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C. T. WOOD.

LASTING AND SOLE LAYING MACHINE.

No. 391,001. Patented Oct. 9, 1888.

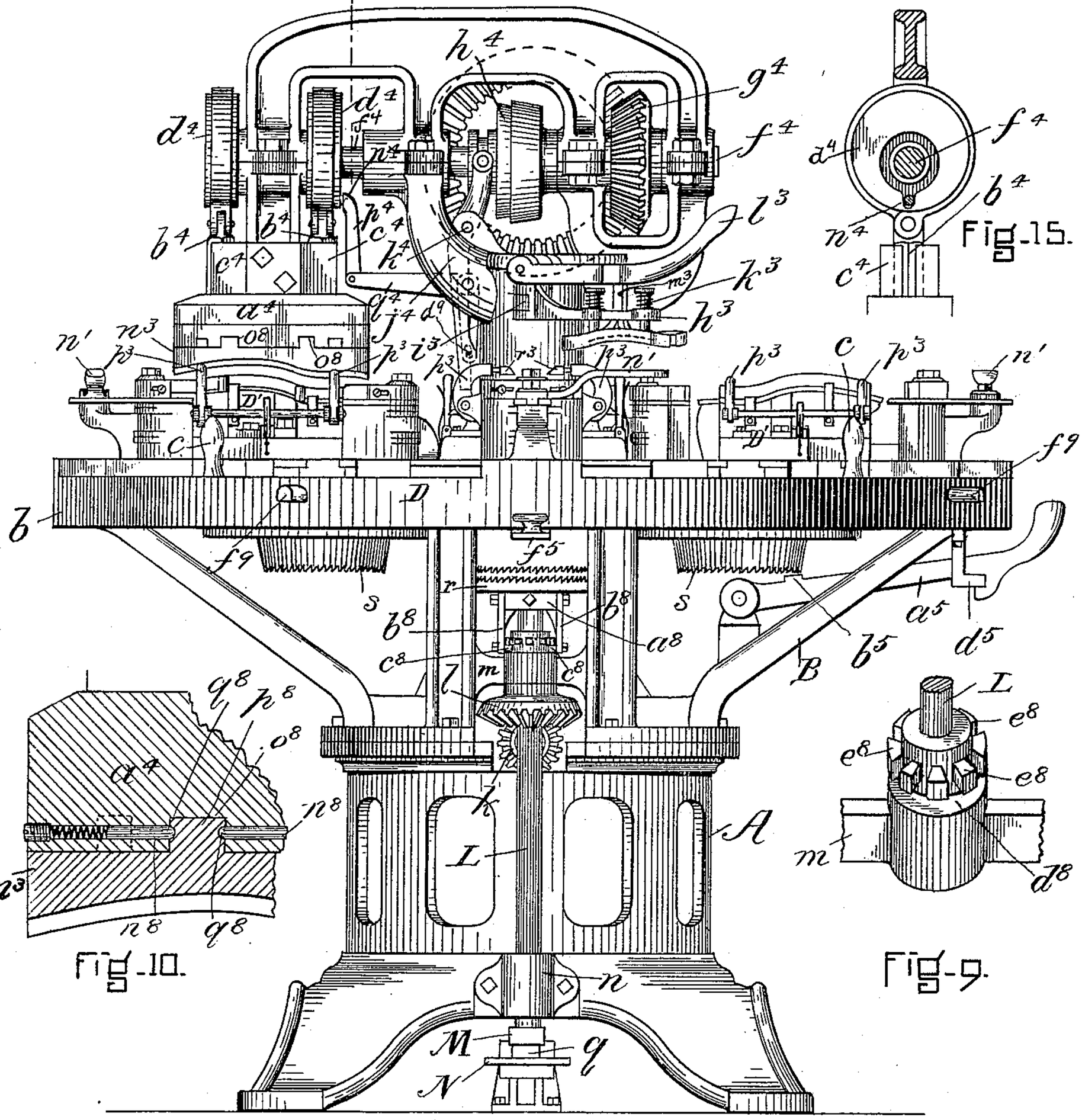

Fig. 1.

Fig. 15.

Fig. 10.

Fig. 9.

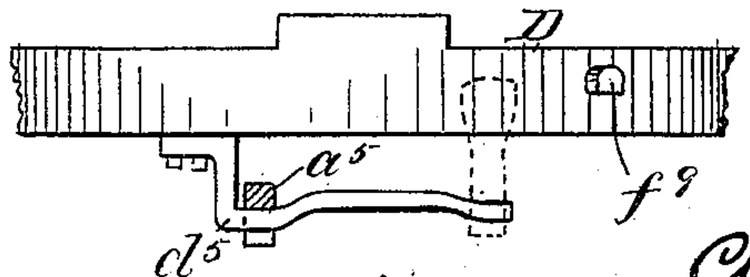

Fig. 11

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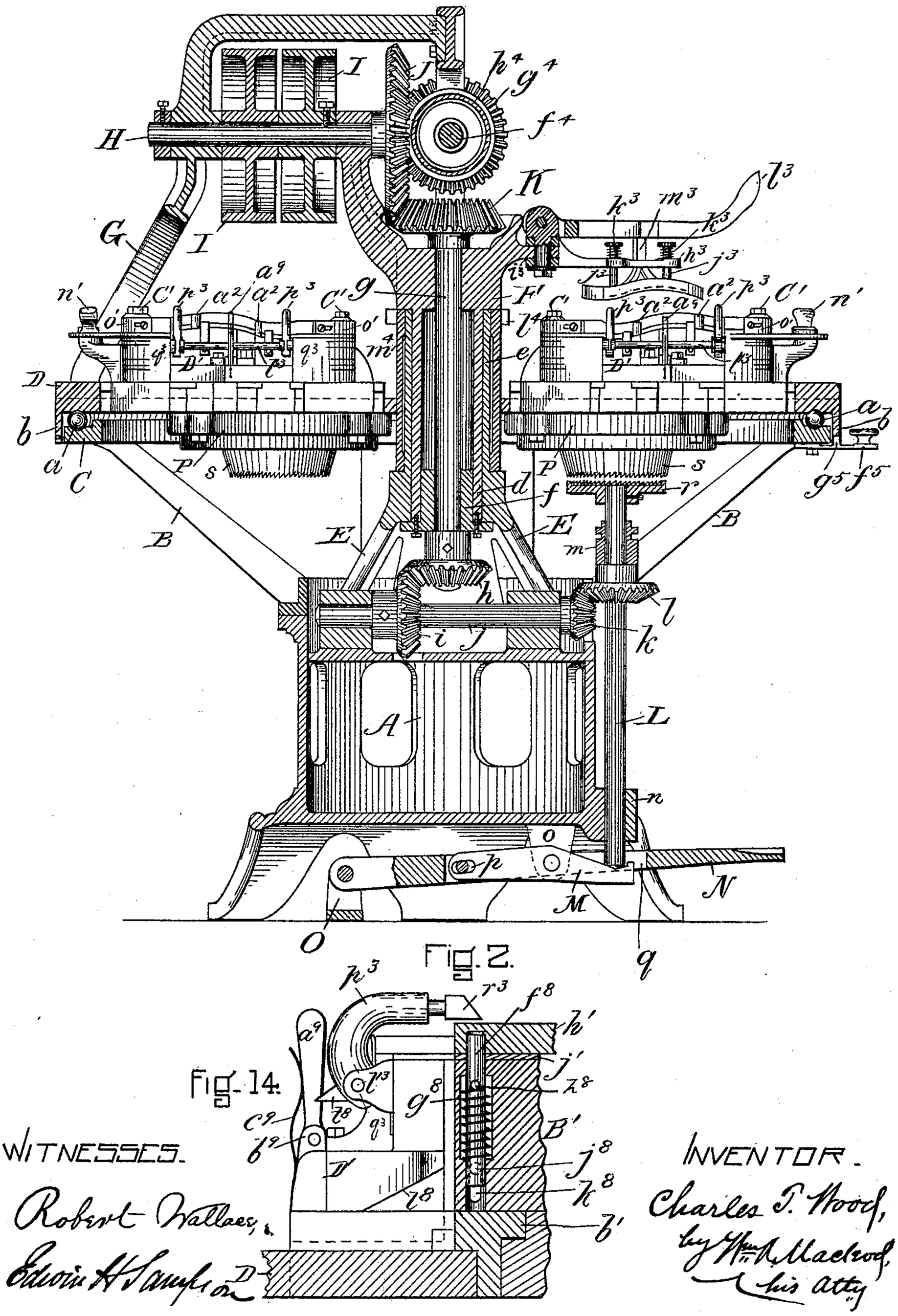

Fig. 2.

Fig. 14.

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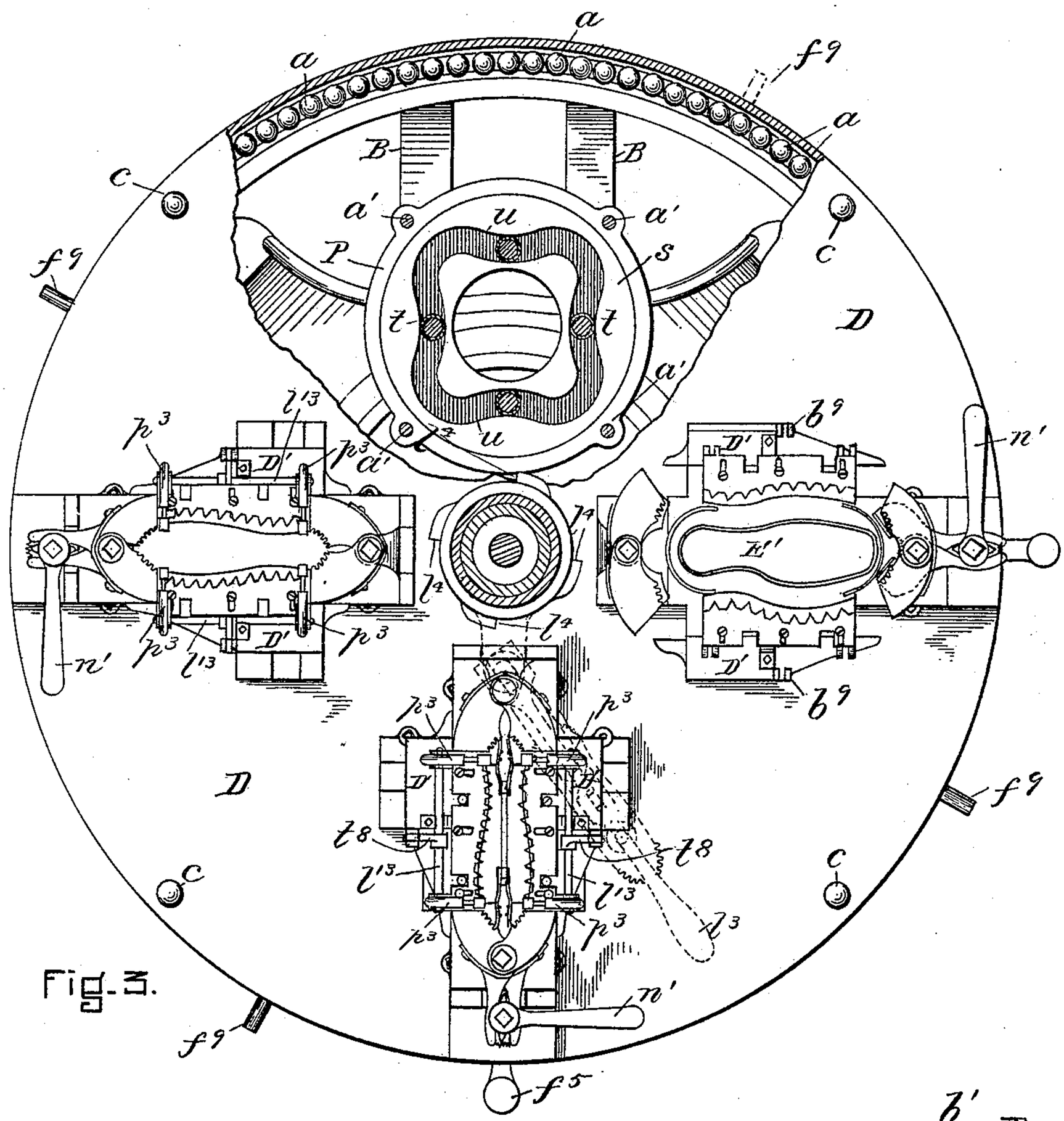

Fig. 3.

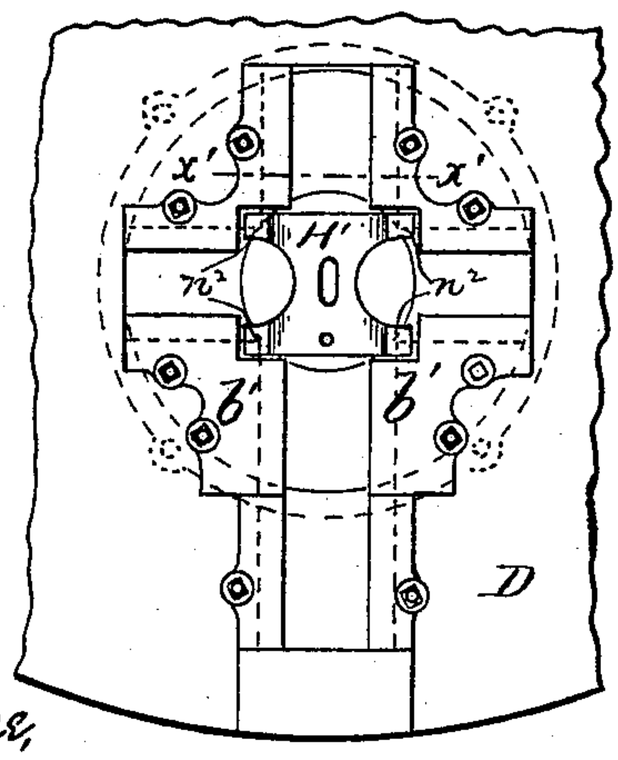

Fig. 12.

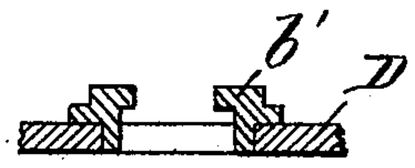

Fig. 13.

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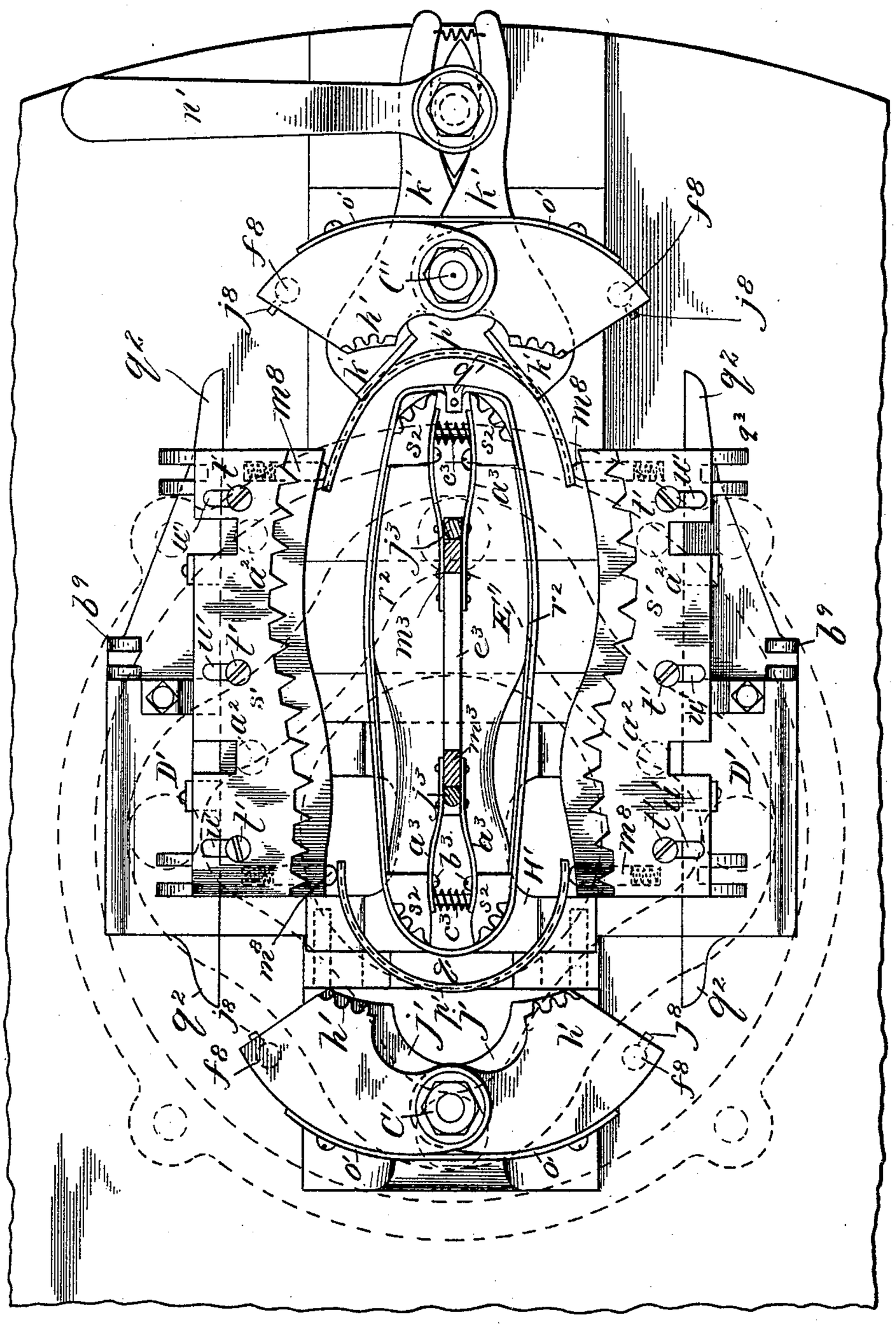

FIG. 4.

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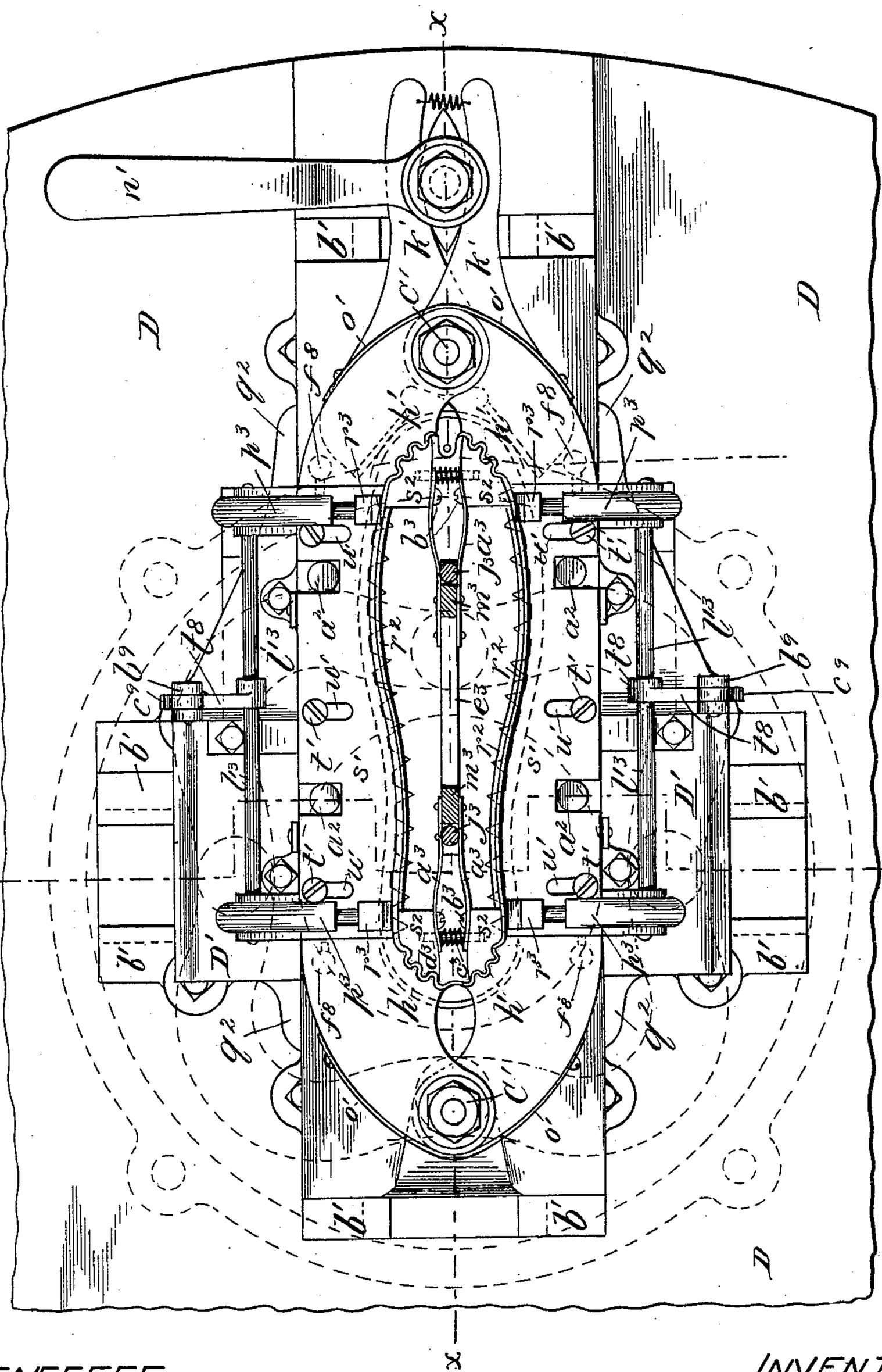

FIG. 5.

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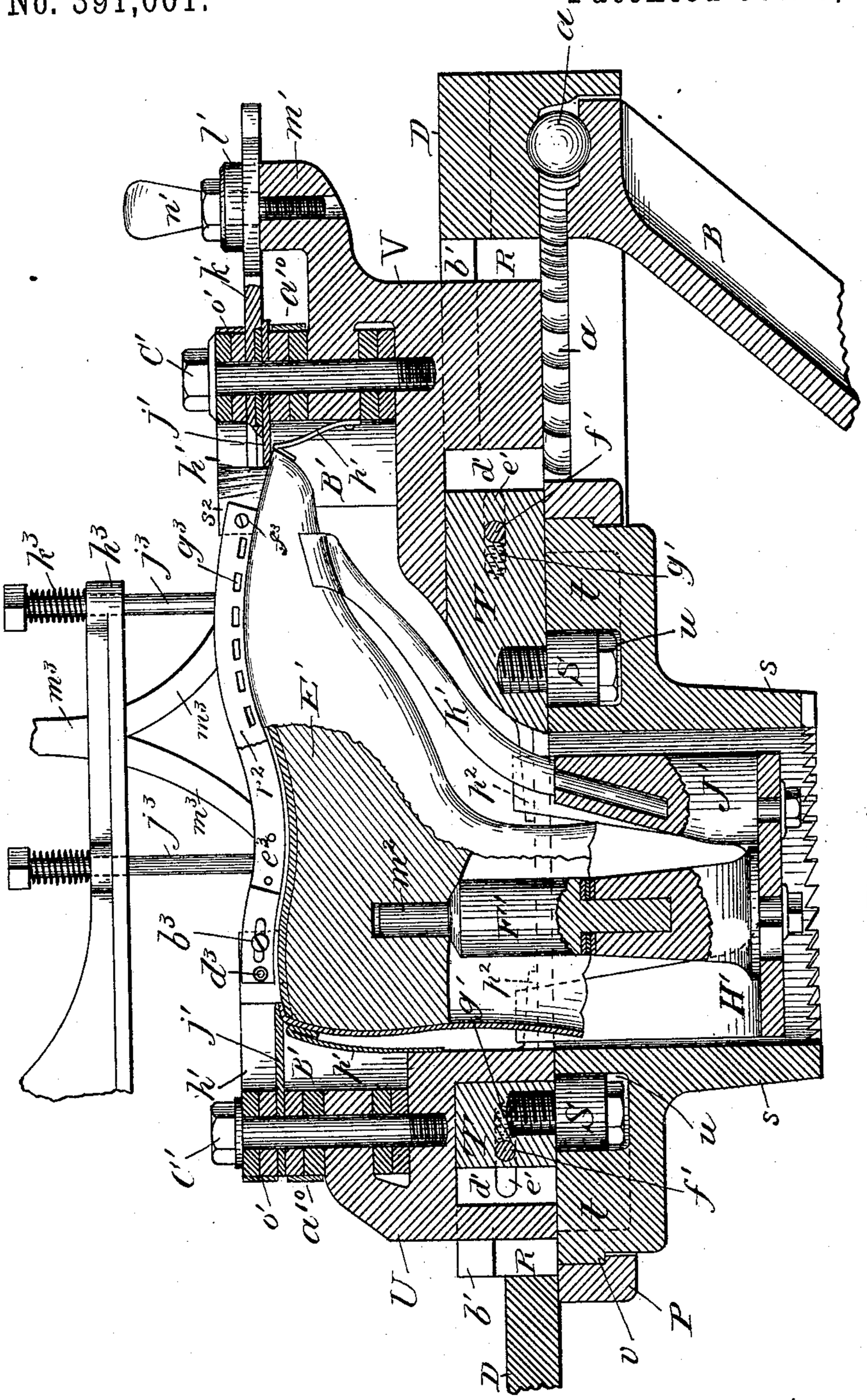

FIG. 6.

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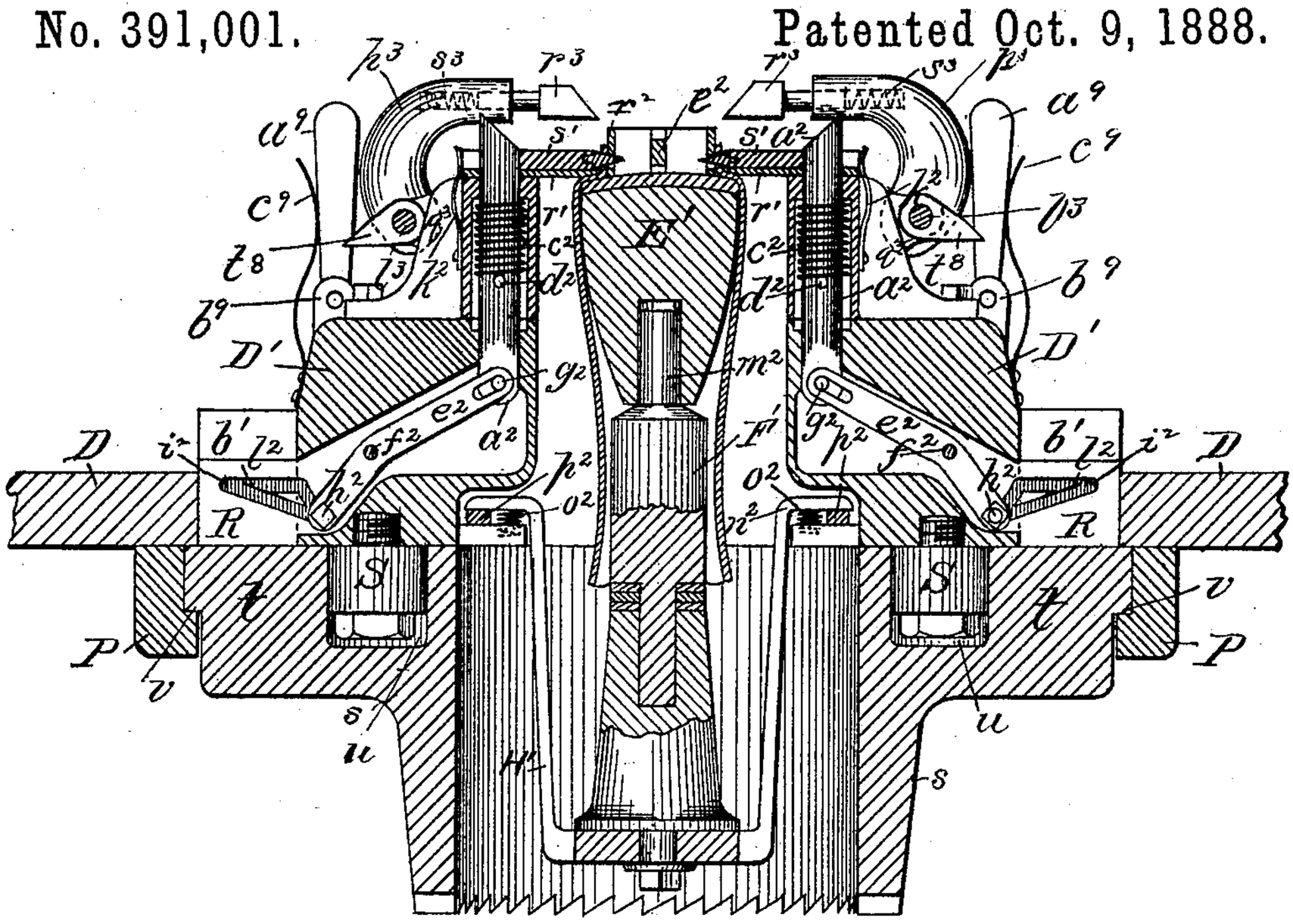

Fig. 7.

Fig. 8.

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UNITED STATES PATENT OFFICE.

CHARLES T. WOOD, OF LYNN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE BAY STATE LASTING MACHINE COMPANY, OF BOSTON, MASSACHUSETTS.

LASTING AND SOLE-LAYING MACHINE.

SPECIFICATION forming part of Letters Patent No. 391,001, dated October 9, 1888.

Application filed February 1, 1888. Serial No. 262,638. (No model.)

To all whom it may concern:

Be it known that I, CHARLES T. WOOD, of Lynn, county of Essex, and State of Massachusetts, have invented certain new and useful Improvements in Lasting and Sole-Laying Machines for Boots and Shoes, of which the following is a specification, reference being had to the drawings accompanying and forming a part hereof, in which—

Figure 1 is a front elevation of my machine. Fig. 2 is a vertical section showing the driving mechanism, as also certain other parts, in full. Fig. 3 is a plan view with the frame and driving parts above the table removed and with the table partially broken away, showing the ball-bearings on which it rests, as also one of the cams which actuate the lasting mechanism. Fig. 4 is a top view of one of the devices for lasting, the lasting jaws or slides being thrown back and the actuating cam underneath being shown in dotted lines. Fig. 5 is a similar view with the lasting jaws and slides closed in the operation of lasting. Fig. 6 is a section on line *x x*, Fig. 5. Fig. 7 is a section on line *y y*, Fig. 5. Fig. 8 is a similar section with the lasting-slides thrown back and with the outsole and sole-laying block in position. Fig. 9 is a detail in perspective, showing the device for dropping the vertical shaft, which is located in front of the machine. Fig. 10 is a lengthwise section through one end of the sole-laying block, showing the manner of detachably securing the block in its head. Fig. 11 is a front view of the arm which sustains the hand-lever shown at the right of Fig. 1. Fig. 12 is a plan of part of the table, showing one of the openings therein for the lasting mechanism with the ways which support the sliding blocks, as also the jack-supporting strap in position. Fig. 13 is a section on line *x' x'*, Fig. 12. Fig. 14 is a section showing the device for actuating and releasing the heel and toe lasting jaws, as also in side view the pawl device by which the dogs which secure the sole-laying block are held and released. Fig. 15 is an end view of one of the eccentrics, showing the locking groove and slot.

The object of my invention is the construction of a lasting and sole-laying machine by which boots and shoes may be lasted easily and rapidly and with a great saving of hand-labor; and it consists in the devices hereinafter described, as also their construction and arrangement in an organized machine.

The chief feature of my machine is that portion of it by which the shoe is lasted, and in the operation of this portion of the device I have endeavored to follow the order in which the different portions of the upper are drawn over the last in lasting a shoe by hand in order that the smoothness and finish of hand-work may be obtained.

I will describe my invention as embodied in the machine shown in the drawings, throughout which like letters of reference indicate like parts.

The frame A of the machine may be of any desired shape so long as sufficient strength is obtained to sustain the necessary pressure of the sole-laying device. I prefer to construct it with four feet supporting a cylindrical standard, to the top of which are bolted a series of arms, B, projecting upwardly and outwardly and supporting a rim, C, (see Fig. 2,) which is grooved on its upper surface to receive a series of balls, *a*, on which the table D rests, a groove being cut on the under side of the table around the edge thereof to receive the balls *a*. The periphery of the table has a downwardly-projecting flange, *b*, Fig. 2, to protect the ball-bearing and prevent it from becoming clogged. By this arrangement the table may be easily revolved by the aid of the handles *c*, Fig. 1, while at the same time it is unyielding under the pressure of the sole-laying device. The arms E are bolted to the upper part of the cylindrical drum of the frame and project upwardly and inwardly, as shown, Fig. 2, supporting a central standard, F, the lower portion of which forms a sleeve, *d*, which is received inside the cylindrical frame *e*, which rises from the arms E. A flanged bushing, *f*, bolted to the lower end of the sleeve *d*, serves as a journal for the lower end of the vertical shaft *g*.

The upper portion of the frame-work of the machine consists of a series of arms and branches (see Figs. 1 and 2) made of a suitable shape to carry the shafts and gears of the driving mechanism, as also to sustain the sole-

laying device, and supported by upwardly-projecting arms from the central standard, F, and by an arm, G, which rises at the rear of the machine from the arms B, which support the table. (See Fig. 2.) The main shaft H is journaled in the upper part of the frame, (see Fig. 2,) and is provided with fast and loose belt-pulleys I. The inner end of the shaft is provided with a beveled gear, J, which meshes with a beveled gear, K, set at right angles thereto and secured to the top of the vertical shaft *g*, which is set in bearings in the central standard, F.

On the lower end of the shaft *g* is secured a beveled gear, *h*, which meshes with a corresponding gear, *i*, on the horizontal shaft *j*, which is mounted in supports in the cylindrical frame. The forward end of the shaft *j* is provided with a beveled pinion, *k*, which meshes with a beveled pinion, *l*, keyed on the vertical shaft L by a vertical spline and groove, which permits of the vertical movement of the shaft L independently of the gear *l* in the well-known manner.

The shaft L is journaled at its upper end in a cross-piece, *m*, of the frame (see Fig. 1) and at its lower end in a bearing, *n*, bolted to the frame. To the upper end of shaft L is bolted a cross-piece, a^8, Fig. 1, to either end of which are secured downwardly-projecting pieces b^8, to the lower end of each of which is secured a friction-roll, c^8, set on a stud projecting inwardly at right angles to the pieces b^8. When the shaft L is down, these friction-rolls c^8 travel on the shoulder d^8 of the bearing of the shaft. (See Fig. 9.) The upper or reduced portion of this bearing is provided with a series of eight equal projections, e^8, having eight equal spaces between them, the friction-rolls c^8 being of a size to pass through each space. As the shaft L is forced upwardly by the treadle, the rolls c^8 are carried up between projections e^8, and are held up while they pass over the projections in front of each roll, when they drop down again, letting down the shaft L. In this way, by a depression of the treadle, the shaft L moves the cylindrical cam-pieces *s* through one-eighth of a revolution, as will be clear. The lower end of the shaft L is seated in a depression in the outer end of the lever M, which is pivoted (see Fig. 2) to a lug, *o*, projecting from the frame. The rear end of the lever M is slotted, as shown at *p*, and is pivoted through said slot to the treadle-lever N, the treadle-lever being cut away centrally, as shown at *q*, Figs. 1 and 2, to accommodate the lever M and its support. The treadle-lever N is pivoted rearwardly to a projection, O, (see Fig. 2,) secured underneath the machine. The levers M N form a compound treadle, and act, when the free end of lever N is depressed, to raise the shaft L.

At the upper end of the shaft L is secured a wheel, *r*, having the upper side of its periphery toothed, as shown, Fig. 2, and adapted to enter corresponding notches on the lower edge of the cylindrical cam-pieces *s*. The cylindrical cam-pieces *s* are provided on top with a flange, *t*, (see Fig. 3,) which lies directly underneath the table D, and which has a cam-path, *u*, cut in its upper face. The periphery of the flange *t* is provided with a peripheral projection, *v*, (see Figs. 6, 7, and 8,) which is received in a corresponding groove cut on the inside of the circular supporting-piece P, which is bolted to the under side of the table, as shown at *a'*, Fig. 3. By this arrangement the cylindrical cam-piece *s* may revolve in the supporting-piece P. Above the cylindrical cam-pieces *s* the table is cut away, as shown at R, Figs. 6, 7, and 8, for the reception of the sliding blocks which carry the lasting jaws and plates. These blocks slide on ways *b'*, secured to the sides of the hole in the table, (see Figs. 12 and 13,) and are actuated by cam-rolls S, (see Figs. 6, 7, and 8,) which are secured to the under side of the blocks, and which act in the cam path *u*, cut in the top of the flange of the cylindrical cam-piece *s*. Since the jaws which gather and last the upper over the toe and heel are required to operate before the sides of the shoe are lasted, the toe and heel blocks are arranged to travel a less distance than the side blocks, and as the cam path which operates them is cut in the same manner for all four blocks in order that the cam, as also the cylindrical cam-piece *s*, may travel always in one direction, it is necessary to provide inner sliding blocks, T, Fig. 6, which slide on ways inside the heel and toe blocks U V, respectively. These inside blocks carry the cam-rolls S, and the recesses *d'*, in which they slide, are longer than the blocks T, which occupy them.

The blocks T are provided with pins *f'*, which project into apertures *e'* in the side of the recesses *d'*, in which the blocks T slide. In front of the pins *f'* in the apertures *e'* are set spiral springs *g'*. As the blocks T are moved inwardly by the cam *u*, the heel and toe blocks are carried forward until the jaws are in contact with the work when they stop, and the subsequent movement of the cam carries the inner blocks, T, inward against the resistance of the spiral springs *g'*, thus taking up the extra movement of the cam. By this arrangement the four quarters of the cam may be cut in exactly the same shape, as shown at *u*, Fig. 3, and each of the quarters may be used interchangeably for actuating the side blocks, and the cam may consequently be revolved continously in one direction.

The toe and heel blocks carry crimping or gathering jaws *h'*, which are serrated on their inner faces, as shown in Figs. 4, 5, and 6, the serrations being deepest at the top of the jaws. These tapering or diminishing teeth are very important, since at the point where the upper turns over the edge of the last there should be no gathers or plaits in the upper. Near the edge of the last the gathers begin and increase in size to the edge of the upper. The serrations of the jaw are therefore correspondingly shaped and act to plait the upper naturally and without forcing or stretching it more

at one part of a plait than at another. The serrated jaws h' are pivoted securely to the sliding blocks by pivot C', as shown in Fig. 6. Below these jaws, on the same pivot, there is another pair of jaws, B', and on top of each of these jaws B' and rigidly secured thereto is a smooth jaw or plate, j', Figs. 4 and 6, which projects in front of the jaw B' and acts at the extreme of the inward movement of the jaw, when the upper has been drawn smoothly over the edge of the last to secure the upper in that position. The jaws B' are closed as the sliding blocks move inwardly by projections q^2, (see Figs. 4 and 5,) which are fast on either end of the side blocks, and which as the side blocks move in come in contact with the outer ends of the inwardly-moving jaws B'. The inward movement of the jaws B' also closes the jaws h', the two being connected by a bolt, f^8, (see Fig. 14,) which lies in a vertical chamber or recess in the forward outer corner of the jaw B'. (See Fig. 14.) The bolt f^8 is forced upward by a spiral spring, g^8, which bears at its upper end against a pin, h^8, in the bolt and at its lower end against a shoulder formed by an enlargement of the bolt-chamber to accommodate the spring, as shown in Fig. 14. The bolt f^8 is pulled down against the resistance of spring g^8 by means of the spur or pin j^8, projecting from its lower end through a slot, k^8, in the end of the jaw B'. This pin j^8 comes in contact with an incline or cam, l^8, cut in the end of the side block, D', and as the block moves inwardly the incline forces the pin j^8 and its bolt downwardly. When the bolt f^8 is up, its upper end projects into a hole in the under side of the crimping-jaw h' and secures the jaw h' and the jaw B' rigidly together, and in this position they move inwardly in the operation of lasting the shoe. As soon as the jaw h' has reached the extreme of its inward movement, the bolt f^8 has been pulled downward by the incline l^8 clear of the jaw h', thus allowing the jaw h' to fly back out of the way, impelled by the spring o'. (See Fig. 4.) When the sliding blocks are moved outwardly to take the shoe out of the machine, the jaws B' are opened by a leaf spring, a^{10}, similar to spring o', secured to the back of the jaws in the same manner as is spring o' to the jaws h'. The plates j' remain in their inward position after the crimping and lasting jaws h' have been allowed to fly back, and, as already stated, project over the edge of the last and serve to hold the upper in position when it has been drawn smoothly over the last by the serrated jaws h'.

At the toe of the shoe a pair of shears, k', are pivoted, also on the same pivot as are the jaws h' and B' and directly above the plates or jaws j'. (See Fig. 6.) These shears are for the purpose of trimming off the fullness of the upper which has been gathered in folds or plaits around the toe, and they are operated by means of a cam, l', pivoted to a projection, m', of the toe-block, (see Fig. 6,) the cam-pivot being provided with a handle, n', by which the cam which lies between the shank of the shears may be turned, thus separating the shanks and causing the cutting-edges of the shears to pass each other. On the inner faces of the toe and heel blocks V U, respectively, are secured (see Fig. 6) the springs p', which support the curved springs q', Fig. 4, which bear against the round ends of the toe and heel near to the edge of the last when the toe and heel blocks have moved inwardly and tend to hold the upper and prevent it from slipping. These springs q' bear near either end against the spring-impelled bolts m^8, set in recesses in the side blocks, (see Fig. 4,) and also serve to center the last in the machine. The side blocks, D', (see Figs. 7 and 8,) are mounted in ways set on the table in the same manner as are the toe and heel blocks, and they are each similarly provided with a cam-roll, S, which acts in the cam path u to operate them. These side blocks have flat plates r', Figs. 7 and 8, having their inner edges shaped, as shown, Figs. 4 and 5, to correspond with the sides of the last, and they act in the same manner as do the heel and toe plates or jaws j' to hold the upper over the edge of the last after it has been drawn into position by the toothed plates s', which lie directly above the plates r'. These plates s' are secured in position by the screw-studs t', (see Fig. 5,) which pass through slots u', thus permitting the plates s' to have an independent sliding movement toward and from the last. When the blocks D' are moving inward when lasting the shoe, the toothed plates s' are not only carried inward with the blocks, but are also thrown inward by the upward movement of the beveled tops of the bolts a^2, so that the points of the teeth project beyond and in advance of the edges of the plate r' when they come in contact with the upper.

The plates s' are held in this position by the upright bolts a^2, which project upwardly through slots or holes cut in the plates. (See Figs. 5, 7, and 8.) The bolts a^2 are set in vertical sockets in the blocks D', and are surrounded by spiral springs c^2, which bear at their upper ends against shoulders in the socket and at their lower ends against the pins d^2 in the bolts. These springs tend to throw the bolts downwardly.

For the purpose of raising the bolts the levers e^2 (see Figs. 7 and 8) are provided, which are pivoted at f^2 in slots in the blocks D'. The inner ends of the levers e^2 are slotted, and are secured by pivots g^2 in the slots to the lower ends of the bolts a^2. The outer ends of the levers e^2 are provided with studs at h^2, which project into cams i^2 cut in the sides of the openings in the table. These cams are of the shape shown, Figs. 7 and 8. When a block D' is in its outward position, the stud h^2 of a lever, e^2, is at the outer end of the cam. When the block advances toward the last, the stud h^2 moves downward and forward in the lower member of the cam i^2, thus raising the inner end of the lever and throwing the bolt a^2 upward, causing the beveled top of the bolt to

pass into the slot or hole in the toothed plate s', thus moving the plate forward toward the work and holding it in its forward position until the stud h^2 has reached the lowest point of the cam i^2, when the stud is free to rise in the other member of the cam, thus allowing the spring c^2 to throw the bolt a^2 down, when the parts assume the position shown in Fig. 8, the plates s' being thrown back by the leaf-springs k^2, secured at their upper ends to the rear edge of the plates and at their lower ends to the blocks D'. (See Figs. 7 and 8.) When the blocks D' are moved back, the studs h^2 pass back in the horizontal part of the cam i^2 until they snap past the leaf-springs l^2, which guide them in their next forward movement and keep them in the lower member or part of the cam.

The teeth of the plates s' may be integral therewith; but I prefer to make them separate from the plates and set them in the edge thereof, as shown, securing them in any suitable manner. By the mechanism just described the toothed plates s' are advanced toward the work, the points of the teeth coming in contact with the work in advance of the plain plates r', and, when the teeth have acted in conjunction with the devices hereinafter described to draw the upper smoothly over the edge of the last, the plain plates r' come in contact with the upper and hold it in position, and the toothed plates s' fly back out of the way in a manner similar to the movement of the jaws h', above described.

The last E', on which the shoe is placed, is supported on a jack, F', which in turn is supported by a metallic strap, H', Figs. 7, 8, and 12, having somewhat the shape of a U. The jack is of the ordinary construction shown, and has a spindle, m^2, on which the last is set in the usual manner. The strap H' bends downwardly in the U shape described, in order that there may be room around the jack to accommodate the leg of a boot, if desired; otherwise the jack might be shorter and its supporting-strap would not need to project downwardly so far. The four upwardly-projecting corners or ends of the strap are bent outwardly at n^2 and rest on a part of the table. (See Fig. 12.)

Between the parts n^2 of the strap and the table are placed spiral springs o^2, Figs. 7 and 8, which give the strap a yielding seat, and also hold the parts n^2 slightly above the table to allow the wedges p^2, Figs. 6, 7, and 8, to be slid under them. These wedges are forced under the ends of the strap by the inward movement of the toe and heel blocks (see Fig. 6) while the toothed plates s' are pulling the upper over the edge of the last and act to lift the last slightly against the plates r' and so cause the plates to hold the upper more securely after it has been drawn smoothly into position. The wedges are projections from the blocks, or are secured thereto, and are withdrawn from under the ends of the strap by the outward movement of the blocks. In front of the jack on the strap is secured a block, J', Fig. 6, in which is socketed a toe-rest, K', on which the toe of the last rests, and is thereby more firmly supported.

While the serrated jaws and plates are in contact with the outside of the upper in drawing the upper over the last it is necessary that there should be some corresponding device inside the upper against which the exterior jaws and plates may work in order to grip the upper and pull it in smoothly and firmly. For this purpose I provide a compressible form having side pieces, r^2, (see Figs. 4, 5, and 6,) the whole form corresponding in shape to the curves of the sole. This form is provided with heel and toe blocks s^2, Fig. 5, there being two such blocks at the toe and two at the heel, each block coacting with one of the jaws h'. These blocks require to be so mounted that they may recede under the pressure of the pivoted jaws after the upper has been gripped between them and the pivoted jaws, and thus allow the upper to be drawn over the edge of the last. To provide for this I secure them at their inner corners to springs a^3 (see Figs. 4 and 5) by means of screws b^3, which pass through longitudinal slots in the springs a^3. For the purpose of allowing the blocks s^2 to recede regularly toward the center of the last and of forcing them outwardly again, I provide the spiral springs c^3 between the blocks, which are supported on a rod, d^3, which projects at either end into apertures in the blocks. (See Fig. 5.) The springs c^3 are compressed as the blocks are forced together. The springs a^3 are secured at their inner ends to a central supporting-piece, e^3, by which the frame is supported. The outer edges of the blocks are secured to side pieces, r^2, which extend from the toe to the heel along the edge of the last, by means of screws f^3, Fig. 6. The side pieces, r^2, are flexible and bend inwardly along the shank of the last under the pressure of the plates s'. These side pieces are provided near their lowest edge with slots g^3, (see Fig. 6,) which receive the points of the teeth of the plates s', which, as the plates advance, come in contact with the upper and force it into or against the slots g^3, thus gripping it securely and preventing it from slipping, while the subsequent advance of the toothed plates causes the side pieces r^2 to recede and draws the upper inwardly smoothly over the edge of the last. The pieces r^2 consist of thin strips of metal and act like springs—that is, they are flexible, and so may be bent inwardly or caused to recede from the position in which they appear in Fig. 4 to that shown in Fig. 5. This bending or receding of the pieces r^2 as the toothed plates s' advance is greatest at the shank of the shoe, as will be obvious upon inspection of the figures last referred to. As soon as the upper has been drawn in smoothly and secured by the plates r', the toothed plates and jaws fly back, as previously explained, and there is no further use of the side pieces, r^2, or the blocks s^2, and they are lifted up and may

be removed. As they are needed each time a shoe is lasted, I have provided a convenient support for them by which they may be easily put in place and removed. This consists of an arm, h^3, Fig. 1, pivoted to a lug, i^3, on the central standard of the frame, so as to swing horizontally. Two uprights, j^3, secured at the their lower ends to the piece e^3, (see Figs. 4 and 6,) extend upwardly through apertures in the arm h^3, and are provided with spiral springs k^3, placed under the enlarged heads of the uprights and between these heads and the arm h^3. (See Fig. 6.) These springs are compressed as the inner frame is thrown down onto the insole on the last, and, when the pressure which holds it down (the hand of the operator on the handle l^3) is removed, act to raise it again. For the purpose of throwing it down, a hand-lever, l^3, Fig. 1, is provided, which is pivoted to a swivel on the inner end of the arm h^3, so as to allow of the vertical movement of the lever l^3. A forked upright, m^3, (see Figs. 1 and 6,) is secured at its lower end to the piece e^3 (see Fig. 4) and extends upwardly and rests in a slot or recess on the under side of the lever l^3. By this arrangement the inner frame may be swung over the last, and then, by seizing the handle of the lever l^3 and pressing downwardly, the inner frame, consisting of the blocks s^2 and side pieces, r^2, and their supports, may be laid upon the insole in position for lasting the shoe.

I have now described the lasting mechanism proper. The shoe, with the last inserted, is placed upon the jack at the right of Fig. 1, and prior to this it is prepared by inserting the last, placing the insole in position, centering the upper upon the last, and pulling the upper at the middle of the toe and heel over the edge of the sole and tacking it down by driving a tack at each place. This is for the purpose of holding the upper in position after it has been properly centered. I prefer to slit the edge of the upper on either side of the tack at the toe and heel, thus holding it in position by a single strip and leaving the fullness of the upper at either side of the center of the toe and heel to be gathered in and lasted smoothly by the machine. After the shoe has been lasted at the center of Fig. 1, the outsole, the inner surface of which has been coated with rubber cement or similar adhesive, is placed upon the insole and the table swung round until the shoe is at the left of Fig. 1 under the sole-laying apparatus. When it is in this position, the sole-laying block n^3, (see Figs. 1 and 8,) which is provided on its under surface with a rib or projection, o^3, arranged to fit in the channel on the bottom of the outsole, comes down and presses the outsole and lays it smoothly upon the insole, the lower surface of the block n^3 being curved to fit the curvature of the bottom of the last. The projection o^3 on the block n^3, which fits into the channel of the outsole, serves to give the greatest pressure to the parts under the channel, where it is most desired that the sole should be laid smoothly and that the adhesive which holds it temporarily in place should unite the parts most thoroughly. The block n^3 is detachably supported by the vertically-moving head a^4 by means of spring-impelled bolts n^8, (see Fig. 10,) which lie in horizontal holes or sockets in the head, and which have rounded ends, which project into grooves q^8 in the projections p^8. The block n^3 is provided with projections p^8, which fit into the recesses or slots o^8, and the sides of these projections p^8 are provided with the grooves q^8 to receive the rounded ends of the bolts n^8. When the projections p^8 are pressed upwardly into the slots o^8 in the heads a^4, the bolts n^8 snap into the grooves q^8 in the sides of the projections and secure the block n^3 to the head a^4. If sufficient downward pressure is applied to the block n^3 to force the bolts n^8 back against their springs, the said block n^3 is released, as will be clear.

The block n^3 is clamped in position on the outsole by means of the dogs p^3, which are secured between lugs q^3 on the side blocks, D′, to the short shafts l^{13}, journaled in said lugs. These dogs bend upwardly and inwardly, as shown, Figs. 7 and 8, and are provided at their upper ends with compressible latches r^3, the shanks of which are received in sockets in the dogs, in the bottom of which sockets are placed spiral springs s^3, which tend to force the latches outward. (See Fig. 7.) The ends of these latches are beveled on the upper side, as shown, and project into the path of the block n^3 as it is being carried downward onto the sole. As the block moves downward, it strikes the inclined or beveled ends of the latches, forcing them back against the resistance of the springs s^3 until the latches arrive opposite the triangular cavities t^3, Fig. 8, in the sides of the block, when they snap into the cavities and hold the blocks firmly in position. The dogs are prevented from rising, after they have clutched the block n^3, by the pawls t^8, (see Figs. 5 and 14,) which are fast on shafts l^{13}. These pawls project horizontally and are received at their outer ends in notches in the upright handles a^9, which are pivoted at their lower ends between lugs b^9 on the blocks D′. A leaf-spring, c^9, is secured to the block D′ and tends to press the handle inwardly against the pawl. (See Fig. 14.) As the pawl t^8 and dogs p^3 are fast to the shaft l^{13}, the dogs cannot rise or fly back until the pawl is released. By pressing back the pivoted handle a^9 the pawl is allowed to drop, and the dogs are released from the block. After the block n^3 is thus secured in place the table is again swung round, and the succeeding shoe comes into position to have the outsole laid. Since the block n^3 is left on the outsole of the preceding shoe, another block must be secured to the head a^4. Thus four blocks n^3 are necessary, each block remaining in position on the sole until the shoe has moved around to its first position at the right of Fig. 1, where it was jacked. At this point the block n^3 is removed and the shoe taken from the jack.

While it is thus moving round upon the table the cement or adhesive has an opportunity to partially dry and secure the sole with sufficient firmness to admit of subsequently handling the shoe and sewing or nailing it without displacing the outsole. The head a^4, which lays the block n^3 upon the outsole, is supported by two eccentric-straps, b^4, the lower ends of which are secured to either end of the head, and which slide in ways in a block, c^4, bolted to a projection of the frame. (See Fig. 1.) The straps b^4 are pivoted to yokes or straps surrounding the eccentrics d^4 on the horizontal shaft f^4, journaled in the upper frame of the machine. (See Fig. 1.)

The shaft f^4 is driven by means of the beveled gear g^4, which meshes with the gear J on the main shaft. The shaft f^4 is divided into two parts, each part carrying a member of the friction device h^4, which is of common construction, and by means of which the part of the shaft which carries the eccentrics d^4 may be revolved or stopped at will by connecting it with or disconnecting it from the part which carries the gear g^4, and which is constantly revolving when the machine is in use. To operate the eccentrics d^4, the shipper-lever j^4 is pivoted at k^4 to a projection on the central standard of the frame. The upper end of the shipper-lever j^4 is provided with a stud which travels in a path in the hub of one member of the friction device, and the lower end of lever j^4 projects downwardly beside the standard of the machine (see Fig. 1) and in the path of the inclined projections or cams l^4, (see Figs. 2 and 3,) secured to the top of the cylindrical sleeve m^4, which surrounds the standard, (see Fig. 2,) and is secured to and revolves with the table. As the cam projections l^4 pass under the end of the shipper-lever j^4, they force the lower end of the lever outwardly or to the left, Fig. 1, thus forcing the upper end in the opposite direction and rendering the friction device operative, while one of the projections l^4 is passing the lower end of the shipper-lever. The length of the cam projections l^4 is such that while one of them is passing the shipper-lever the eccentrics d^4 will make one complete revolution. To further insure the stopping of the eccentrics d^4 at the same point each time, a cam-groove is cut on the inner face of the inner eccentric, (see Fig. 15,) and the groove is provided at one point with a vertical slot opening downwardly from it. This groove and slot receive a stud, n^4, Fig. 1, set in the upper end of the upright p^4, which is pivoted to the end of the bell-crank lever q^4, which in turn is pivoted to a projection on the central standard, and the lower end of which projects downwardly beside the standard and parallel to the shipper-lever j^4, and is connected with the shipper-lever by a pin, d^9, Fig. 1, which projects into a slot in the shipper. By this means the bell-crank lever q^4 is moved at the same time that the shipper-lever is moved. As the lower end of this bell-crank lever q^4 is moved outwardly, the stud n^4 is raised out of the slot into the circular groove in the eccentric and lies in the groove until the eccentric has made a complete revolution, when the stud arrives again at the slot opening out of the groove and drops into it, thus stopping the eccentric and locking it. When the shoe has passed around to its first position to the right of Fig. 1, the operator throws back the pivoted dogs p^3 by pressing back the handles a^9 and lifts off the sole-laying block n^3. He then opens or throws back the sliding blocks by revolving the cam u through one-eighth of a revolution. This is effected by means of the lever a^5, (see Figs. 1 and 11,) which is pivoted at its inner end to a projection on the frame by vertical and horizontal pivots, which allow it to be moved either horizontally or vertically.

The lever a^5 is provided with a tooth, b^5, which, when the lever is raised, is in contact with the toothed edge of the cylindrical cam-piece s, in the top of which the cam u is cut. The outer or handle end of the lever is supported on an arm, d^5, secured to the frame underneath the table. The horizontal portion of the arm (see Fig. 11) is bent upwardly, so that as the lever arm is moved horizontally the tooth b^5 is thrown into contact with the teeth of the piece s. The arm a^5 is carried back to its first position again by the next movement of the table by means of the pin f^9, projecting from the edge of the table, which strikes the arm when it is in the dotted position shown in Fig. 11, but which passes over the arm as soon as the arm is back again in first position, left of Fig. 11. By a lateral movement of the lever a^5 the cam may be revolved and the sliding blocks thrown back, as will be obvious. After the blocks have been thus opened or thrown back, the shoe, lasted and with the outsole laid, may be removed and a shoe ready to be lasted put in its place.

The spring-catch f^5, Figs. 1 and 2, is secured to the stationary rim of the frame and extends downwardly in front of the flange of the table, and a projection, g^5, on the spring lies in a groove in the flange and serves to hold the table stationary while the shoe is being lasted, as also to stop the table when it is revolved at exactly the right point. When it is desired to revolve the table, the catch f^5 is depressed and the table started. When the projection g^5 is opposite the next slot in the flange, it snaps into the slot, and the table is then in the position in which it is required to be when the next shoe is lasted and the sole of the preceding one is laid.

When it is desired to last uppers which are very hard and unyielding, or which have sole-leather tips, for example, which render them stiff, I prefer to soften and break up the edges around the toe by the use of an auxiliary device adapted to form flutes or corrugations therein, similar in form to the teeth of the blocks s^2 and jaws h', thus aiding somewhat the operation of the machine. Such auxiliary

device forms the subject of another application for Letters Patent, and will be found more fully described therein.

The operation of the machine is as follows: The last, with the upper and insole in position, is placed on the jack at the right of Fig. 1. The spring-catch f^5 is then depressed to disengage its projection g^5, Fig. 2, from the holding-notch in the rim of the rotary table D, thus leaving the said table free to be moved through a quarter-revolution by the operator, who seizes one of the handles c for this purpose, and when the quarter-revolution is effected the further movement of the table is stopped by the said projection g^5, which engages another notch in the said table. The shoe is now in the central position, Fig. 1, and the operator next grasps the handle l^3 and swings the compressible form or inner frame (which is to co-operate with the serrated end and side gripping-jaws in grasping the edge of the upper) over the shoe, and then by depressing said lever the said form or frame is forced against the shoe. The operator next momentarily touches the treadle-lever N with his foot, thereby raising the shaft L and causing the toothed clutch-wheel r carried thereby to engage the toothed cylindrical cam-piece s, in the top of which is formed the grooved cam n. (Shown in Fig. 3.) As soon as the revolution of the said shaft has commenced, it is held up by the rollers c^8, which now travel on the projections e^8 of the bearing m, said rollers being on the arms b^8 of the frame a^8, bolted to the said shaft L, and when one-eighth of a revolution of the cam n has been effected the said rollers c^8 drop down between the said projections e^8, thereby disengaging the said clutch-wheel from the said cam-piece s. This one-eighth revolution of the cam n forces in the sliding blocks D′, U, and V, thereby moving the lasting jaws and plates inwardly, drawing the upper smoothly over the insole. The toothed or serrated jaws and plates then fly back, and the smooth plates j' and r', which press on the upper inside of the edge of the last, as shown in Figs. 6 and 8, securely hold the upper in lasted position in readiness for the laying of the outsole. The compressible form or inner frame, which is connected with the lever l^3, is now allowed to rise and is swung to one side out of the way. The lever n' is then turned, closing the shears and trimming off the surplus gathers of the upper around the toe. The shears are then opened again and a coating of cement or other adhesive applied to the inner surface of the outsole, which is then placed in position on the insole. The catch f^5 is depressed and the table revolved through another quarter-revolution, carrying the lasted shoe around to the left of Fig. 1 under the sole-laying apparatus. The movement of the table moves the cam projections l^4, Fig. 3, under the shipper j^4, which starts the eccentrics d^4 and forces the block n^3 down upon the outsole, where it is held by the dogs p^3. (See Fig. 7.) The succeeding shoe is now in position to be lasted, and the operation is repeated. When three succeeding shoes have been lasted, the first shoe is around again at the right of Fig. 1, where it was put into the machine, and it is now removed by pressing back the handles a^9, releasing the dogs p^3, removing the block n^3, and opening or throwing back the sliding blocks by means of lever a^5, as already described. When it is removed, another shoe is inserted in its place, and the operation goes on.

As the upper is securely held in lasted position by the plates j' and r' until the outsole has been applied and temporarily secured in place by cement or other adhesive substance, it is obvious that no nails are required to secure the lasted upper in place, and that the lasting and sole-laying operations are continuously performed on one and the same machine. The said plates j' and r' are not released from their grip on the upper until the shoe is brought around to its first position at the right of Fig. 1, when the cam-piece s is given a one-eighth revolution by the hand-lever a^5, Figs. 1 and 11, as hereinbefore described, to move back the sliding blocks D′, U, and V and the lasting-jaws and plates operated thereby preparatory to lasting another shoe. The said lasting and holding plates j'' and r' do not extend inwardly over the edge of the last or insole far enough to prevent the outsole from being properly cemented or stuck down to the insole and upper, so as to retain the latter in lasted position when the cement has set, the pressure of the outsole against the insole and upper when the block n^3 is down being of course greatest beneath the rib or projection o^3, which is inside of the ends of the lasting and holding plates, as shown in Fig. 8, and if the said block be not provided with the said rib or projection o^3 the shape of its under surface will be such (operating in connection with the rounded bottom of a last) as to cause the outsole to be securely stuck down to the insole and upper within the inner ends of the holding lasting-plates.

I have described the sole-laying block n^3 as being provided with a projection adapted to enter the channel on the outsole. When the outsole is not channeled, the block n^3 will be smooth, the projection in such case not being desired. I have also previously stated that the shoe is prepared for the machine by securing the upper in position on the last by means of a tack at the heel and another at the toe. The tack at the heel is not, however, generally required. Usually a single tack at the toe is all that is necessary.

Instead of the spring-catch f^5, for holding the table D in a given position, other well-known forms of catch or stop device may be used.

What I claim is—

1. A lasting-machine having toothed jaws and plates mounted on sliding blocks to admit of their being moved toward and from the work and a compressible frame, substantially

as described, placed inside the upper on the insole to coact with said jaws and plates in gripping the upper and drawing it in over the edge of the insole, substantially as shown and described.

2. A lasting-machine provided with horizontally-movable cam actuated sliding blocks aranged to approach and recede from the heel and toe and the sides of a shoe, in combination with a pair of serrated jaws and a pair of smooth jaws pivoted to the heel and toe blocks, said serrated and smooth jaws being adapted to operate independently of each other and with a serrated plate and a smooth plate carried by each of the sliding side blocks, the said serrated plate and smooth plate being movable independently of each other, and the said smooth jaws and plates being adapted to impinge against the upper inside of the edge of the sole of the last, whereby the upper, after it has been drawn over the edge of the sole of the last by the serrated jaws and plates, will be held in position by the said smooth jaws and plates after the serrated jaws and plates have been disengaged therefrom, substantially as set forth.

3. The combination, in a lasting-machine, with the cam-actuated sliding blocks D′, of toothed plates s', mounted on said blocks, the beveled topped bolts a^2, and their levers and actuating-cams, for the purposes and substantially as set forth.

4. The combination of the sliding blocks D′, the plates s', provided with apertures to receive the bolts a^2, and having springs k^2, to retract said plates, and the plates r', rigidly secured to the sliding blocks, substantially as shown and described.

5. In a lasting-machine, the combination, with the sliding blocks U V D′, of the plates r' j', whereby when the upper is drawn over the edge of the last it is retained in position, substantially as shown and described.

6. In a lasting-machine, the combination, with the sliding blocks D′, of the upright bolts a^2, having beveled tops and actuated in one direction by the lever e^2 and its actuating-cam and in the other direction by the spiral spring c^2, and the toothed plates s', having apertures to receive the bolts a^2, substantially as shown and described.

7. The combination, with the cam-actuated blocks D′, of the plates r', secured thereto, and the plates s', and mechanism for moving said plates s' toward and from the work, and a form placed inside the upper, having yielding side pieces, r^2, substantially as shown and described.

8. The combination, with the sliding blocks U V, of the inner blocks, T, and their actuating-cams, said blocks T being set in slots in the blocks U V, having pins s' projecting into slots in the blocks U V, said slots being provided with the springs g', whereby, after the blocks U V have been moved forward a sufficient distance, the further throw of the cam is taken up by the inner blocks, T, for the purposes and substantially as shown and described.

9. The combination, with the sliding blocks U V, of the serrated jaws h' and the plates j', pivoted thereto, substantially as shown and described.

10. A lasting-machine provided with serrated jaws to operate upon the toe and heel of the upper and correspondingly serrated blocks, opposing said jaws inside the upper on top of the inner sole, each of said serrations being tapering, whereby the increasing fullness of the upper toward the edge thereof is gathered in evenly and the upper at the edge of the last is left smooth, substantially as shown and described.

11. The combination, with the cam-actuated sliding blocks U V, of the serrated jaws h' and the plates j', pivoted thereto, and the shears k', pivoted to the block V, substantially as shown and described.

12. The combination, with the cam actuated sliding blocks U V D′ and their actuating mechanism and the lasting jaws and plates, of the yielding side pieces, r^2, and blocks s^2, substantially as shown and described.

13. In a lasting-machine in which the shoe is placed between sliding blocks which carry the lasting jaws and plates, the combination therewith of the horizontally-swinging arm h^3, pivoted to the frame of the machine, the vertically-moving lever l^3, pivoted to said arm h^3, the uprights j^3, which slide in apertures in the arm h^3, the rigid arm m^3, the yielding side pieces, r^2, and blocks s^2, whereby the side pieces and blocks may be placed accurately on the insole when in use, and when not in use may be raised and swung out of the way, substantially as shown and described.

14. The combination, with the sliding blocks and their actuating-cam, of the U-shaped strap H′, which supports the jack, the springs o^2, and the wedges p^2, whereby the shoe is forced upwardly as the upper is drawn over the last, thereby crowding the upper against the rigid plates r' and holding it securely in position, as set forth.

15. The combination, with the sliding blocks D′, carrying the holding-plates r', of the dogs p^3, provided with the spring-actuated latches r^3, and the sole-laying pressure-block n^3, having apertures to receive the said latches, substantially as set forth.

16. The combination, with the sliding blocks D′, carrying the holding-plates r', of the dogs p^3, the shafts l^{13}, the pawls t^8, the spring-actuated handles a^9, and the sole-laying pressure-block n^3, substantially as set forth.

17. In a lasting and sole-laying machine, the combination, with the sliding blocks D′ U V, of the plates or jaws j' and r', the dogs p^3, the pressure-block n^3, and the reciprocating head a^4, with which the said block is detachably connected, substantially as set forth.

18. In a lasting and sole-laying machine, the combination, with the shoe-holding mech-

anism, the sole-laying pressure-block n^3, and the reciprocating head a^4, by which said block is carried, of the sleeve m^4, having the cam projections l^4, the shipper-lever j^4, and the bell-crank lever q^4, its upright p^4, and stud n^4, which acts in a groove and slot in the face of the eccentric d^4, the eccentric d^4, and its shaft and the friction-clutch h^4, whereby as the cam projection moves under the lever j^4 the eccentric is unlocked and given one revolution, substantially as shown and described.

19. The combination, with the lasting mechanism, of the serrated piece s, the vertically-movable shaft L and mechanism for revolving the same, the gear r, and the treadle mechanism, whereby as the treadle is depressed the shaft is raised and the gear r thrown into contact with the piece s, for the purposes and substantially as described.

20. The combination, with the blocks U V D′ and their jaws and plates j' r', and the piece s, for actuating said blocks, of the toothed lever a^5, pivoted to a swivel set in the frame, whereby, by the movement of the lever, the cam may be actuated and the blocks forced backward from the work, freeing the same, substantially as shown and described.

21. The combination, with the revolving table D, provided with pins f^9, of the pivoted arm a^5 and the supporting-arm d^5, having its horizontal portion bent upwardly, substantially as shown and described.

22. In a lasting and sole-laying machine, the combination, with a central standard having an annular groove or recess and an outwardly-extending supporting-rim secured to said standard, of a rotary table carrying on its upper side within its periphery a series of lasting devices, said table having a central sleeve received in said groove or recess in the said standard, a sole-laying apparatus, also within the periphery of the said table and operated from the same driving-shaft or prime motor from which the said lasting devices are operated, and ball-bearings interposed between said rim and table outside of the said lasting devices and sole-laying apparatus, whereby the pressure of the sole-laying block will be properly resisted without straining the supporting-bearings of the said rotary table, as set forth.

23. The combination, with the sliding blocks D′, carrying the holding-plates r', and the sliding blocks U and V, carrying the holding-plates j', of the sole-laying pressure-block n^3, having the rib or projection o^3 to enter the channel in the bottom of the outsole when the latter is being laid, substantially as set forth.

24. The combination, with the serrated jaws and plates which act on the outside of the upper and their actuating mechanism, of the yielding frame located inside the upper, and consisting of the perforated side pieces, r^2, and the serrated side blocks, s^2, and their supports, substantially as shown and described.

25. The combination, with the side pieces, r^2, of the blocks s^2, the supporting-springs a^3, and the pins d^3 and their springs, substantially as shown and described.

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