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J. E. MATZELIGER.

LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.

Fig. 1.

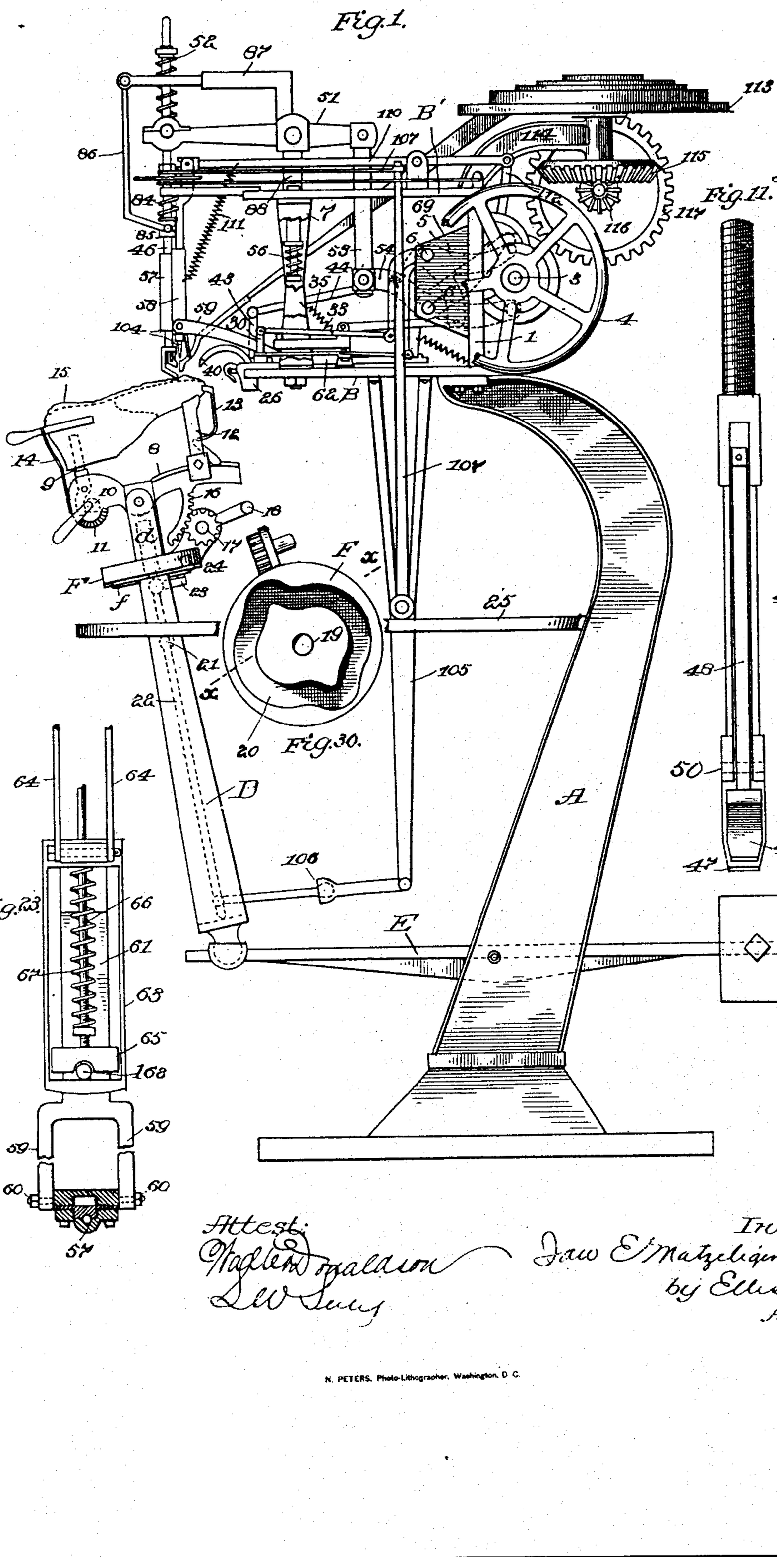

Fig. 30.

Fig. 11. and 12

Fig. 23.

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(No Model.) 7 Sheets—Sheet 2.

J. E. MATZELIGER.

LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.

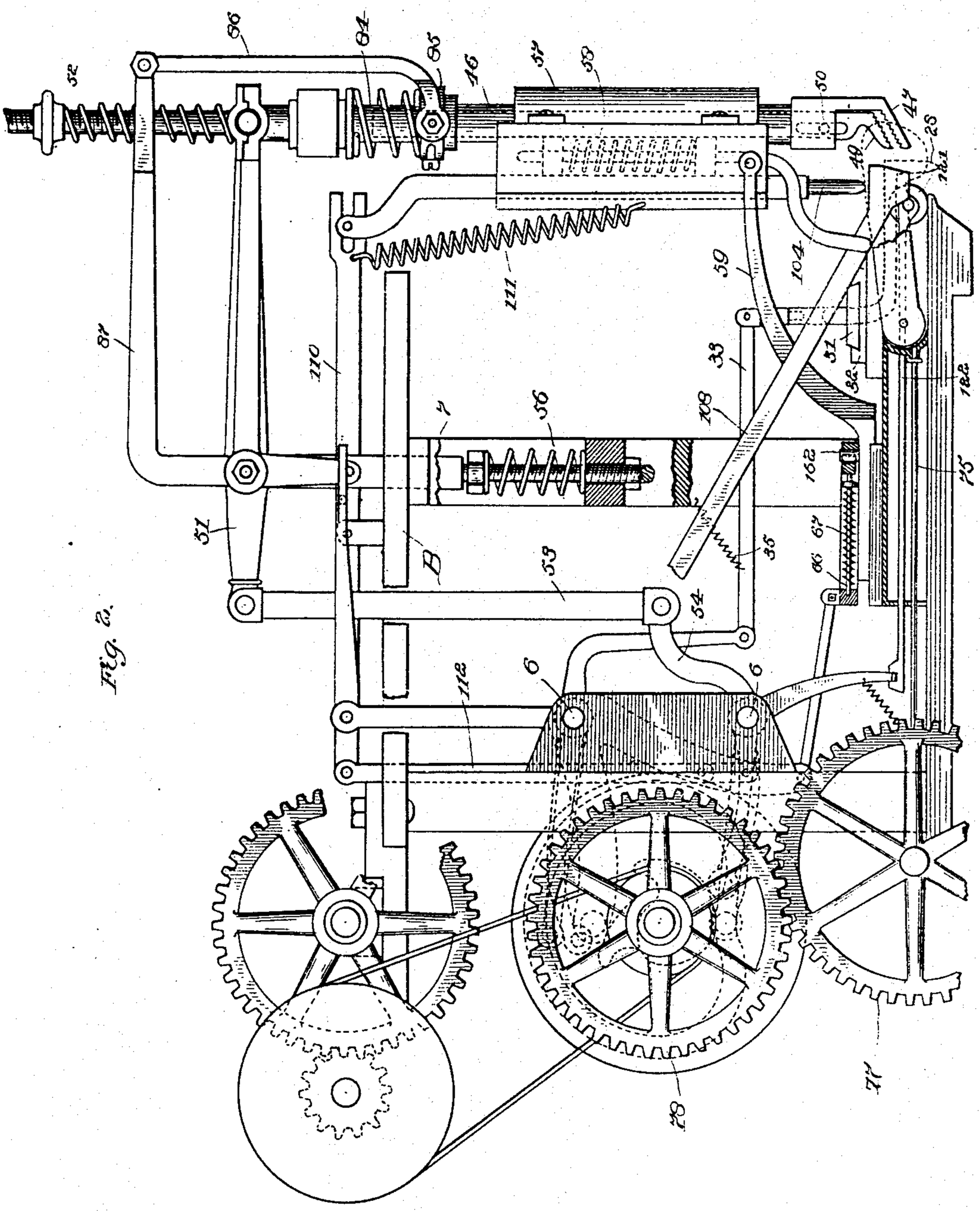

Fig. 2.

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J. E. MATZELIGER.

LASTING MACHINE.

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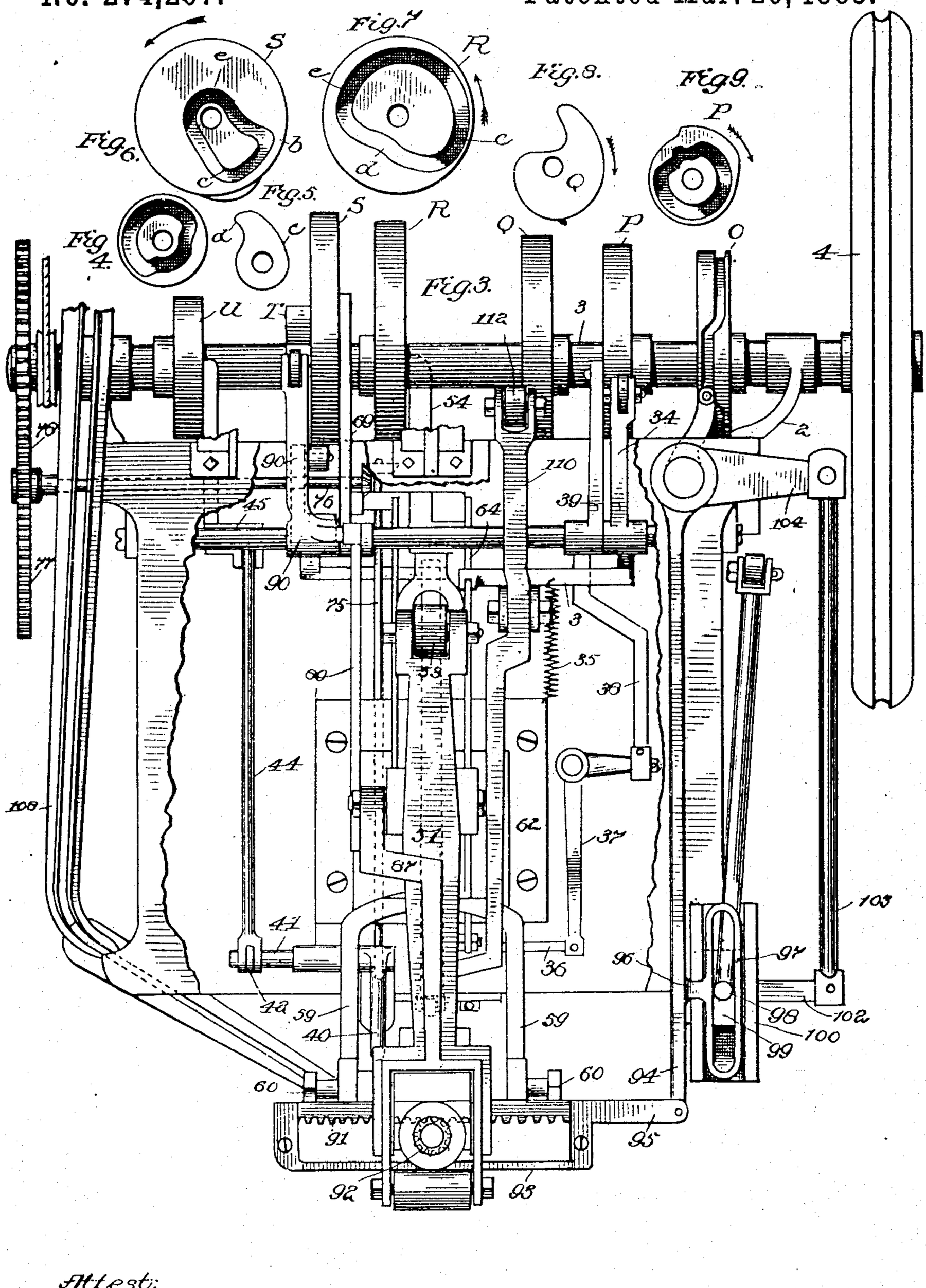

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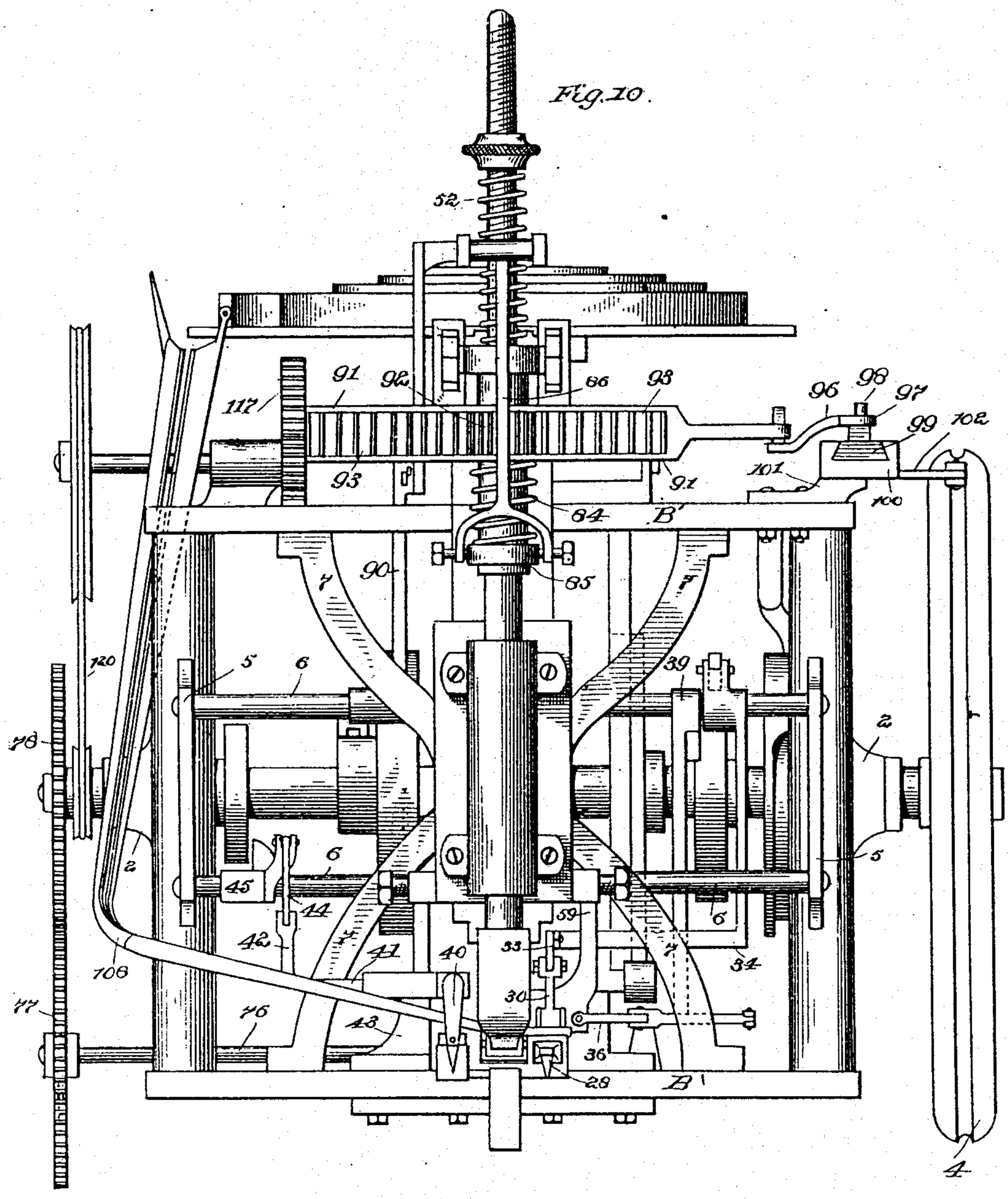
LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.

Fig. 10.



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J. E. MATZELIGER.

LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.

Fig. 15.

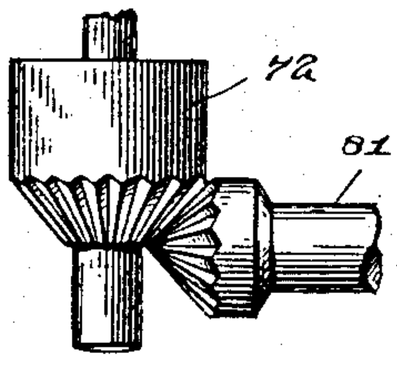
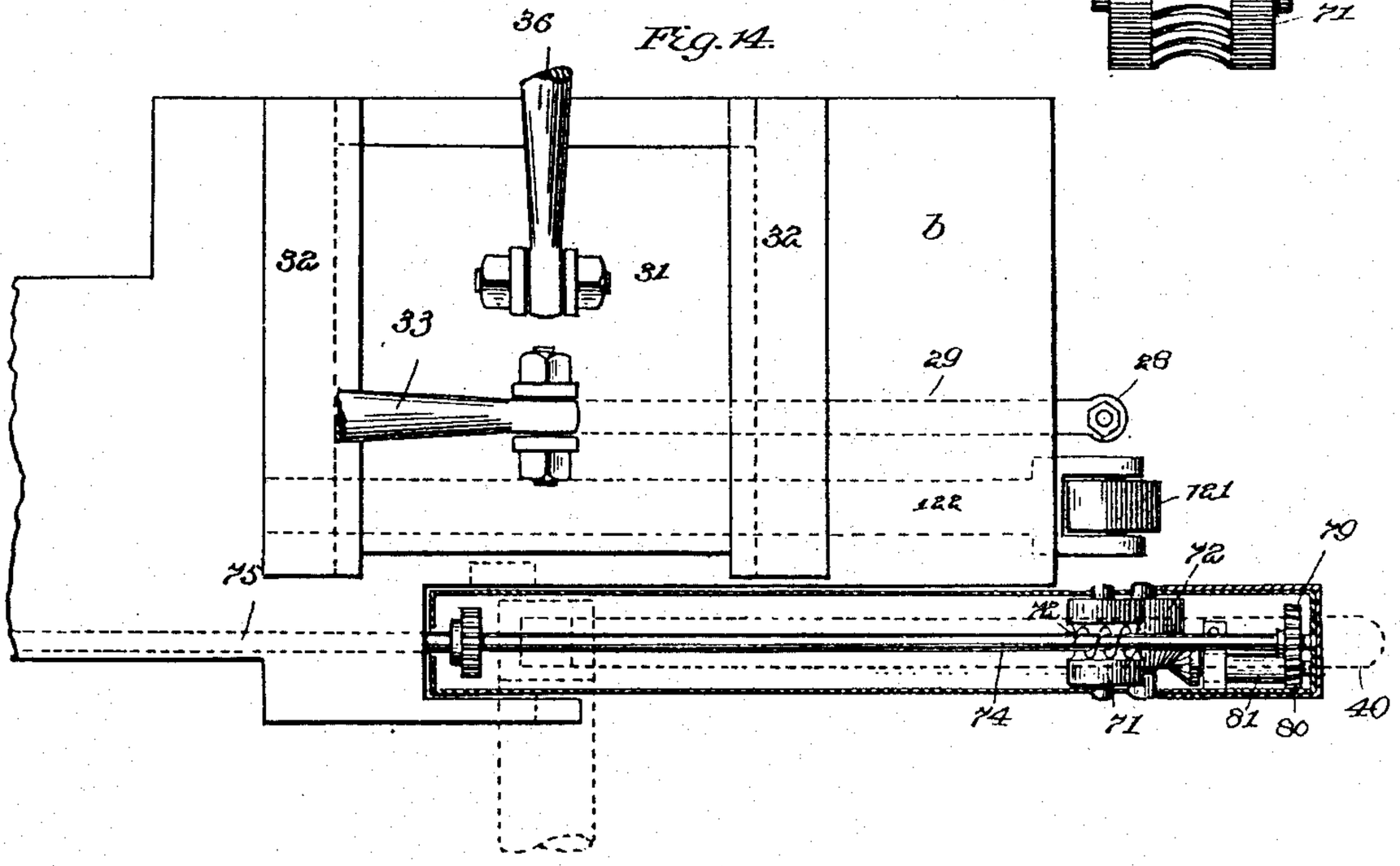


Fig. 13.

Fig. 16.

Fig. 14.



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(No Model.) 7 Sheets—Sheet 6.

J. E. MATZELIGER.

LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.

Fig. 17

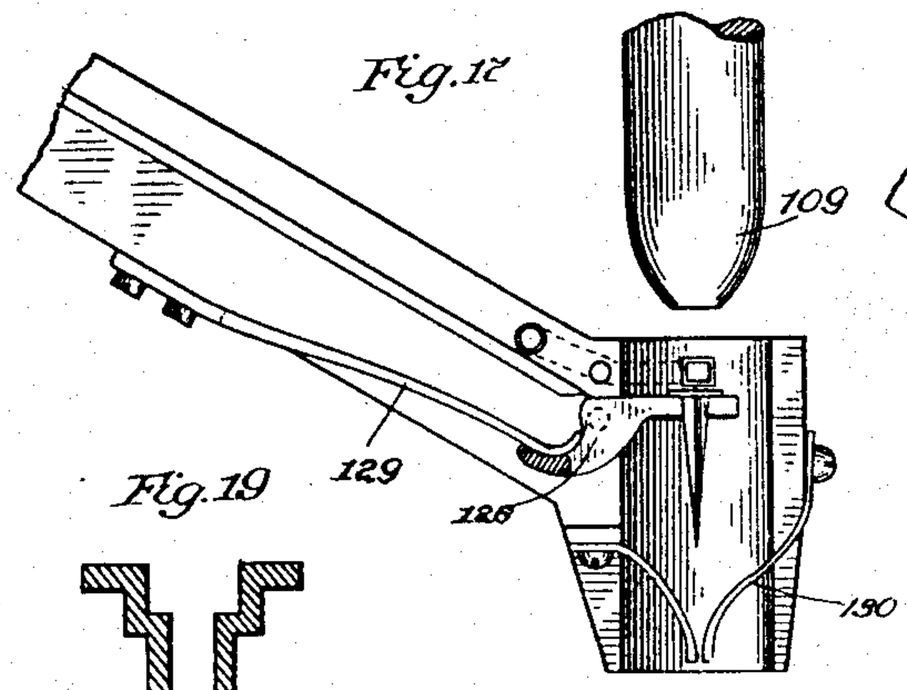


Fig. 18.

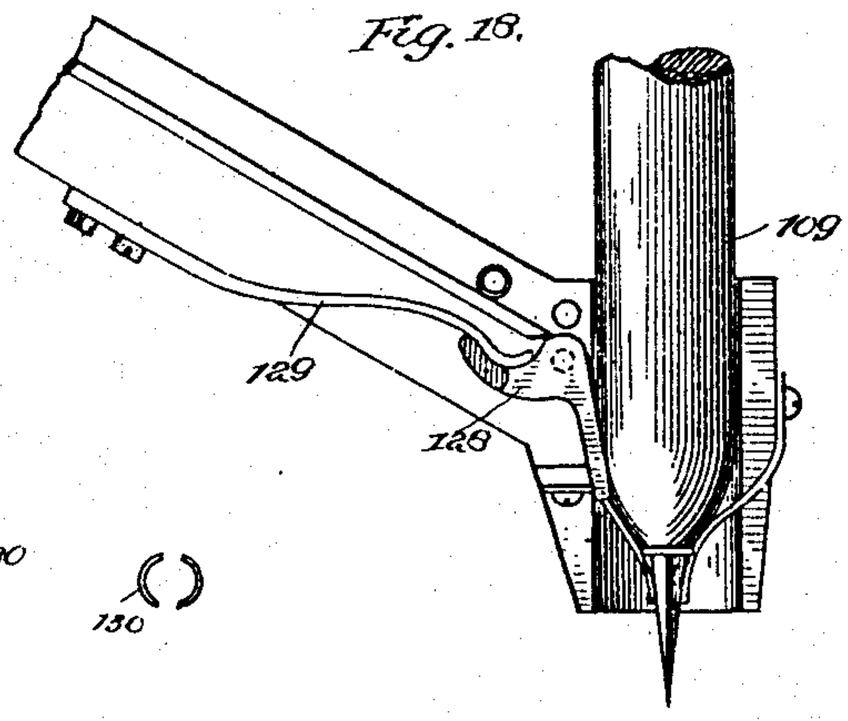


Fig. 19

Fig. 20.

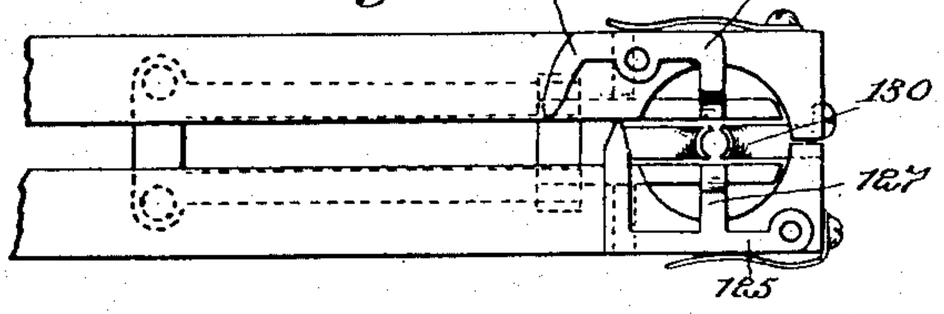


Fig. 22.

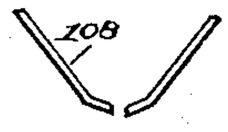
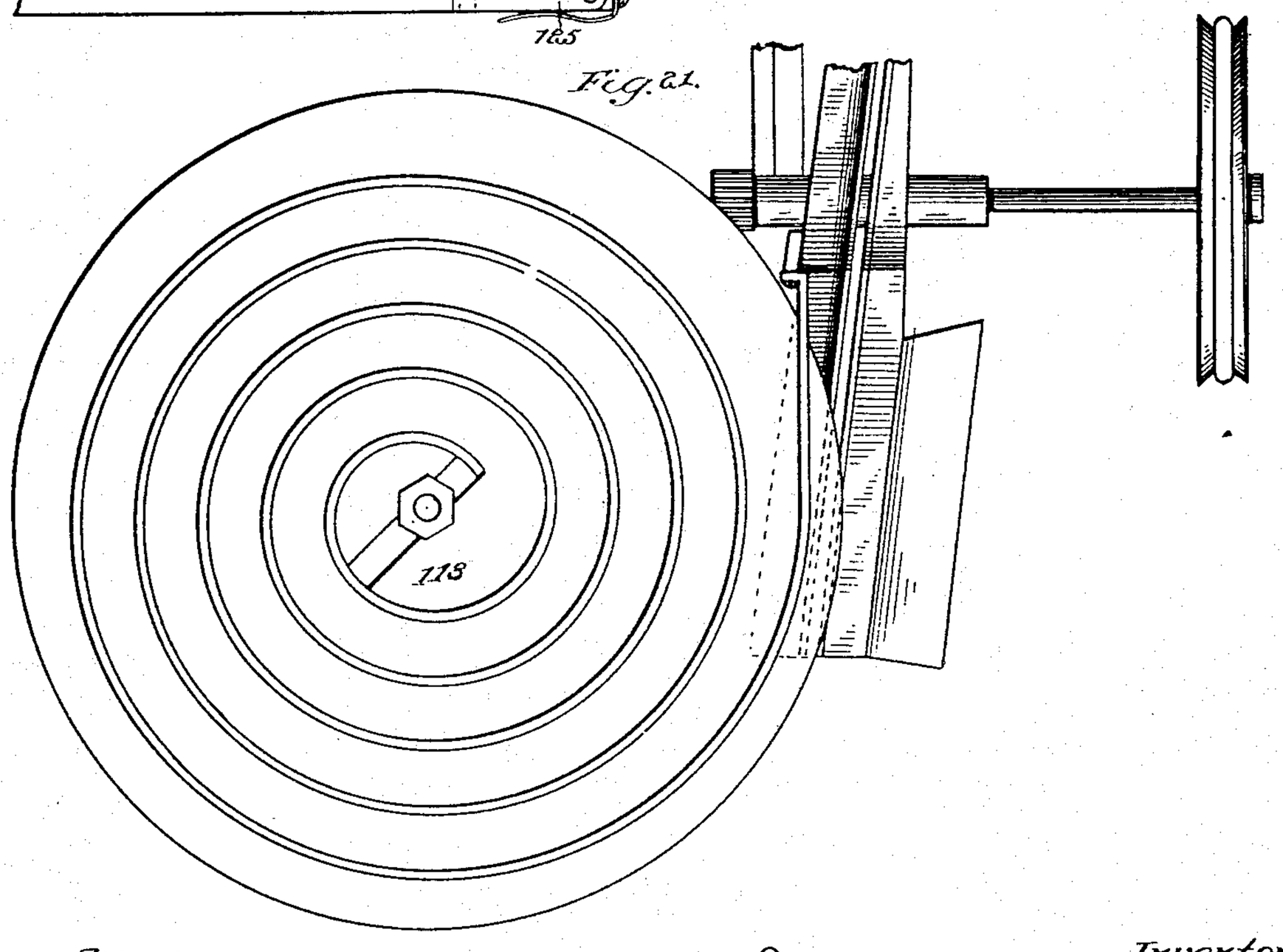


Fig. 21.



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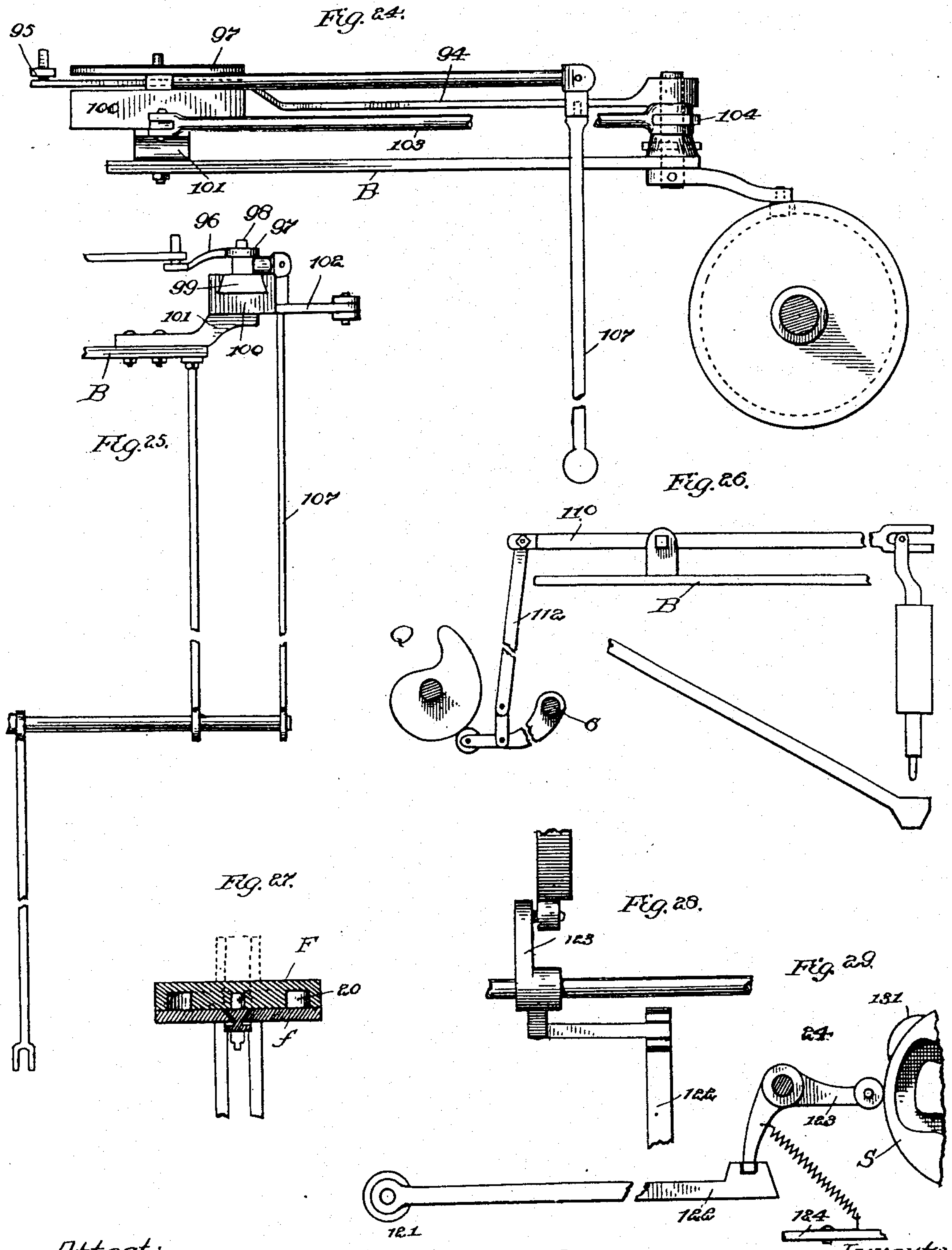
(No Model.) 7 Sheets—Sheet 7.

J. E. MATZELIGER.

LASTING MACHINE.

No. 274,207. Patented Mar. 20, 1883.



Attest:
Walter Donaldson
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Inventor
Jan E. Matzeliger
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UNITED STATES PATENT OFFICE.

JAN EARNST MATZELIGER, OF LYNN, MASSACHUSETTS, ASSIGNOR OF TWO-THIRDS TO MELVILLE S. NICHOLS AND CHARLES H. DELNOW, BOTH OF SAME PLACE.

LASTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 274,207, dated March 20, 1883.

Application filed January 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, JAN EARNST MATZELIGER, of Lynn, in the county of Essex, Commonwealth of Massachusetts, have invented certain new and useful Improvements in Lasting-Machines; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to the lasting of boots and shoes.

The object of it is to perform by machinery and in a more expeditious and economical manner the operations which have heretofore been performed by hand.

Heretofore devices have been contrived for performing a part of the operation, such as holding the last in proper position and drawing the leather over the last, while the nailing was done by hand. In my machine I perform all the operations by the machine, and automatically, requiring only the service of a boy or girl or other unskilled labor to attend the machine.

My invention includes the mechanism for holding the last in place and allowing it to be turned and the last fed forward in proper position for the operation of the machine. It includes a feeding device for moving the last step by step at a proper distance, whereby the mechanism for drawing over the leather may operate successively and at proper intervals. It includes pinchers or gripping mechanism for drawing the upper over the last, mechanism for turning the gripping mechanism in order to plait the leather at the heel or toe, mechanism for holding the last in proper position for the operation of the feeding mechanism, mechanism for feeding the nails and holding them in proper position to be driven, and mechanism for driving the nails at the proper instant. The details of construction are all fully set forth hereinafter, and, together with the principles of my invention, are stated in the claims.

In the accompanying drawings, Figure 1 is a side elevation of the right of the machine. Fig. 2 is a side elevation of the upper part of the machine, portions of the parts being broken away. Fig. 3 is a plan view of the machine, with the upper plate broken away to show the works within. Figs. 4, 5, 6, 7, 8, and 9 are details connected with Fig. 3. Fig. 10 is a front elevation of the upper part of the machine, with the jack removed. Figs. 11 and 12 represent respectively front and side views of the pinchers detached and enlarged. Figs. 13, 14, 15, and 16 represent different views of the feeding and rolling devices and a part of their operating mechanism. Figs. 17, 18, 19, and 20 represent details connected with the tacking mechanism. Figs. 21 and 22 represent the distributer and form of channel or chute. Fig. 23 is a detail of a tension device. Figs. 24, 25, 26, 28, and 29 represent details of the mechanism for connecting and operating the various parts. Figs. 27 and 30 represent detail views of the jack-cam.

All the working mechanism is mounted upon a column, A, which is securely fixed upon the floor. It is bent forward, and upon its upper end supports a plate, B, having fixed in the rear part posts 1 1, to which is fixed an upper plate, B′. On the rear of these posts are brackets 2 2, in which are the bearings of the main driving-shaft 3. On the end of this driving-shaft is a main drive-wheel, 4. Upon the shaft 3 are set the cam-wheels and cams, which give proper motion to the mechanism, all as hereinafter described. On the front side of the posts are projections 5 5, in which are supported rods 6 6, on which the various bell-crank levers turn. The upper plate is further supported upon the lower by means of a pedestal-bracket, 7 7.

The devices which hold the leather of the upper and guide it as the last moves, the devices which hold the last steadily in place and roll down the leather and feed the last forward step by step, are located upon the lower plate. The devices for drawing the leather, for nailing, and for feeding the nails are supported mainly upon or from the upper plate.

The jack for holding the last is mounted upon an arm, D, pivoted upon a weighted lever, E, which is pivoted in the column near the base. The weight is upon the rear end, and is adapted to counterbalance the weight of the jack and last and hold the latter up to

the work. The base of the jack consists of a pivoted piece, 8, on the top of the arm D. It is provided at one end with a pivoted pin, 9, which extends down through a slot in the enlarged end of the piece 8, and is adapted to be pressed back by a cam, 10, (shown in detail in Figs. 27 and 30,) the handle of which is held in place by means of a spring, which takes into a segmental rack, 11. By this means the pin is thrown inwardly at its upper end, and, when the last is in place upon the pin, presses the toe down upon the small post 12, which is adjustably fixed on the other end of the piece 8. The post 12 slides upon flanges upon the piece 8, and is held in any suitable position, according to the size of the last, by means of a set-screw. A spring, 13, fixed to the standard or post 12, presses against the toe of the last to hold the upper in place. Upon the other end is a spring, 14, which carries at its upper end a small clamp, 15, adapted to embrace the heel and so hold the upper and the heel stiffening to the last. A segmental rack, 16, is fixed to the under side of the long end of the piece 8, and, projecting downward, engages with a small pinion, 17, which has a handle, 18, by means of which it is turned to raise or lower the end of the piece 8, and thus adjust vertically the position of the last. The upper end, *d*, of the arm, to which the piece is directly pivoted, is held upon the top of a cam-disk, F. This cam-disk rests and turns upon a disk, *f*, fixed to the upper end of the arm D, the disk F being held thereon by means of a central pin projecting upward from the disk *f* into a hole, 19, in the disk F. On the under side of F is a cam-groove, 20.

Within the standard or arm D, which is slotted, is pivoted, at 21, a lever, 22, on the upper end of which is an arm, 23, having a pin, 24, projecting up through the plate or disk *f* into the cam-groove 20; and this cam-groove is of such shape as to give, when the last is turned, to the mechanism which pulls the upper a proper rotary motion to form the plaiting at the heel and toe, all as hereinafter fully described. This rotary motion, it will be understood, is due to the rotation of the jack with the upper plate, F, carrying the cam-groove over the pin 24, and thereby moving the upper end of the lever in and out. A bracket, 25, fixed to the column, has on its forward end a loop, which encircles the arm D and holds it within proper limits.

It may be here premised that when the last has been jacked it is brought by the attendant up into proper position for commencing the work. For this purpose it is made to bear against a guide, 26, fixed to the under side, and at the forward end to a supplemental plate, *b*. (Shown in the detached and enlarged views, Figs. 13 and 14.) The edge of the last, with its upper, bears against this guide-piece as it moves around throughout the entire revolution of the jack.

In order to obtain a regular step-by-step movement of the last for the successive operation of the pincher and nailing mechanism, hereinafter described, I provide a feeding-spur, 28, Figs. 13 and 14. This spur is formed by the downwardly-bent end of a pivoted lever, 29. This lever has an upwardly-turned end, 30, Fig. 1, and is pivoted in a sliding block, 31, which moves laterally in guides 32 in the upper face of the plate *b*. The upper end, 30, of the lever 29 is pivoted to a rod, 33, which connects it with the lower end of a bell-crank lever, 34, pivoted on the rod 6. The rear end of the bell-crank lever 34 runs back and bears on the face of the second cam, (marked P.) The periphery of the cam P is shaped as shown in the face view thereof in Fig. 9, so that the high part of the cam is considerably less than half the circumference and holds the rear end of the bell-crank lever up, thus drawing back the upper end of the arm 29 and lifting the spur sufficiently long to allow it to be moved to take a new hold. A spring, 35, tends constantly to draw the lower end of the bell-crank lever forward and hold the spur downward to the last.

I now proceed to describe the means for giving a lateral movement to the sliding block 31 for laterally moving the spur, in order to move or feed the last a single step. This sliding movement of the block is required to be a positive movement. To effect this the block is connected by a rod, 36, to the forward arm of a bell-crank lever, 37, pivoted on a plate, B. The other end is connected by a small rod, 38, to a bell-crank lever, 39, the rear arm of which is connected to a cam-groove by a suitable pin in the face of the cam-wheel P. This groove is shown in the face view of the said wheel. The cam P moves in the direction of the arrow, and when the pin of the bell-crank lever rises at the first sharp turn in the cam-groove the rear part of the bell-crank lever is sharply depressed, and through the described connections the slide-block 31 is moved to the right to feed the last along from left to right until the pin reaches the middle projection in the low part of the groove. Then the rear end of the bell-crank lever is raised, and it continues to rise and carries back the block to its first position until it reaches the next sharp turn in the cam-groove, from which point the pin moves through the segment of a circle, and the lever therefore and the slide-block remain stationary. It will be understood that the up-and-down movement of the spur performed by the bell-crank lever 34 is timed so as to carry the spur down onto the last and lift it from the last at the proper times—that is to say, after the spur is carried from right to left to take a new hold it immediately descends to take hold of the last, and the slide 31 is then moved to the right, and as soon as it reaches the right limit the spur is lifted.

In order to hold the last steadily in place against any lateral movement while the feeding-spur is going back to take a new hold, I provide a holding-spur, 40, the position of which is shown more clearly in Figs. 13 and 14. This is carried on a small rock-shaft, 41,

which has an arm, 42, the rock-shaft being supported in a small bracket, 43, on the forward edge of the plate B. The arm 42 is connected by a rod, 44, to a bell-crank lever, 45, on the rod 6. The rear end of this bell-crank lever is provided with a pin, which works in the groove in the face of the cam-wheel U. This groove resembles the groove in the cam-wheel P, but is reversed, so as to cause the holding-spur 40 to descend and take hold of the last to turn it in place while the slide-block is moving back.

I now proceed to describe the gripping devices by means of which the edge of the upper is seized, drawn over the edge of the last, and held down upon the bottom while the tacks are inserted, and which also at the heel and the toe perform the proper plaiting. It will be understood that a compound motion is required of this gripping mechanism: First, the jaws of the gripper or pinchers must open and close to take hold of the edge of the upper, then the pinchers must rise and move over the edge of the last to stretch the leather, and then come down upon the bottom of the last, all the while holding firmly the leather in order to bring it down tightly stretched into its proper place, and there it must hold it until the tack is inserted, when the operation of the pinchers must be repeated. The pinchers are provided with two jaws—one fixed and the other movable in relation to the fixed. The shank or rod of the pinchers is shown in position in Figs. 1 and 2 at 46, and in an enlarged view in Figs. 11 and 12. The shank 46 carries the outer or fixed jaw, 47. The shank 46 is grooved longitudinally, as shown in full lines in Fig. 11 and in dotted lines in Fig. 12, and in this groove lies the shank 48 of the movable jaw 49. The shank 48 is slotted, and a pin, 50, passes through side plates on the shank 46 to hold the shank 48 to the shank 46 and permit the necessary vertical movement. The main shank of the pinchers is round and threaded upon its upper end, as shown in Figs. 11 and 12. It is supported upon the lever 51, Figs. 1 and 2, which lever is pivoted on a standard in the upper plate, B′. The front end of this lever is forked, and within the fork is located a ring mounted upon trunnions. Through this ring passes the threaded end of the shank aforesaid. The upper end is surrounded by a coiled spring, 52, the lower end of which bears upon the ring and the upper end against a thumb-screw, by means of which its tension is regulated. Thus the whole pincher-shank and pinchers are supported upon the ring through the spring 52, and this gives a yielding or spring tension to the pinchers when they have seized the edge of the leather and are drawn up by the action of the lever 51. The rear end of the lever 51 is connected by means of a rod, 53, to a curved lever, 54, which is pivoted upon the lower rod, 6. Its rear end extends back by the side of the cam-wheel R, and a pin in said lever enters the groove in the face of said wheel. The groove in this wheel has a long high and a short low part. Its face is to the right, as shown in Figs. 3 and 7. In order to understand the vertical movement imparted to the pinchers by this cam-groove, it may be here stated that during this vertical movement, by means of mechanism hereinafter described, the pinchers receive also a front-to-rear movement, in order to draw the leather over the last after they have gripped it. It will be observed that the shaft is not exactly in the center of the solid part of the cam-wheel. We will suppose the pinchers to have gripped the leather. This occurs when the highest part of the cam (marked *c*, Fig. 7) bears upon the pin of the curved lever, and consequently the pinchers are at their lowest point of depression. At that time they are moved by the other mechanism, hereinafter described, farthest to the rear. Then from the point *c* to the point *d* the pin is made to rise quickly, and thereby the pinchers rise by the same motion, drawing up the leather vertically in order to stretch it upward. From the point *d* to the point *e*, as the wheel advances, the pin and rear end of the lever are depressed, and with them the pinchers come down upon the last, having by other mechanism been moved from the last; but they do not at first come down as low as they were carried by the point *c*, since the point *e* is a less distance from the center or shaft; but from the point *e* around again to the point *c*, as the wheel moves, the pin of the curved lever is held down, and consequently the pinchers are held down; but it will be observed from the shape of the groove that the pinchers will be gradually lowered more and more as the pin approaches the point *c*. During the first part of its movement the pinchers have hold of the leather and the nailing has been performed, and during the latter part of the movement from *e* to *c* the jaws of the pinchers have opened and the pinchers have been moved to the rear while being thus lowered in order to bring them again to the leather to take a new grip. Then at the point *c* the pinchers again seize the leather and rise, as before. The spring-tension upon the leather in the lifting part of the movement of the pinchers is caused by the spring 52. As the lever rises this spring becomes compressed and the tension increases. In order to guard against any excessive strain and consequent tearing of the leather, I provide a second tension, which may come into play when the spring 52 has reached a certain point of compression. This consists in making the post on which the lever 51 is pivoted rise upon a spring, 56, which is supported in the upper part of the adjustable bracket heretofore referred to. The post passes through the upper plate and through the pedestal, and is provided with a collar threaded upon the post for adjustment, the spring resting upon the pedestal-bracket. This spring is set at the proper tension, say, at a certain number of pounds, depending upon the position of the fulcrum of the lever 51 and the limit of tension required. When the strain upon the spring

52 reaches that limit the spring 56 will yield, and thus limit the movement or strain on the pinchers.

I have in the description of the parts last given referred to the lateral or front-to-rear movement of the pinchers which takes place during the vertical movement, and thus forms a resultant, causing the pinchers to draw up the leather and carry it over and lay it down upon the last. I now proceed to describe the mechanism by which this lateral or front-to-rear movement is accomplished.

The shank of the pinchers below its pivot in the arm 51 passes through a guide, 57, on the front of a block, 58. This block is carried upon prongs 59, which embrace the block on each side and support it by means of small trunnions 60, the trunnions being fixed to the lower end of the block. The prongs 59 are carried upon the front end of a sliding bar, 61, which moves in guides in a block, 62, fixed to the upper surface of the lower plate, B. This bar is connected to a bell-crank lever which gives positive movement to the bar through an intermediate tension-spring. (Shown on an enlarged scale in the detached figure, 23, and the interposed tension-spring is also shown in Figs. 1 and 2.) In the forward part of the bar 61 is set a pin, 162. A yoke, 63, includes said pin and passes back to the rear, being connected to the bell crank-lever by rods 64. In rear of the pin 162 is a small block, 65, on a spindle, 66. This spindle passes back through the rear cross-piece of the yoke 63, and between said rear cross-piece and the collar on said spindle has a coiled spring, 67, encircling the spindle and tending constantly to press the block 65 forward, so that when a forward pressure is applied by means of the bell-crank lever to the rod 64 it applies a yielding pressure through the rear cross-piece of 63, through the spring 67 upon the pin 162, and thereby carries forward the prongs 59 with a yielding pressure, and with them the guide 57 and the pinchers. This, it will be understood, is the force applied to the pinchers to draw the upper to the front over the last. The collar on the spindle 66, in front of the spring, is a threaded nut, and by turning it the tension of the spring 67 may be adjusted, in order to put a proper amount of strain upon the leather. The rods 64 run back and connect with a transverse arm of a bell-crank lever, 69, the pin of which works in a groove in the face of the cam S. The shape of this groove is shown in the face view of the said cam in Fig. 6. The rear arm of the bell-crank lever 69 is over the shaft, and is on the right-hand side of the cam-wheel, as shown in the drawings. When the rear end of the lever 69 is up, the pinchers, through the described intermediate connections, are drawn back to take a fresh hold upon the leather, and as the rear arm of 69 comes down the pinchers are carried forward. That part of the cam-groove in wheel S, between *b* and *c*, holds the pin in one position, during which time the pinchers are in their rear position and the mechanisms operate to cause them to raise the edge of the leather from the point *c* to *d* on cam S, the pin of lever 69 is depressed, and the pinchers, having by that time seized the leather, are carried forward to draw the leather over the last. From *b* to *e* the pin passes around the curve remaining in position, during which time the pin has no vertical movement and the pinchers remain in their advanced position over the last, holding it in place while the tacking mechanism is operating; and from *e* to *c* the pinchers are drawn back to take a new hold upon the leather.

In order that the pinchers may be enabled accurately and certainly to seize the edge of the upper, I provide a guide in which the edge of the upper passes, and which holds it accurately in position in line with the movement of the pinchers. This guide mechanism is shown in position in Figs. 2 and 10 and on an enlarged scale and detached in Figs. 13 and 14 and detail Figs. 15 and 16. This guide mechanism is carried upon the left-hand side and at the forward end of the supplemental plate *b*. It consists of a fixed and movable jaw, *m* and *n*, the jaw *n* being pivoted upon the fixed jaw *m*. The forward end of the fixed jaw is continued, and passes into a slot in the movable jaw, with a pivoting-pin passing through both. A spring, 70, holds the movable jaw properly closed against the fixed, and the edge of the leather passes between the two, and is carried along by the transverse feeding mechanism heretofore described, the edge being held between the jaws always in the same position. The jaws are inclosed in a case, as represented in Fig. 13 in section, a space being left by the case between the two jaws for the passage of the leather.

In order to press the wrinkles out of the leather and keep the edge in a proper vertical position, I provide the jaws with small rollers 71 72. The roller 71 is driven by a worm, 73, on a shaft, 74. This shaft is journaled within the fixed jaw, as shown in Fig. 13. It receives its motion through pinions from shaft 75, which shaft extends to the rear, and is connected by means of beveled gears to a transverse shaft, 76, which is driven by pinions 77 78, the latter being on the end of the main driving-shaft. The front end of the shaft 74 carries a beveled gear, 79, which meshes into a beveled gear, 80, on the counter-shaft 81 in the movable jaw. This counter-shaft has its bearings in a small block in the front end of the jaw and in a small post, 82, the rear end of which is formed with a beveled gear, as shown in the detached view, Fig. 13, which meshes into a beveled gear in the side of the roller 72. The roller 72 is held in the case, and its smooth periphery bears against the periphery of the roller 71, pressing lightly thereon sufficiently to take the wrinkles out of the leather. It will be understood that the rollers turn inwardly in the direction of the arrow to draw the leather up into the jaws. By reference to Fig. 10 it will be observed

that these guiding-jaws are located on the left-hand side of the pinchers, and as the movement of the last is from left to right the leather is drawn up and properly guided before it reaches the pinchers.

I have described the general movements of the pinchers and the general construction of the jaws and shanks. I now proceed to describe the mechanism for opening and closing the jaws of the pinchers for gripping and releasing the edge of the upper.

It will be borne in mind from the description heretofore given of the general movement of the pinchers that they pass backward from the last, gradually descending. This brings the pinchers back against the edge of the upper, and it is necessary at that point that the movable jaw should be raised, so that the gripping-face of the fixed jaw should bear against the leather. It will be observed that the jaws are opened back to the rear, as shown in Figs. 1 and 2, so that when the movable jaw is raised it opens the space between the two jaws. In practice it is necessary that the upper jaw should be raised about three-fourths of an inch, and this occurs just before the lower jaw comes back against the upper. The position of these jaws is shown clearly in Figs. 1 and 2. As the edge of the upper is held by the guides heretofore described inclined forward, it is in position to enter the opening between the jaws as they are moved back, so that the jaws cannot under any circumstances fail to grip the edge. The movable jaw is raised by means of a cam on the main shaft, through intermediate links and levers, and is forced down by a spring, 84. The upper end of the shank 48 is connected to a collar, 85, which surrounds the shank 46 and slides freely thereon. A forked rod, 86, is pivoted to a bell-crank lever, 87, at its upper end, its lower or forked end embracing the collar 85, to which it is also pivoted. The bell-crank lever 87 is pivoted upon a standard, 88, in the upper plate, it being the same standard to which the lever is pivoted which raises and lowers the pincher mechanism. The lever 87 is preferably forked at its upper end to pass the upper end of the main shank. The vertical arm of the bell-crank lever 87 is connected by pusher 89 to the bell-crank lever 90, which bears on the cam T, a side view of which is shown in separate figure, (5.) The shape and position of this cam are such as to throw up the rear end of the bell-crank lever and advance the pusher to lift the movable jaw immediately after the nailing mechanism is operated. It begins to open at the rise of the cam at the point *c* of cam T. The first movement is sufficient to cause the jaws to release the leather, and, as before stated, this occurs immediately after the tacking. The increased rise of the cam from *c* to *d* continues to lift the jaw until at the point *d* it is at its greatest height. The lifting of this jaw takes place during the backward movement of the pinchers, and immediately after the fixed jaw reaches the edge of the leather the rear end of the bell-crank lever 90 drops from the point *d* of the cam T, and the movable jaw is forced down to grip the upper. It is forced down by means of the spring 84, heretofore described. It remains constantly in contact with the leather until lifted by the movement of the cam and intermediate mechanism.

Only the movements heretofore described of the pincher mechanism are necessary on the sides of the last. In order to form the plaiting at the heel and toe, another movement is required. For this purpose it is necessary that the shank of the pinchers shall have rotary motion. I impart this motion by means of a rack, 91, which meshes into a pinion, 92, on the shank of the fixed jaw, above the upper end of the shank of the movable jaw. The rack is carried upon the shank of the jaws, being held thereto by two bars, 93, which are set off from the rack and pass just in front of the shank, one above and the other below the pinion, whereby the rack is held in place, and is carried vertically by the shank in its movement. The rack is connected to an arm, 94, by means of a pin in said arm, which passes up through a hole in the arm 95 of the rack, the pin passing freely through said hole, and being long enough to permit the required movement of the rack with the shank of the pinchers. It will be understood that the lateral movement of the rack will give rotary movement to the pinchers and turn them either to the right or to the left; and, further, that this movement is to be applied only when the pinchers are operating at the heel or toe.

In order to put the rack-moving mechanism into and out of operation at the proper point, and make the apparatus in this respect also automatic, I have provided mechanism as follows, (shown in Fig. 24:) An arm, 96, is fixed to the arm 94, and extends laterally therefrom. It is provided with a slotted head, 97, and in the slot in this head projects a pin, 98, fixed in a block, 99, which slides in a dovetailed groove in a pivoted block, 100. This block is pivoted upon an arm, 101, on the plate B′. The outer side of the block 100 is provided with an arm, 102, which is connected by means of a bar, 103, to the bell-crank lever 104. This bell-crank lever 104 has a pin, which works in a cam-groove in the periphery of the wheel on the main shaft. It will be apparent that when the lever is rocked it will impart longitudinal movement to the connecting-bar 103 and turn the block 100 either to the front or rear. The block acts upon the slotted head 97 of the arm 96 through the pin 98. It will be plain that its action, both in direction and in amount upon the arm 94, will depend upon the position of the pin 98. If the pin 98 be in the center of the slot in the opposite end of the arm 96, it will have no effect upon the arm 94; but the block 100 will simply turn. If, however, the pin 98 be down into the front end of the slot and the connecting-bar 103 be pushed to the front, the pin 98 will act upon the head 97 as upon a lever, and will push the rack in one di-

rection, and thereby turn the pinchers to the right, as viewed in Fig. 1; but if the pin 98 be in the other end a like movement of the connecting-rod 103 will draw the rack in the opposite direction, and will turn the pinchers to the left. The object of this twofold motion of the pinchers is to plait upon one side of the heel or toe by folding in one direction and upon the other side in the opposite direction. It is necessary for the automatic operation of the machine that the position of the pin 98 should be determined by the movement of the jack as it brings the heel or toe to the work. The plate F, its cam, and the lever 22 have been heretofore described, and are shown in Fig. 1.

It remains only to point out the connection between the lever 22 and the pin 98.

Referring now to Fig. 1, a lever, 105, is pivoted upon a bracket on the machine. This lever is connected at its lower end by a connecting-bar, 106, having a ball-joint connected to the lower end of the lever 22. The upper end is connected to a rod, 107, to the block which carries the pin 98. The cam-groove in the plate F is arranged to give the proper motion and position to the pin 98, and to cause it to stand at one end when plaiting upon one side of the heel or toe, and to shift to the other end of the slotted head when plaiting upon the other side, so that the plaits on both sides are folded inward. The cam-groove is alike on both sides, and is adapted to move the pin 98 as the jack is turned to bring the toe or heel to the work, and when the center of the toe or heel is at the pinchers, then the pin is on the dead-center, and no movement is imparted to the rack; but as the plate F turns the cam moves the lever and passes the pin to the opposite end of the slotted head, thus moving the rack-bar and allowing the mechanism to operate for giving the reciprocating movement to the said bar as often as required, until the toe or heel is opposite and a comparatively straight surface of the last again approached, when the pin is again brought by the shape of the cam-groove to the center and the motion of the rack-bar ceases.

I now proceed to describe the tacking mechanism.

The tacks are brought to the driving-point by means of a polished-steel channel, 108, leading from the tack-distributing mechanism, hereinafter explained, to a point just in rear of the pinchers. The forward end is supported upon a rod which passes through guide-brackets and rests upon a spring, whereby the forward end of the guide-tube is drawn up out of the way of the pinchers when not forced down by the driver. The extreme end of the channel turns down into a vertical position, and above the vertical part of the bore is a hole in line with the bore and the driver. When a tack drops, therefore, through the channel, it passes down into the vertical part of the tube, which brings the head of it directly under the raised end of the driver. The driver (marked 109) slides in a guideway in the rear part of the block which carries the pinchers. Its upper end is connected to a lever, 110, Fig. 26, the forked forward end of this lever holding the pin in the upper end of the driver. The driver is provided with an offset, and is drawn down by a strong spring, 111, which gives the blow upon the tack. The lever 110 is supported in a post on the plate B′. The rear end of the lever 110 is connected by a connecting-rod, 112, to a lever pivoted upon the lower rod, 6, which has a transverse pin under a cam, Q, Figs. 8 and 26. This cam is constructed, as shown, so as to slowly depress a spindle, release the end of the lever 110, and when it is released the spring connected to the driver brings the driver instantly down, delivering a stroke upon the head of the tack. The mechanism is so timed that this occurs immediately after the pinchers have drawn the leather over the last. The head of the driver is made sufficiently large, so that if it meets the leather it will not injure it. The lower part of the channel consists simply of two grooved steel bars placed sufficiently near each other to leave space for the shank of the tack, which moves between them with the point downward, the head running upon the upper edges of the rows. The tack passes down the incline until it reaches the vertical tube, entering the tube through a slot, into which the channel opens, thus delivering the tack to the tube in vertical position with the pin downward. The upper part of the channel is in the form of a trough, with a slot in the bottom continuous with the slot in the way below, the channel serving to catch the tacks as they fall from the distributer. The distributer is a circular plate, 113, mounted upon a vertical shaft in a bracket, 114. The lower end of its shaft is provided with a crown-wheel, 115, which meshes into a pinion, 116, upon a shaft carried in a bracket in the upper plate. The other end of this shaft has an open pinion, 117, driven by pinions and band 120 from the pinion on the end of the main shaft. This gives a slow rotary movement from left to right. On top of the plate, and supported upon the central spindle which runs down through the hollow shaft which supports the plate into a supporting-bracket below, is a volute composed of flat bars set on edge. The tacks are put into the interstices of the volute and rest upon the receiving-plate, and as the plate turns it carries them gradually outward until it brings them around to the point by the side of the extreme outer end of the volute, by which they are guided accurately one by one into the upper end of the slotted guideway. At the lower end they are delivered to the vertical tube in position to receive the blow from the hammer by special mechanism shown in Figs. 17, 18, 19, and 20. In order to prevent the tacks from crowding one upon the other at the delivering end, I provide a cut-off mechanism consisting of pivoted stops 124 125, Fig. 20. These stops extend across the channel and are pressed constantly inward

by means of springs. The stop 124 is provided at the inner end with a transverse pin, 126, which projects into the path of the driver. A like pin, 127, is also set upon the stop 125, and projects also into the path of the driver. Stop 124 is pivoted in the middle, and is the first to arrest the flow of tacks. Stop 125 is secured at its end at a distance from the first stop sufficient to give room for a single tack. The inner ends of the pins 126 and 127 are beveled, as shown in perspective views, so that as the driver descends it closes stop 124 and opens stop 125, thus stopping the flow of the tacks, and permitting a single tack to be fed down. The tack thus fed in would be prevented from entering the opening in the vertical tube by the driver itself; but when the driver rises out of the tube the tack slides down and is received upon a slotted tripper, 128. The arms of this tripper extend into the tube and support the tacks within the tube and in line with the driver, as shown in Fig. 17. The tripper is held up by a spring, 129, the tension of which is sufficient to sustain the tack, but which yields readily to the descent of the driver. Spring-guides 130 guide the tack in its descent directly to the leather. After the tack is driven the machine rolls down the leather in order to smooth it. This is accomplished by means of a roller, 121, (shown clearly in Fig. 29,) on the front end of a sliding bar, 122, in the plate *b*. This bar runs directly back to the rear, where it is connected with a lateral arm of the bell-crank lever 123. The vertical arm of the bell-crank lever is drawn back by a spring, 124, which tends to keep the roller in a retracted position. The bell-crank lever 123 has an arm which carries a transverse pin, extending under the face of the cam-wheel S, on which is a high part, 131, arranged to strike the pin and operate the lever to push forward the roller immediately after the tack is driven.

The cams and cam-wheels heretofore described are all upon the main shaft G, which is provided with any suitable kind of drive-wheel.

Having thus described my invention, what I claim is—

1. In combination with the jack, the disk F, having cam-groove and supporting the jack, the arm D, plate *f*, and lever 22, said parts operating together in connection with devices for putting the pincher-rotating devices into and out of working position, substantially as described.

2. The feeding-spur adapted to take hold of the last, in combination with mechanism, substantially as described, for moving said spur vertically and laterally to feed the last, substantially as described.

3. The feeding-spur 28, on lever 29, in combination with sliding block 31, rod 33, bell-crank lever 34, spring 35, and cam P, and with rod 36, bell-crank lever 37, and described connections of said lever with the grooved cam, all substantially as described.

4. The combination of the holding-spur 40 and its described operating mechanism with the feeding-spur and the mechanisms for giving it vertical and horizontal movement, whereby the last is held while the feeding-spur moves back, all substantially as set forth.

5. In a shoe-lasting machine, the combination, with a movable rack, a feeding-spur and a holding-spur for automatically moving the last step by step and for holding it in position, of the pinchers and three separate trains of mechanism, substantially as described, for raising and lowering said pinchers, for moving them laterally, and for opening the jaws, whereby the upper is stretched upward and carried over upon the last, all substantially as described.

6. The combination of the pivoted shank carrying the lower jaw, mechanism for moving it vertically, a shank carrying the upper jaw and sliding in the first shank, a spring for holding the upper jaw down to grip the leather and mechanism to raise it to release the leather, a guide-block, and devices for swinging the pinchers laterally, all substantially as described.

7. The combination of pinchers provided with mechanisms for causing them to grip the leather and draw it over the last, and mechanism for turning the pinchers at the toe and heel of the shoe, and a rotary jack and suitable connecting mechanism whereby the upper is drawn over and plaited, substantially as described.

8. The combination of pinchers provided with mechanisms for gripping the leather and drawing it over the last, mechanism for turning said pinchers, and connecting devices between said turning mechanism and the jack, whereby the turning of the jack to bring the toe or heel to the gripper causes the turning mechanism to operate, all substantially as described.

9. The combination of pinchers provided with mechanisms for gripping the leather and drawing it over the last, mechanism for turning said pinchers to right or left, connecting devices between said turning mechanism and the jack, said connecting mechanism being operated by a cam provided with a groove connected to the jack, whereby when the toe or heel is passing the gripper the gripper is made to turn first in one direction and then in the other, all substantially as described.

10. The combination of the pinchers adapted to operate on the upper substantially as described, a pinion on the shank of the pivoted jaw, a rack-bar connected to a lever and slotted head or loop 97, a pin, 98, in said loop, connected by bars and levers to a grooved disk connected to the jack, whereby the pin is held in central position in the head when the pinchers are operating on the sides of the last, and is passed toward one end and then the other when the pinchers are passing around the toe or heel, a pivoted block, 100, provided with an arm, 102, and mechanism for turning the said block, all as set forth.

11. The shank 46 of the lower jaw, in com-

bination with the shank carrying the movable jaw, and with the lever 51 and suspending-spring 52, substantially as described.

12. The shank 46, carrying lower jaw, shank 48 and movable jaw, both suspended on pivot, and spring on lever 51, in combination with post 88 and lever 87 and the connecting and driving mechanisms, substantially as described.

13. The post 88, supporting-lever 51, and the pinchers, in combination with the spring 56 and the operating mechanism, substantially as described.

14. In combination with the guide-block 58, the prongs 59, bar 61, yoke 63, interposed spring 67, and devices for imparting positive movement to the guide-block, substantially as described.

15. The pinchers mounted on the main frame of the machine, and having jaws constructed and operated as described, in combination with the guiding-jaws, also on the main frame, and with the jack arranged to turn in relation to the guiding-jaws and pinchers, substantially as described.

16. The guiding-jaws having rollers in said jaws, in combination with mechanism, substantially as described, connecting said rollers to the driving-power, and with the pinchers, whereby the edge of the upper is guided in proper position in relation to said pinchers and moved with the jack, substantially as described.

17. The combination of the fixed and movable jaws M N and spring 70, the rollers 71 and 72, the shafts, and the intermediate gearing, all substantially as described.

18. The combination of the shank 48 and upper jaw, sliding on shank 46, with lower jaw, collar 85, spring 84, rod 86, bell crank lever 87, and connections with the driving mechanism, substantially as described.

19. The pinchers adapted to grip and draw the upper over the last and to turn for plaiting the upper, and mechanisms for imparting the necessary motions to said pinchers, in combination with tacking devices located by the side of the said pinchers, all substantially as described.

20. In combination with the channel and the tack-driver, the stops 124 125, placed one above the other, and provided with projections whereby they are operated by the descent of the driver, substantially as described.

21. In combination with the channel, stops, and driver, the slotted spring-tripper 128, substantially as described.

22. The combination of the tripper, the tube, driver, and spring-guides 130, substantially as described.

23. The combination of feeding and holding spurs, the pinchers and guiding mechanism, and the rollers 121, substantially as described.

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Witnesses:

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