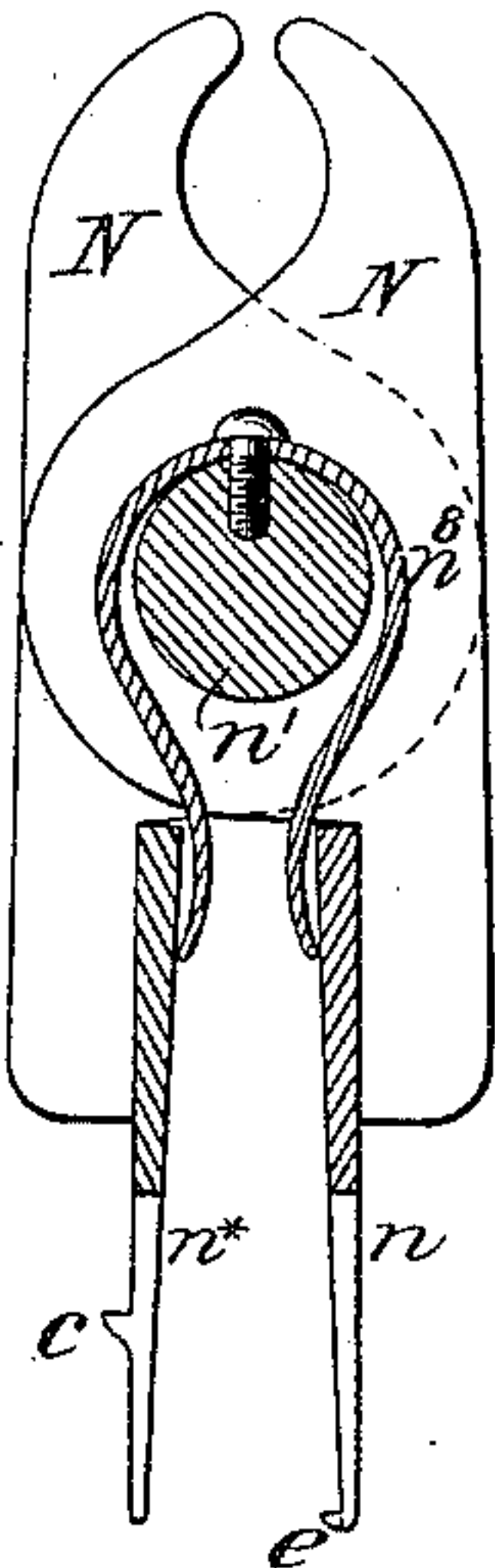


Fig. 9.

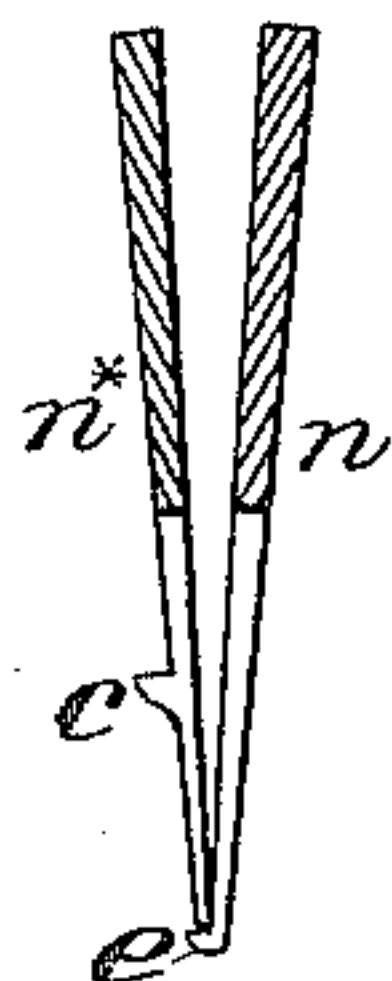


Fig. 8.

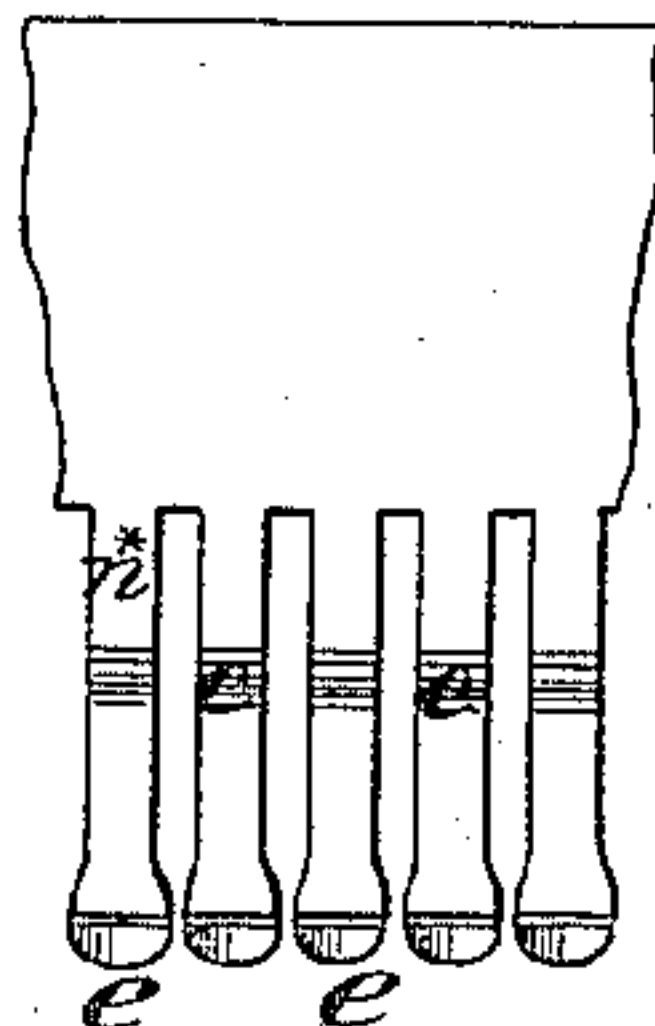


Fig. 10\*.

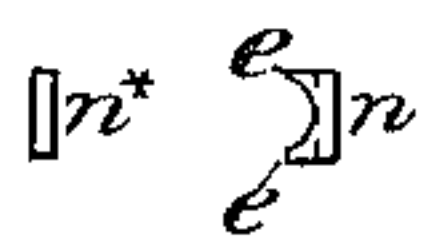


Fig. 9\*.

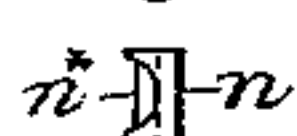


Fig. 11.

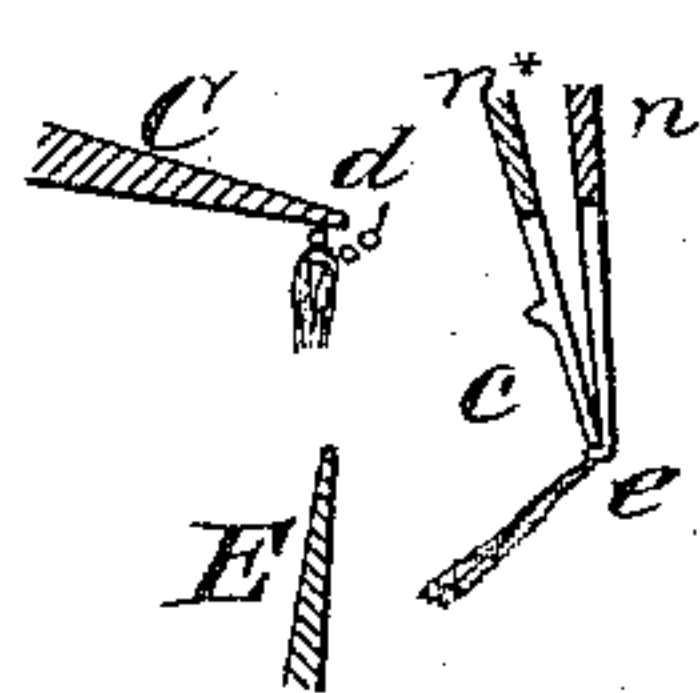


Fig. 12.

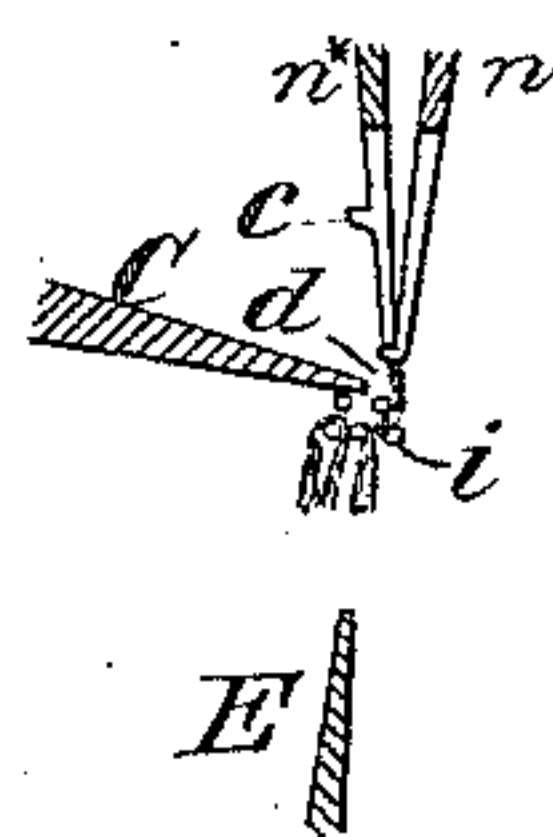


Fig. 13.

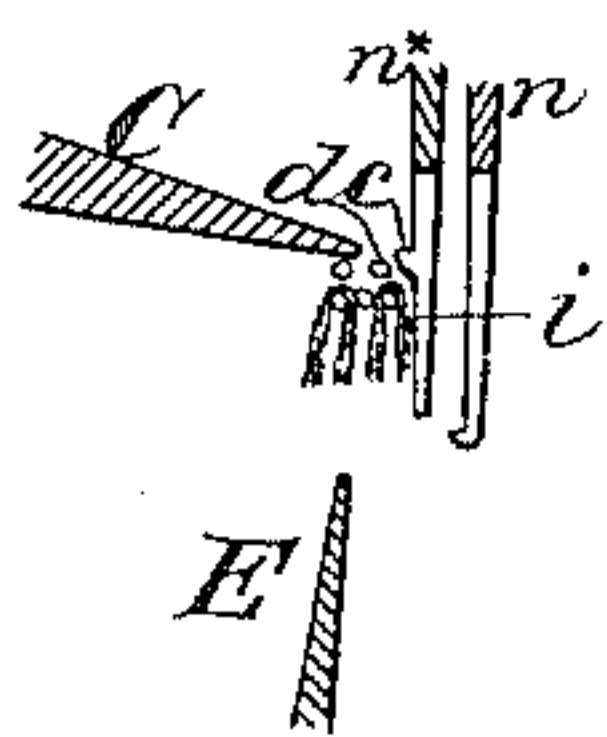
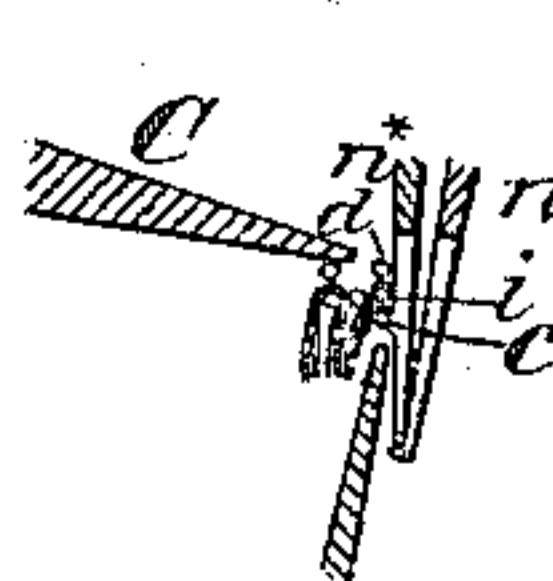


Fig. 14.



Witnesses:

Matthew Pollock  
Jno. Haynes

Inventor:

Albert L. Skinner  
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Brown & Bull



(No Model.)

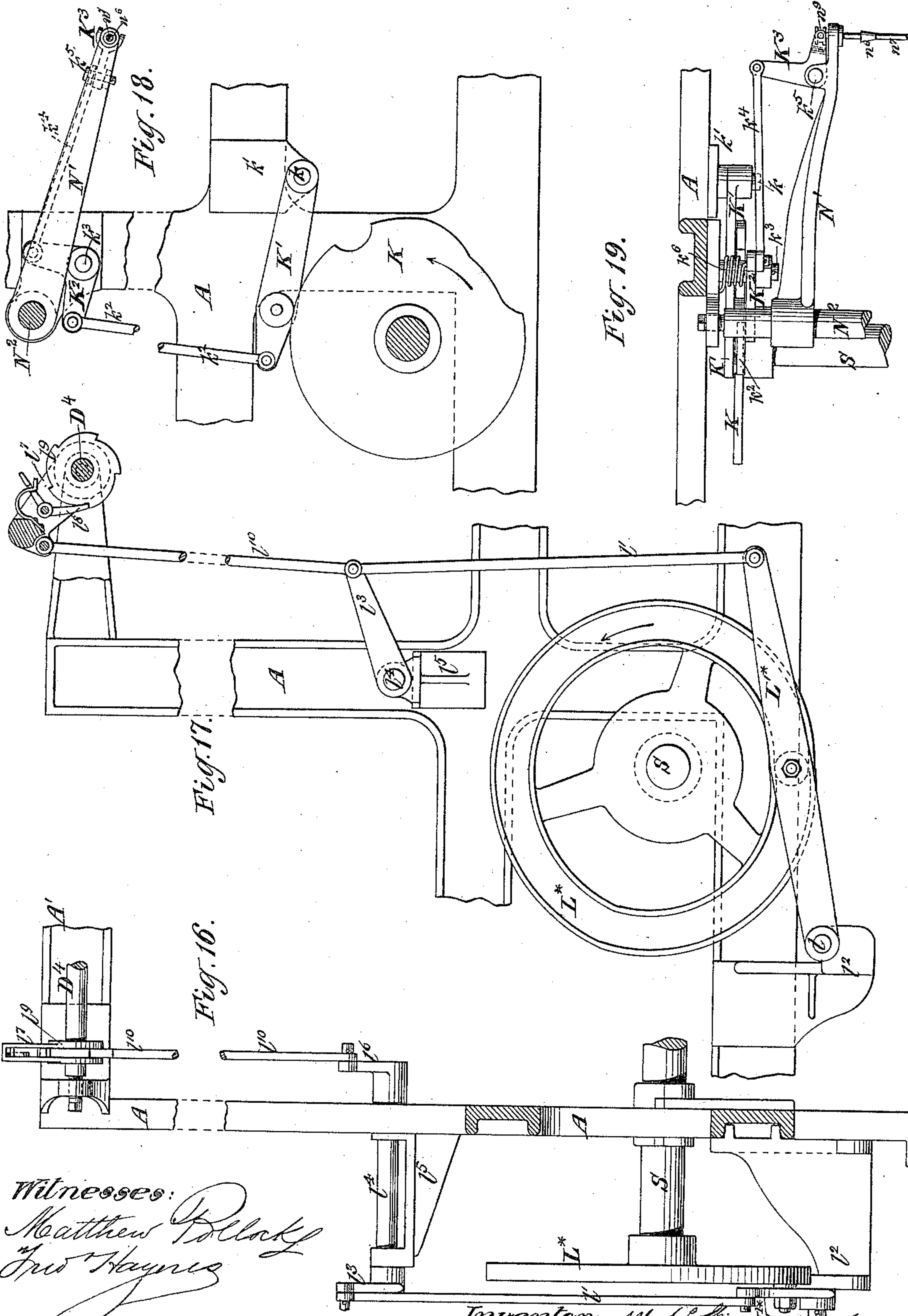
8 Sheets—Sheet 6.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.



Witnesses:  
Matthew Pollock  
Geo. Haynes

Inventor: Albert L. Skinner  
By his attorney: Mount & Co.

(No Model.)

8 Sheets—Sheet 7.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.

Fig. 21.

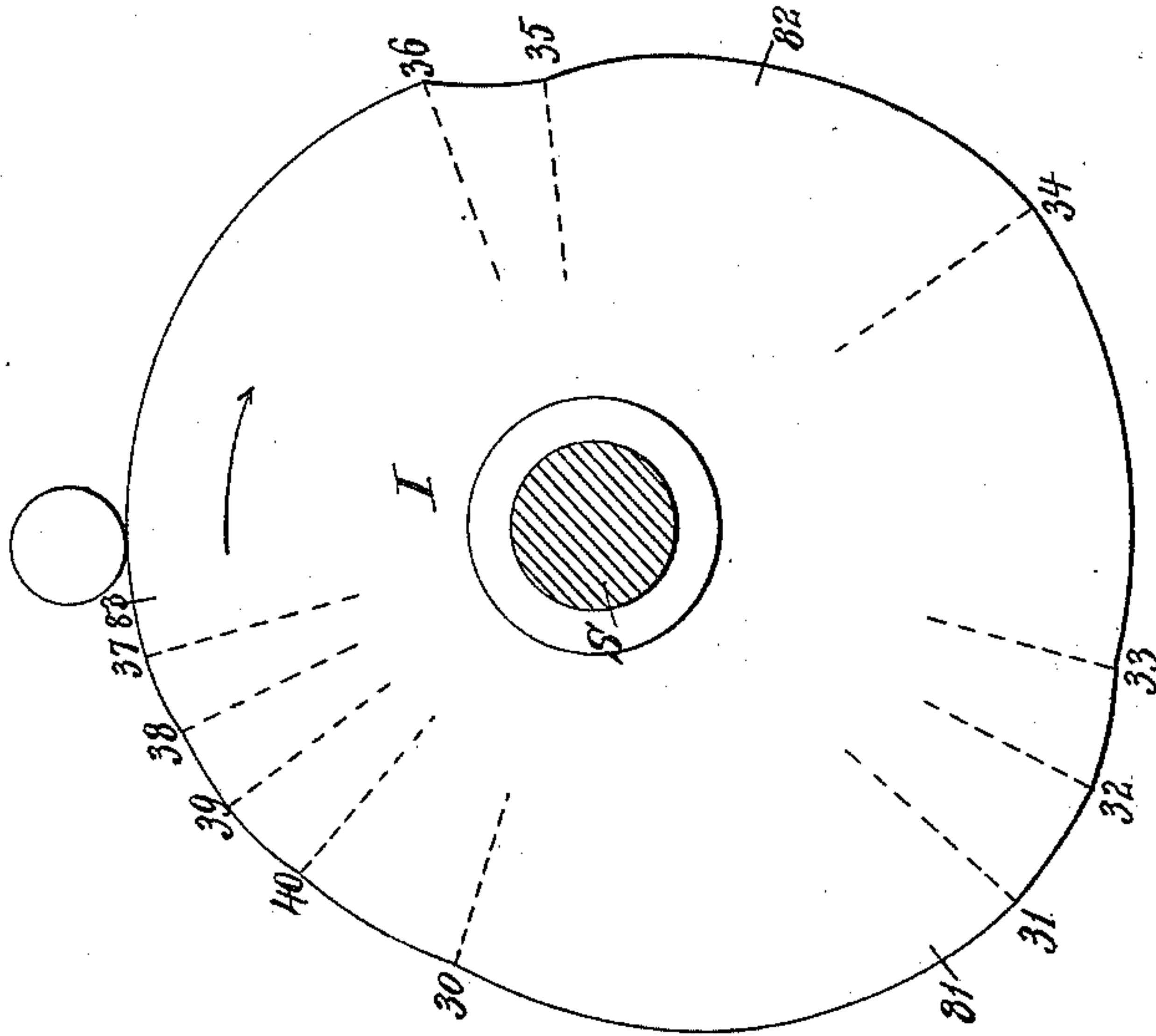
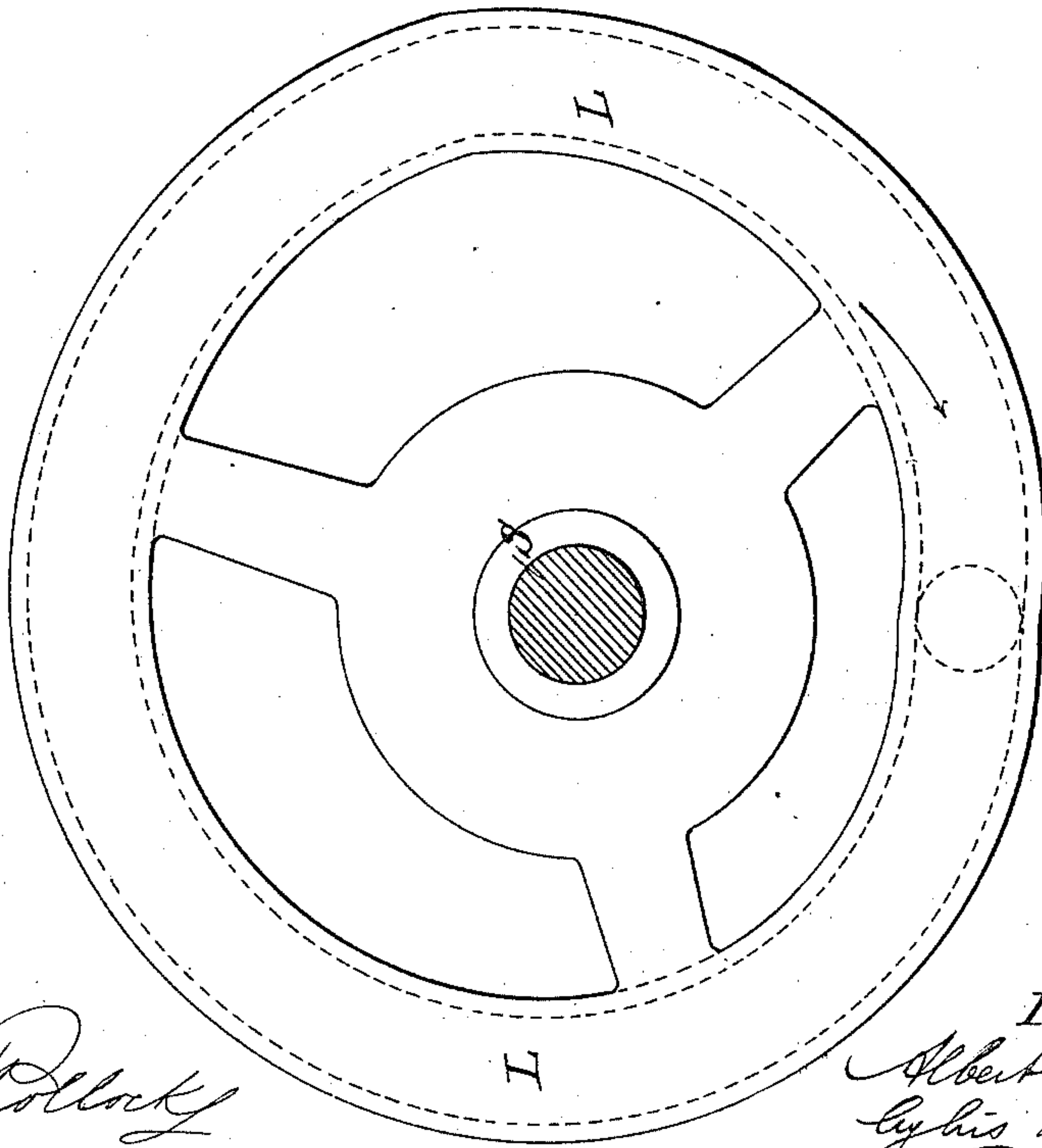


Fig. 20.



Witnesses:

Matthew Pollock  
Jas. Haynes

Inventor:

Albert L. Skinner  
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Brown & Hall

(No Model.)

8 Sheets—Sheet 8.

A. L. SKINNER.

LOOM FOR WEAVING TUFTED FABRICS.

No. 330,069.

Patented Nov. 10, 1885.

Fig. 25.

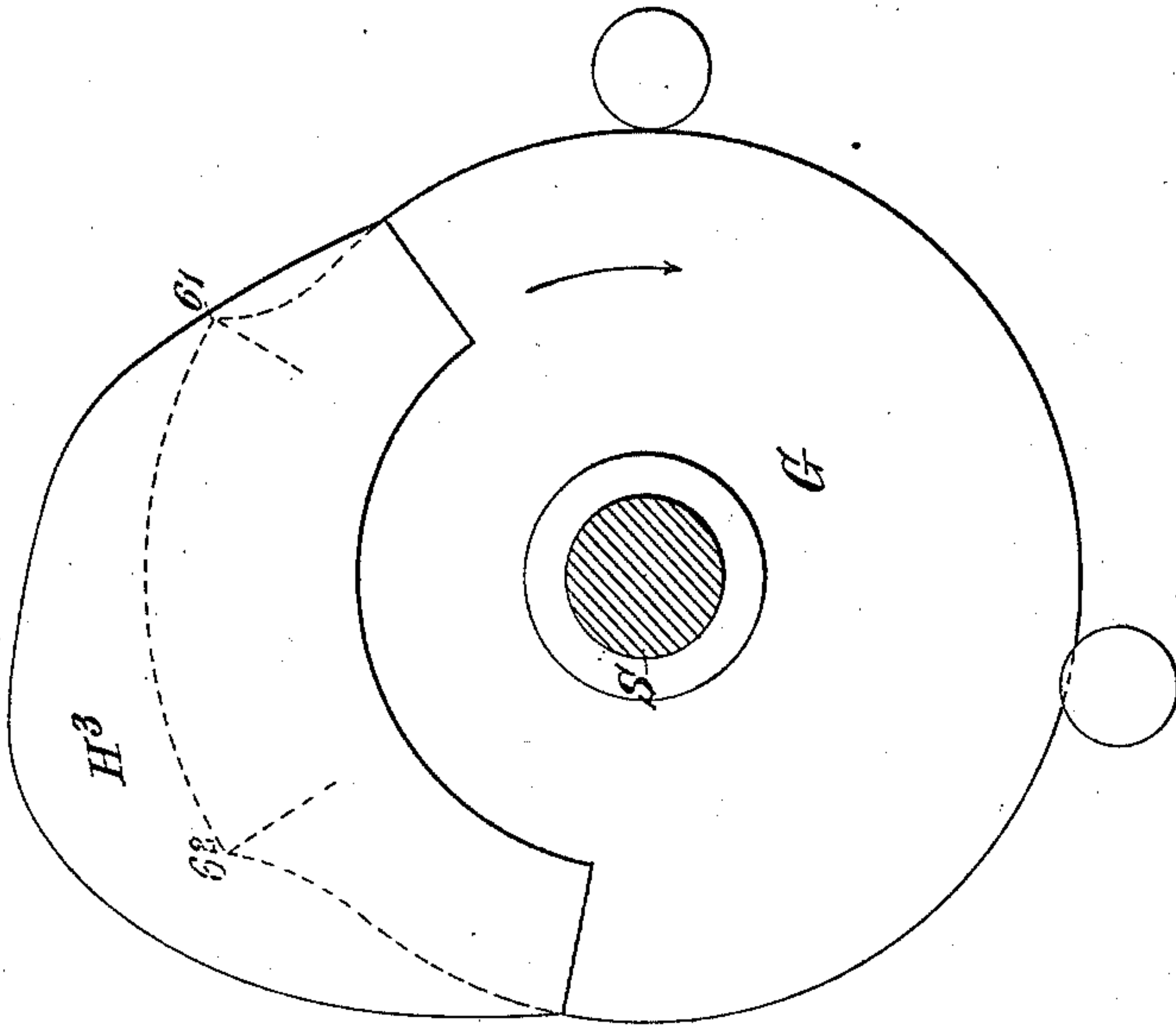


Fig. 23.

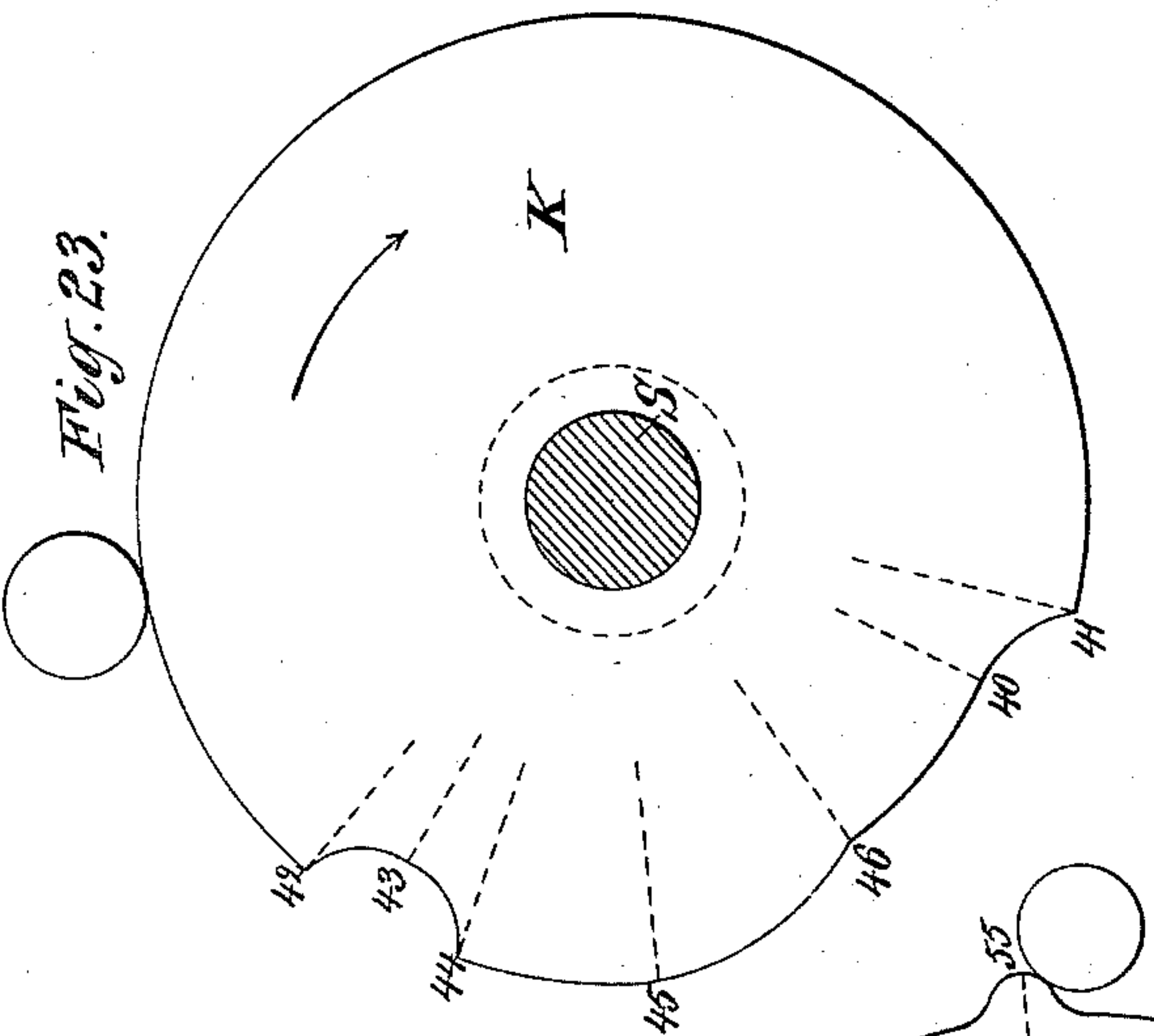


Fig. 24.

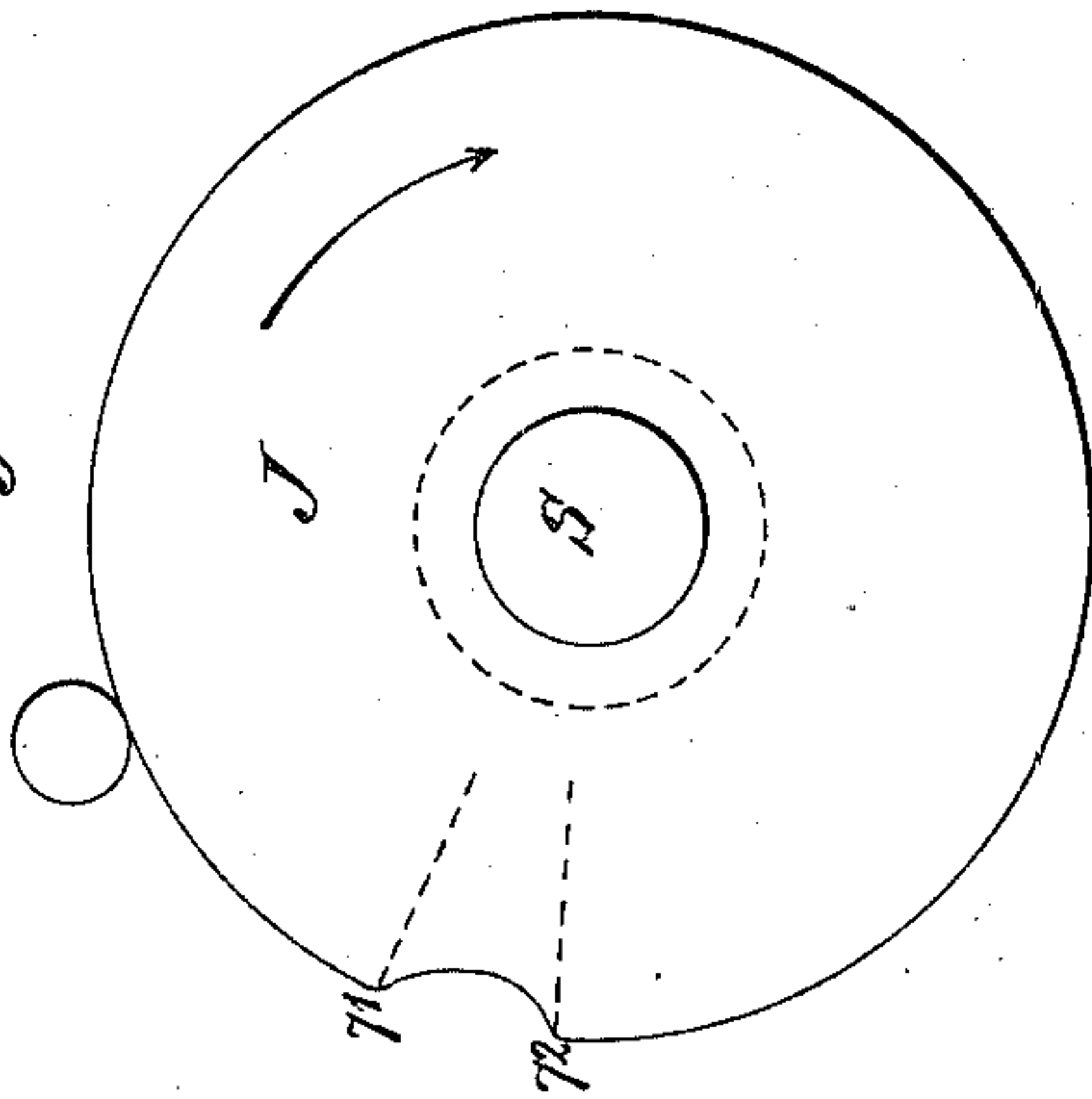
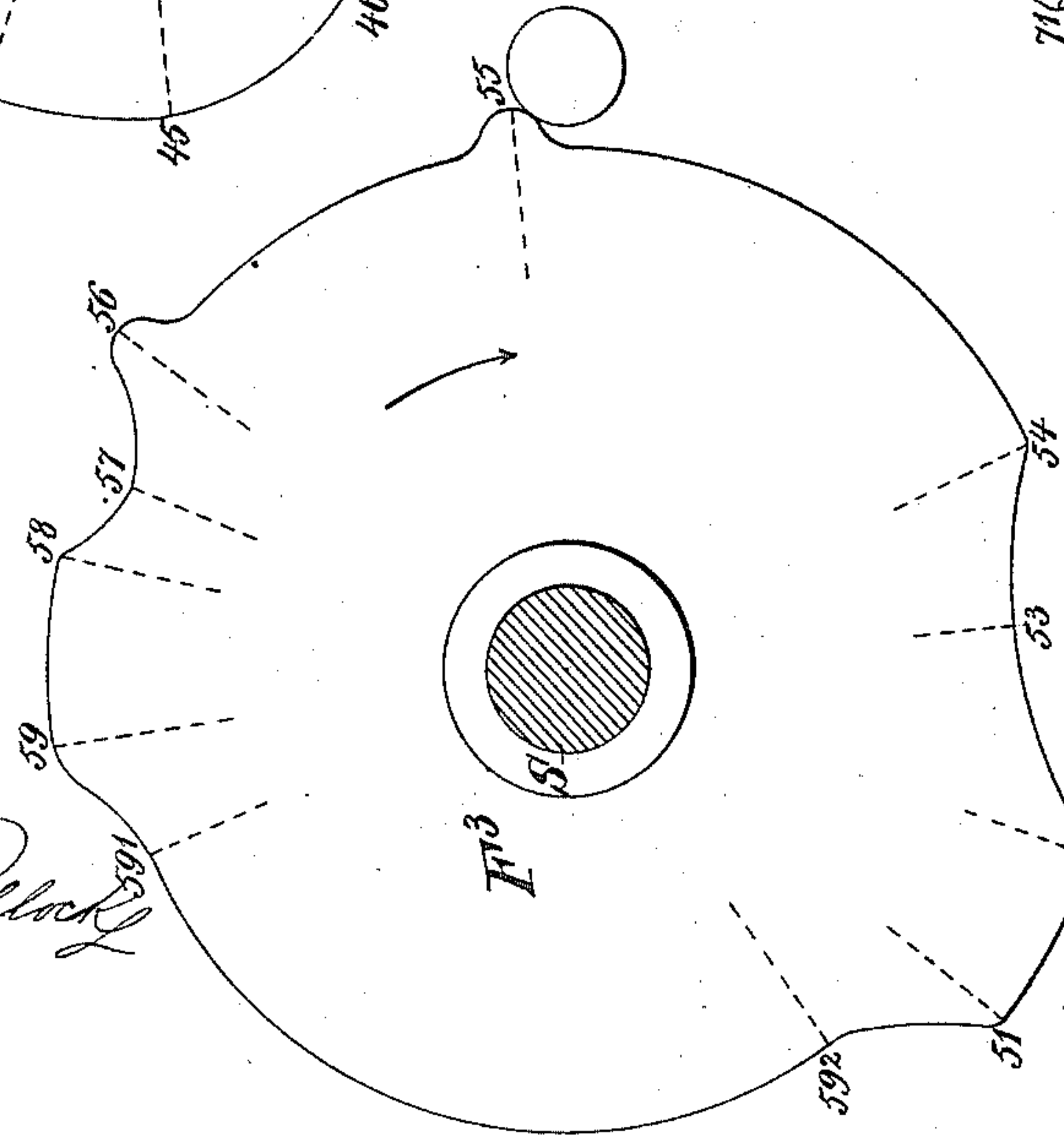


Fig. 22.



Witnesses:

Matthew Pollock  
Fred Haines

Inventor:

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Rowntree & Ball



# UNITED STATES PATENT OFFICE.

ALBERT L. SKINNER, OF YONKERS, NEW YORK.

## LOOM FOR WEAVING TUFTED FABRICS.

SPECIFICATION forming part of Letters Patent No. 330,069, dated November 10, 1885.

Application filed April 8, 1884. Serial No. 127,106. (No model.)

*To all whom it may concern:*

Be it known that I, ALBERT L. SKINNER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Looms for Weaving Tufted Fabrics, of which the following is a specification, reference being had to the accompanying drawings.

This invention is more particularly intended for the weaving by power of what are known as "Moquette" carpets, but may be wholly or in part applicable to power-loom for weaving other tufted fabrics.

To explain the nature of my invention, I will first refer, briefly, to my Letters Patent No. 251,304, dated December 20, 1881. According to those Letters Patent, the tuft-yarns are drawn from their spools by clamps, and while held in these clamps pieces are cut from them of the proper length to produce the tufts, and these pieces are taken from the clamps by nippers which insert them into the warp.

The object of this invention is twofold—viz., to simplify the construction of the loom and to increase its efficiency.

The invention consists in certain new combinations, hereinafter described and claimed, whereby the clamps described in my former patent, hereinabove cited, are dispensed with, and the nippers employed to insert the tufts are made to do the work done by those clamps.

The invention also consists in an improvement in the nippers themselves, whereby they are made to work with more certainty, and in an improvement in the means of operating them.

The invention also consists in a device for preventing the tufts after their insertion into the warp by the nippers from being disturbed by the crossing of the shed.

The invention further consists in improved mechanism for operating the cutters employed to cut off the tuft-pieces, and in certain provisions for the use of those cutters for trimming or evening the ends of the tuft-yarns without working the other parts of the loom.

In the accompanying drawings, Figure 1 is a nearly central longitudinal vertical section of the loom, showing the parts involved in this invention, but having omitted all parts

not necessary to the illustration of the invention. Fig. 1<sup>a</sup> is a front view of portions of the tuft-nippers and their operating mechanism. Fig. 1<sup>b</sup> is a side view of part of the mechanism for operating the nippers. Fig. 1<sup>c</sup> is a transverse section of the nippers and one of the spool-carriages and chain-carrying shafts. Fig. 2 is a front view of the lower part of a loom to which my invention is applied, representing it with the front of the framing partly broken away to expose to view the parts behind it. Fig. 3 is a side view of a portion of the loom, showing the device, which I call the "straight-edge," for holding the tufts during the crossing of the shed, and the means of operating the same. Fig. 4 is a plan of part of the loom, illustrating the tuft-cutters and means of operating the same. Fig. 5 is a side view of part of the mechanism for operating the nippers. Fig. 6 is a side view of another part of the mechanism for operating the nippers. Fig. 7 is a side view of part of the cutter-operating mechanism and part of the mechanism for operating the straight-edge. Fig. 8 is a front view of the nipper-fingers on a larger scale than the figures previously referred to. Fig. 9 is a transverse section corresponding with Fig. 8. Fig. 9\* is an end view of one pair of nipper-fingers closed. Fig. 10 is a view like Fig. 9, but showing the nipper-fingers separated, and showing also the jaws which carry said fingers and the springs for opening them. Fig. 10\* is an end view of a pair of nipper-fingers corresponding with Fig. 10. Figs. 11, 12, 13, 14 are diagrams illustrating the operation of the nippers and the straight-edge. Fig. 15 is a plan of part of the straight-edge and its operating mechanism. Fig. 16 is a front view of the cam and mechanism for operating the chains for carrying the tuft-yarn spools. Fig. 17 is a side view of the same. Fig. 18 is a side view of the cam and principal parts of the mechanism for closing the tuft-yarn nippers. Fig. 19 is a plan corresponding with Fig. 18. Figs. 20 to 25, inclusive, are side views of the several cams provided on the main shaft of the loom for operating the several parts of the tufting mechanism, representing them on a scale twice that in which they are shown in the other figures, showing all in the proper rela-



tive positions corresponding with Fig. 1. Fig. 20 represents the cam for operating the tuft-spool-carrying chains. Figs. 21, 22, 23 represent the cams for operating the nippers. 5 Figs. 24 and 25 represent the two cams for operating the device, hereinafter termed the "straight-edge," for holding the tufts in the warp until they have been secured in the weaving, the last-mentioned view showing 10 also the cutter-operating cam.

Similar letters of reference indicate corresponding parts in the several figures.

The framing A of the loom may be and is represented as of ordinary form, and is shown 15 provided with a web-supporting plate, C, so arranged in rear of the breast-beam B that its lower edge is close to the line to which the fell comes in weaving.

The lay L may be operated by any suitable 20 means, according to the number of shots of filling employed for each row of tufts. It is represented in Fig. 1 as operated by a three-leaved cam, L', for the employment of three shots of filling. The said cam, which is on 25 the main shaft S of the loom, acts on a lever, L<sup>2</sup>, which is connected with the lay by a rod, L<sup>3</sup>.

The heddles and other parts of the loom not represented in the drawings and not hereinafter described may be constructed, arranged, 30 and operated substantially as in other looms for weaving tufted fabrics—for instance, that described in expired Letters Patent No. 16,037, dated November 4, 1856. I prefer to use a 35 needle for inserting the weft, as that does not require so great an opening of the shed as is required by a shuttle. Such a needle and its operating mechanism are fully described in my application for Letters Patent Serial No. 124,640, filed March 18, 1884.

40 The spool-carrying chains D, for carrying the tuft-yarn spools D', and the shafts D<sup>4</sup> and wheels D<sup>3</sup>, for carrying said chains, may be arranged and operated as in other looms for weaving tufted fabrics—as, for instance, in the 45 loom described in the expired Letters Patent hereinabove mentioned. The carriages D<sup>2</sup>, for said spools, may be constructed and adapted to the chains in the manner described and claimed in my hereinbefore-cited Letters Pat- 50 ent.

The cam L\* and other mechanism for operating the spool-carrying chains D are shown in Figs. 16, 17, and a part thereof in Fig. 2. As this mechanism operates only upon the shaft D<sup>4</sup> 55 of the lower chain-carrying wheels D<sup>3</sup>, and the upper chain-carrying wheels are simply moved by the chains, I have only represented the shaft D<sup>4</sup> of the lower wheels. The cam L\* is represented at the left-hand end of the shaft 60 S, where it operates upon a lever, L\*, working on a fixed fulcrum, l, secured in a bracket, l<sup>2</sup>, bolted to the outer side of the left-hand main standard of the loom. This lever is connected by a rod, l', with one arm, l<sup>3</sup>, of a rock-shaft, 65 l<sup>4</sup>, which works in bearings in a bracket, l<sup>5</sup>, attached to the loom-framing, another arm,

l<sup>6</sup>, of the said rock-shaft being connected by a rod, l<sup>0</sup>, with a pawl-lever, l', which works loosely on the shaft D<sup>4</sup>, and which carries a spring-pressed pawl, l<sup>8</sup>, engaging with a ratchet-wheel, l<sup>9</sup>, fast on the said shaft. The said 70 cam L\* is represented as grooved to receive a bowl on the lever L\*, so that it operates on the lever with a positive motion both in an upward and downward direction. 75

The nippers Nn Nn\*, for holding the tuft-yarns while the tuft-pieces are cut off, and for inserting the tuft-pieces into the warp, have a general resemblance to those which constitute 80 part of the subject-matter of my hereinbefore-cited Letters Patent—that is to say, they have an opening and closing movement, a movement upward and downward or to and fro between the tuft-carrying chains and the plane 85 of the warp, and a semi-rotary or turn-over movement; but they have also a series of slight oscillating movements while in and near the warp, and the construction of the fingers differs somewhat from those of said Letters Patent. I will now proceed to describe them. 90

The jaws N N, (shown in Figs. 1, 1<sup>a</sup>, 1<sup>c</sup>, and 10,) to which are attached the plates of which the fingers n n\* are constructed, are pivoted together by the long crank-pin n', the ends of which are firmly secured in two crank-arms, 95 n<sup>2</sup>, one of which is shown in Figs. 1<sup>a</sup> and 1<sup>b</sup>, journaled into two arms, N', of a rock-shaft, N<sup>2</sup>, which works between center screws or in bearings secured to the side frames of the loom. These jaws are to be opened by springs 100 n<sup>8</sup>, (best shown in Fig. 10,) placed between them, and are to be closed by conical wedges n<sup>6</sup> on a rod, n<sup>7</sup>, which slides through the journals n<sup>3</sup> of the crank-arms n<sup>2</sup>.

As thus far briefly described, the nippers 105 and their operating mechanism do not differ from those described in my hereinbefore-cited Letters Patent. The fingers only differ from those described in my former Letters Patent in two particulars—viz., in that the front fin- 110 gers, n\*, have on their outer faces, some distance above their points, projections c, for the purpose of pressing the tufts under the filling, as shown in Fig. 14, and hereinafter more fully explained, and in that the back fingers, n, 115 have the end portions, e e, which are turned forward to lap the ends of the front fingers, n\*, hollowed out, as shown in Figs. 9\* and 10\*, so that there is no lap at the middle of the width, but only at the sides, where the 120 lap takes the form of two prongs. The form of the lapping end prevents the bending of the tuft-piece where the nippers take it, and tends to gather the yarn into the center of the width of the nipper-fingers. 125

The movement of the nippers upward and downward or to and fro between the spool-carrying chains and the warp is produced, substantially as described and shown in my hereinbefore-cited Letters Patent, by means of a 130 cam, I, which is shown in Figs. 5 and 21, and the outline of which is so dotted in Fig. 1 that



by a comparison with Fig. 5 its position can be traced. This cam acts upon a lever,  $I'$ , which works on a fixed fulcrum,  $i^3$ , and which is connected by a rod,  $i^4$ , with one of the arms  $N'$ , hereinbefore described, in which the nippers are suspended. The upward movement which, according to the present invention, I thus give to the nippers, is such as to bring their turned-up points close up to the yarn-guides  $b$  of the spool-carriages, as shown in Fig. 1<sup>c</sup>, instead of only bringing them to a height which will leave room for yarn-clamps to come between them and the said guides.

The turning-over or semi-rotary motion of the nippers is accomplished, as described in my hereinbefore-cited Letters Patent, by means of a sliding toothed rack-bar,  $j$ , gearing with a pinion,  $j'$ , which is fast on one of the crank-arm journals  $n^3$ ; but instead of the said rack-bar having applied to it a separate cam and connections, such cam and connections are now dispensed with by simply connecting its rear end, as shown in Fig. 1, with a fixed pivot,  $j^2$ , secured in the loom-framing some distance below and forward of the rock-shaft  $N^2$  or axis of motion of the arms  $N'$ . This connection causes the pinion and the portion of the rack in gear with it, as they rise and fall together with the arms  $N'$ , to move on radii of different lengths and different centers, and so causes such a movement of the rack lengthwise on the pinion as to produce the turning over of the nippers in opposite ways as they move upward and downward or to and fro between the tuft-yarn spools and the warp.

In order to provide for a limited amount of oscillating movement, which, according to my present invention, I give, as hereinafter described, to the nippers independently of the movement produced by the rack-bar  $j$ , and of their up and down movement, and also to provide for the withdrawal and reinsertion of the nippers into the warp to insert the tufts, the connection of the rack-bar with the fixed pin  $j^2$  is made by a short slot in the rack-bar, which permits it to have a small amount of direct longitudinal motion.

The oscillating movement just mentioned as given to the nippers independently of the movement obtained from the rack and pinion is for the purpose of better effecting the operation of inserting the tuft-pieces into the warp and the formation of the tufts, and is produced by means of a nearly upright lever,  $F$ , (see Figs. 1, 1<sup>a</sup>, 1<sup>b</sup>, and 2,) which is forked at its upper end to engage with a wrist-pin,  $f$ , on one of the crank-arms  $n^2$ . This lever works on a fulcrum,  $f'$ , at the rear end of a nearly horizontal lever,  $F'$ , which works on a fixed fulcrum,  $f^2$ , secured to the loom-framing, not far behind the breast-beam, and the front end of which is connected by a spring,  $F^2$ , with the loom-framing, as shown in Fig. 1, in such manner as to hold the rear end of the said lever in a certain position, except when it is depressed by the downward pressure of the

wrist-pin  $f$  of the nippers in the fork of the lever  $F$ . The spring  $F^2$  is not shown in Fig. 2, as the part of the loom-framing with which it is connected is there omitted to expose to view the parts behind it. The backward and forward movement of the forked lever  $F$  to produce the oscillation of the nippers is obtained from a cam,  $F^3$ , on the main shaft  $S$ . This cam is shown in Figs. 6 and 22, and its outline is so dotted in Fig. 1 that by a comparison of the latter with Figs. 6 and 22 its position can easily be traced. This cam operates directly on a lever,  $F^4$ , which works on a fixed fulcrum,  $f^3$ , and which is connected by a rod,  $F^5$ , with the lower end of the forked lever  $F$ . A spring,  $F^6$ , connecting the lower end of the lever  $F$  with the front of the loom-frame, keeps the lever  $F^4$  always in contact with and under the control of the cam  $F^3$ .

The peculiar movements of the nippers produced through the forked lever  $F$  will be better understood by incorporating their description into the description of the general operation of the loom, hereinafter given.

The longitudinal movement of the rod  $n^7$  and its conical wedges  $n^6$ , for producing the closing of the nippers and controlling their opening by the springs  $n^8$ , is produced by means of a cam,  $K$ , on the main shaft  $S$ , (see Figs. 2, 18, and 19,) the said cam operating on a lever,  $K'$ , which works on a fixed fulcrum,  $k$ , secured in a hanger,  $k'$ , bolted to the loom-framing. This lever is connected by a rod,  $k^2$ , with one arm of an elbow-lever,  $K^2$ , which works on a fixed fulcrum,  $k^3$ , secured to the loom-framing near the rock-shaft  $N^2$ , the other arm of said elbow-lever being connected by a rod,  $k^4$ , with one arm of an elbow-lever,  $K^3$ , (see Fig. 19,) which works on a fulcrum-pin,  $k^5$ , secured to one of the nipper-carrying arms  $N'$ , the other arm of the latter elbow-lever being connected by a fork with a grooved head,  $n^9$ , provided on the said rod  $n^7$ . A coiled spring,  $k^6$ , (shown in Fig. 19,) applied between the elbow-lever  $K^2$  and the loom-framing, operates to draw the cone-shaft  $n^7$  in a direction to withdraw its conical wedges  $n^6$  from between the nipper-jaws and permit the opening of the nippers by their springs  $n^8$ , the said spring  $k^6$  also operating to keep the bowl of the lever  $K'$  in contact with the cam  $K$ , which operates on said lever to force the conical wedges  $n^6$  between the nipper-jaws to close the nippers.

$E$  is what I call the "straight-edge," for holding the tufts in the warp from displacement by the crossing of the warp in shedding. This consists of a plate of steel having a thin straight horizontal upper edge situated below the warp and near the line of the fell. This straight-edge is secured to a stout bar,  $E'$ , and it has both an upward and downward and a backward and forward movement, and to permit these movements its bar  $E'$  is secured to two arms,  $E^*$ , which are pivoted by pins  $E^6$  to the arms  $E^2$  of a horizontal rock-shaft,  $E^3$ ,



which works in bearings provided in fixed brackets  $E^4$ , secured to the breast-beam of the loom.

The mechanism for producing the two movements of the straight-edge is best shown in Fig. 3, but is also shown in Fig. 2, and in part in Fig. 1.

$G$  is the cam on the shaft  $S$  for producing the upward and downward movement, acting upon a lever,  $G'$ , working on a fixed fulcrum,  $g$ , and connected by a rod,  $G^2$ , with an arm,  $E^5$ , provided on the rock-shaft  $E^3$ .

$J$  is a cam on the shaft  $S$  for producing the backward and forward movement of the straight-edge, acting upon one end of a lever,  $J^*$ , which works on a fixed fulcrum-pin,  $g'$ , secured in a bracket,  $J'$ , bolted to the exterior of the loom-framing, and the other end of which is connected by a rod,  $J^2$ , with one arm,  $J^3$ , of a rock-shaft,  $J^4$ , which is fitted to bearings in a bracket,  $J^5$ , bolted to the loom-framing, and another arm,  $J^7$ , of which is connected by a rod,  $J^6$ , with the straight-edge. The said rock-shaft  $J^4$  has coiled around it a spiral spring,  $J^8$ , which is so attached to it and to the bracket  $J^5$  as to tend to turn the said rock-shaft in a direction to keep the lever  $J^*$  to a bearing on the cam  $J$ , and to pull back the straight-edge.

The cutters  $H$   $H^*$  are like those described in my hereinabove-cited Letters Patent, except that the straight one is placed in the rear instead of in the front, the reason for this change being that it requires to be stiffer and to have a heavier stock, and when placed in rear it does not so much obstruct the view of the tuft-yarns as when placed in front. The cutter-stocks  $H'$   $H'^*$  work in slideways  $H^2$ , and both have their movements produced by a single cam,  $H^3$ , which may be a separate cam on the main shaft  $S$ , but is represented as composed of a wing-piece secured to the cam  $G$ , which produces the upward and downward movement of the straight-edge. This cam operates upon a lever,  $H^4$ , which works on the fixed fulcrum  $g$ , and is connected by a rod,  $h$ , with the arm  $h'$  of a rock-shaft,  $H^5$ , which works between center-screws or in bearings secured to the side frames of the loom, and which carries two similar cams,  $H^6$ , one near each side of the loom, (but only one shown,) which act upon sliding rods  $h^2$ , which are attached to the stock  $H'$  of the straight rear cutter,  $H$ , near its ends, and which work through fixed guides  $h^3$ , secured to the cross-piece  $A'$ , of the framing. The said cams  $H^6$  act through the rods  $h^2$  to produce the forward movement of the stock  $H$  and its cutter. The corresponding or backward movement of the front cutter-stock,  $H'^*$ , by which the cutting of the tufts is effected, is produced by the action of a pin or projection,  $h^4$ , on the side of each cam  $H^6$  on one of two arms,  $H^7$ , which are loose on the rock-shaft  $H^5$ , and which are connected with the front cutter-stock,  $H'^*$ , by two rods,  $h^5$ . The movement of the front cut-

ter thus produced does not begin until the back cutter has nearly completed its backward movement, and it is continued after the back cutter has completed its movement, and while the latter is stationary with its edge close to the tuft-yarns.

The shaft  $H^5$  and its cams  $H^6$  are turned back to permit the return movement of the rods  $h^2$  and cutter-stock  $H'$ , by means of a coiled spring,  $h^6$ , applied between the arm  $h'$  of the said rock-shaft and the cross-piece  $A'$  of the loom-framing. The turning back of this rock-shaft and cams also liberates the loose arms  $H^7$  of the rock-shaft from the projection  $h^4$  on the cams. The return movements of both cutters are then effected by spiral springs  $H^8$ , which connect the back cutter-stock,  $H'$ , with the loose arms  $H^7$ , provided on the rock-shaft  $H^5$ , and which pull the stock  $H'$  and the arms  $H^7$  toward each other, thus causing the stock  $H'$  to move backward and the rods  $h^5$  to push the front cutter-stock,  $H'^*$ , forward.

The provision for operating the cutters to trim the ends of the tuft-yarns, without at the same time operating the other parts of the loom, consists of a treadle,  $H^9$ , or jointed prolongation attached to the front end of the cam-lever  $H^4$ , and having its extremity or foot-piece  $h^9$  projecting slightly in front of the loom-framing, to be within reach of the foot or hand of the attendant. By means of this treadle or prolongation the rod  $h$  may be made to produce the operation of the cutters in the same way as they are produced by the cam  $H$ .

In order to prevent the prolongation  $H^9$ , when in the form of a treadle, as shown, from injuring the feet of the attendant while the loom is in operation, and to allow it to yield in case of anything getting under it on the floor, it is connected with the treadle by a pivoted joint,  $h^6$ , which is constructed, as shown in section in Fig. 7, with two faces,  $h^7$   $h^8$ , which will come to a bearing against each other when the treadle is depressed, and so prevent downward flexure of the joint, but will permit upward flexure of the joint and an upward yielding movement of the treadle.

The several parts having now been described, I will now describe the operation of drawing off the tuft-yarns, cutting therefrom the tuft-pieces, inserting the latter into the warp and forming them into the tufts, and securing the tufts in the web.

I will first suppose the chains which carry the tuft-yarn spools to have stopped in position to present a spool-carriage and spool directly over the nippers, and the yarns to be trimmed, so that their ends protrude uniformly through the several guides  $b$  on the carriage. The nippers, having been operated by the part 30 31 of the cam  $I$ , (see Fig. 21,) have risen with their points upward and their fingers open, and while the part 31 32 of the said cam operates they stop in the position



shown in Fig. 1<sup>o</sup>, to receive between them the ends of the tuft-yarns. They then, under the control of the part 40<sup>x</sup> 41 of the cam K, (see Fig. 23,) close to seize the yarns, and then, under the control of the part 32 33 of the cam I, descend just far enough to draw off from the spool a sufficient length of yarn to produce the tufts and stop under the influence of the part 33 34 of said cam while the tuft-pieces are cut off by the cutters. They then, under the control of the part 34 35 of the said cam I, further descend, holding and carrying the tuft-pieces. During their descent they are turned over by the action of the rack-bar *j* and pinion *j'*, as hereinbefore described, so that just before they arrive in their lowest position corresponding with the point 35 of the cam I their points are directed downward. Just before they reach the warp the wrist-pin *f* enters the fork of the lever F, which is then held in the proper position to receive the said pin by the part 51 52 of the cam F<sup>3</sup>. (See Fig. 22.) The said pin remains engaged with the fork of said lever F until the operation of inserting the tuft-pieces and forming and securing the tufts is completed, the lever F' and the spring F<sup>2</sup> in the meantime permitting the forked lever F to rise and fall to accommodate itself to the upward and downward movements of the nippers produced by the cam I, while the slotted connection of the rack-bar *j* at *j'* permits the oscillating movements given to the nippers during the operation of forming the tufts by the operation of the forked lever F produced by the cam F<sup>3</sup>. These movements will be better understood by reference to Figs. 11, 12, 13, 14, and will presently be described. The nippers enter the warp very near the fell, and after they have completed their downward movement and carried the tufts entirely through the warp and as far below it as necessary, they swing back to the position shown in Fig. 11, under the control of the part 52 53 of the cam F<sup>3</sup>. They are then, by the action of the part 35 36 of the cam I, raised high enough to withdraw half the length of the tuft-pieces through the warp, and as they are so raised they are at the same time thrown forward by the action of the part 53 54 of the cam F<sup>3</sup>, being thus brought to the position shown in Fig. 12, in which they bring the tuft-pieces close to the last shot of filling, *d*, which has been inserted. In this position they are held by the part 36 37 of the cam I and the part 54 55 of the cam F<sup>3</sup> while the shed is opened and a shot, *i*, of filling is put in, except that just as the lay beats up the offset 55 of the cam F<sup>3</sup> momentarily carries them a little farther forward, to take them out of the way of the reed as the latter beats up the shot *i*. After the beating up of the shot *i* the nippers go back to the position shown in Fig. 12, and as the lay retires the nippers, still closed, descend through the warp, under the control of the part 37 38 of the cam I, passing behind the beaten-up shot *i*, and in so doing return-

ing the ends of the tuft-pieces which they had withdrawn and turning the said ends over the said shot *i*. Just before their descent is completed the nippers are opened by the action of the fall 42 43 in the cam K. They are now in the position shown in Fig. 13; but in coming to this position they had to be swung back slightly to enable them to clear the shots *d* and *i*, and in order to permit this the portion of the cam F<sup>3</sup>, between the offset 55 and the offset 56, which will be presently described, is sufficiently recessed. The nippers remain open, as shown in Fig. 13, under the control of the portion 38 39 of the cam I, long enough to liberate the tufts, and are closed again by the rise 43 44 in the cam K, for the purpose of giving their fingers all the rigidity practicable. After closing they descend farther under the control of the part 39 40 of the cam I, to bring the projections *c* on their front fingers below the shot *i*, as shown in Fig. 14, and they are then momentarily swung forward by the abrupt offset 56 on the cam F<sup>3</sup>, for the purpose of causing the projections *c* to press the tufts under the said shot, as shown in the said Fig. 14, and leave a clear space between the tufts and the parts of the nippers below the said projection for the reception of the straight-edge E, which has been caused by the projection 61 62 on the cam G to rise into the said space and to be held up there, while it is held forward by the cam J, to keep the tufts pressed forward under the shot *i*, as shown in Fig. 14, during the final withdrawal of the nippers from the warp by the first portion of the rise 30 31 of the cam I.

It may be here stated that the straight-edge E is always held forward by the cam J, which is nearly a complete circle concentric with the shaft S, except just before it is raised by the rise of the projection 61 62 of the cam G, when it is allowed to come back a little way to enable it to get behind the tufts by the depression 71 72 of the cam J, but quickly moved forward again. The straight-edge holds the tufts forward during the crossing of the shed on the shot *i*, and continues to hold them while the next shot of filling is put in and while the lay is advancing to beat up the said shot and until just before the reed beats up, when it is caused to descend.

It might be stated that the final withdrawal of the nippers was preceded by the swinging back under the influence of the part 56 57 of the cam F<sup>3</sup>, to enable the projections to clear the shot *i*. The part 57 58 of the said cam swings the nippers forward again a little way after they pass the shot, and the part 58 59 holds the fork while the nippers are being disengaged from the fork F. The part 59 591 of the said cam controls the backward movement of the fork to a position where it is held by the part 591 592 out of the way while the nippers are rising to take, and also while they are coming down with, the tuft-yarn until the



part 592 51 brings it forward to a position to receive the pin *f* of the descending nippers.

Returning to the description of the action of the portion 43 44 of the cam K for opening and closing the nippers, I will proceed to further explain the action of the said cam. The nippers remain closed while the portion 44 45 of the said cam operates, and while the nippers are rising they are opened, under the control 10 of the part 45 46, and they remain open under the control of the portion 46 40<sup>x</sup> until closed by the action of the part 40<sup>x</sup> 41, to prepare for drawing off material for new tufts, as already described.

15 Of the three shots of filling employed for each course of tufts, one is put in while the nippers are going up to take the yarns from the spools, and is beaten up just as the nippers are about to take the yarn, and while the point 20 81 in the cam I is in operation. The next shot is put in while the nippers are descending, and is beaten up when the point 82 of the said cam is in operation, and in time for the lay to begin to recede before the nippers first 25 enter the warp. The third shot is put in, as has been before stated, while the nippers are just a little forward of the position shown in Fig. 12, and when the point 83 of the cam I and the highest point of the offset 55 of the cam 30 F<sup>3</sup> are in operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with the tuft-yarn spools and their carriages and carrying-chains 35 and cutters for cutting off the yarn from said spools in pieces to produce tufts, of nippers having a positive movement toward and from said chains for taking the tuft-yarn from the spools and drawing it off therefrom while said 40 chains are stationary, a rest to hold the said yarn while being cut off by the cutters in pieces to produce the tufts, a turning-over movement, and movements toward and from the plane or planes occupied by the warp for 45 inserting the said pieces into the warp to produce the tufts, and mechanism, substantially as herein described, for operating the said chains and cutters, and producing the said movements of the nippers, all as herein set 50 forth.

2. The combination, with nippers for inserting the tuft-pieces into the warp, of mechanism, substantially as herein described, for giving the said nippers a movement through 55 the warp and back for the insertion of the tuft-pieces and formation of the tufts, and mechanism, substantially as herein described, for giving them an oscillating movement while in the warp for the purpose of pressing the 60 tufts forward toward the fell of the web, substantially as herein set forth.

3. The combination, with the nipper-carrying arms, the nippers pivoted to said arms and furnished with toothed pinions, and mechanism, substantially as herein described, for 65 giving said arms a to-and-fro motion, of a rack-

bar gearing with said pinions and pivoted at a fixed point out of the axis of motion of the said arms, whereby the movement of the nippers on their pivots is obtained by the movement of the said arm, substantially as herein 70 described.

4. The combination, with nippers for inserting the tuft-pieces into the warp, and means, substantially as herein described, for 75 actuating said nippers, of a straight-edge, and mechanism, substantially as herein described, for operating the same for holding the tufts during the crossing of the shed, substantially as herein set forth. 80

5. The combination, with the straight-edge for holding the tuft-pieces during the crossing of the shed, and mechanism, substantially as herein described, for operating the same, of 85 tuft-inserting nippers having projections on their front fingers for pressing forward the tufts in the warp to a position to be held by said straight-edge, and mechanism, substantially as herein described, for giving the said 90 nippers a forward motion while in the warp, all substantially as herein set forth.

6. The combination, with the nippers, the carrying-arms in which they are pivoted, and mechanism, substantially as herein described, for producing the upward and downward 95 movement of said carrying-arms, of the crank-arm *n*<sup>2</sup> and crank-wrist *f*, the forked lever F, its supporting-lever F<sup>v</sup> and its spring F<sup>2</sup>, a cam for operating the said forked lever, and means for connecting the said cam with the 100 said forked lever, substantially as herein described.

7. The combination of the straight-edge E, the arms E\*, which carry it, the rock-shaft E<sup>3</sup>, provided with arms E<sup>2</sup>, to which said arms 105 E\* are pivoted, the shaft S, the cam G on said shaft S and its connections with said rock-shaft, and the cam J on said shaft S and its connections with said arms E\*, all substantially as herein described, and for the pur- 110 pose herein set forth.

8. The combination, with the cutter-stocks H' H<sup>\*</sup>, of the rock-shaft H<sup>5</sup>, furnished with cams H<sup>6</sup> and with loose arms H<sup>7</sup>, the said 115 cams having projections *h*<sup>4</sup> to actuate said loose arms, the rods *h*<sup>2</sup> and *h*<sup>5</sup>, between the said loose arms and cams and the cutter-stocks, the springs H<sup>8</sup>, connecting said arms H<sup>7</sup> with the cutter-stock H', a cam for operating the 120 said rock-shaft, and means, substantially as herein described, for connecting said cam with said rock-shaft, substantially as herein set forth.

9. The combination, with the tuft-cutter stocks and a shaft and mechanism, substan- 125 tially as herein described, through which said stocks are operated, of a treadle or lever whereby an attendant may work the cutters when the other parts of the loom are not in operation, substantially as and for the pur- 130 pose herein set forth.

10. The combination, with the cutters and



their stocks H' H'\* and the cam H<sup>3</sup> and lever H<sup>4</sup>, and connections, substantially as herein described, between said cutters and lever, of a prolongation or treadle attached to said lever to permit the operation of the cutters by an attendant when the loom is not in operation, as herein set forth.

11. The combination, with the cutter-stocks H' H'\* and the cam H<sup>3</sup> and lever H<sup>4</sup>, and connections, substantially as herein described,

between said lever and cutter-stocks for operating the same, of the treadle H<sup>9</sup>, connected with said lever by a joint, as h<sup>6</sup> h<sup>7</sup> h<sup>8</sup>, which permits upward flexure, but is incapable of downward flexure, substantially as and for the purpose herein described.

A. L. SKINNER.

Witnesses:

JAMES IRVINE,

A. C. MOTT.