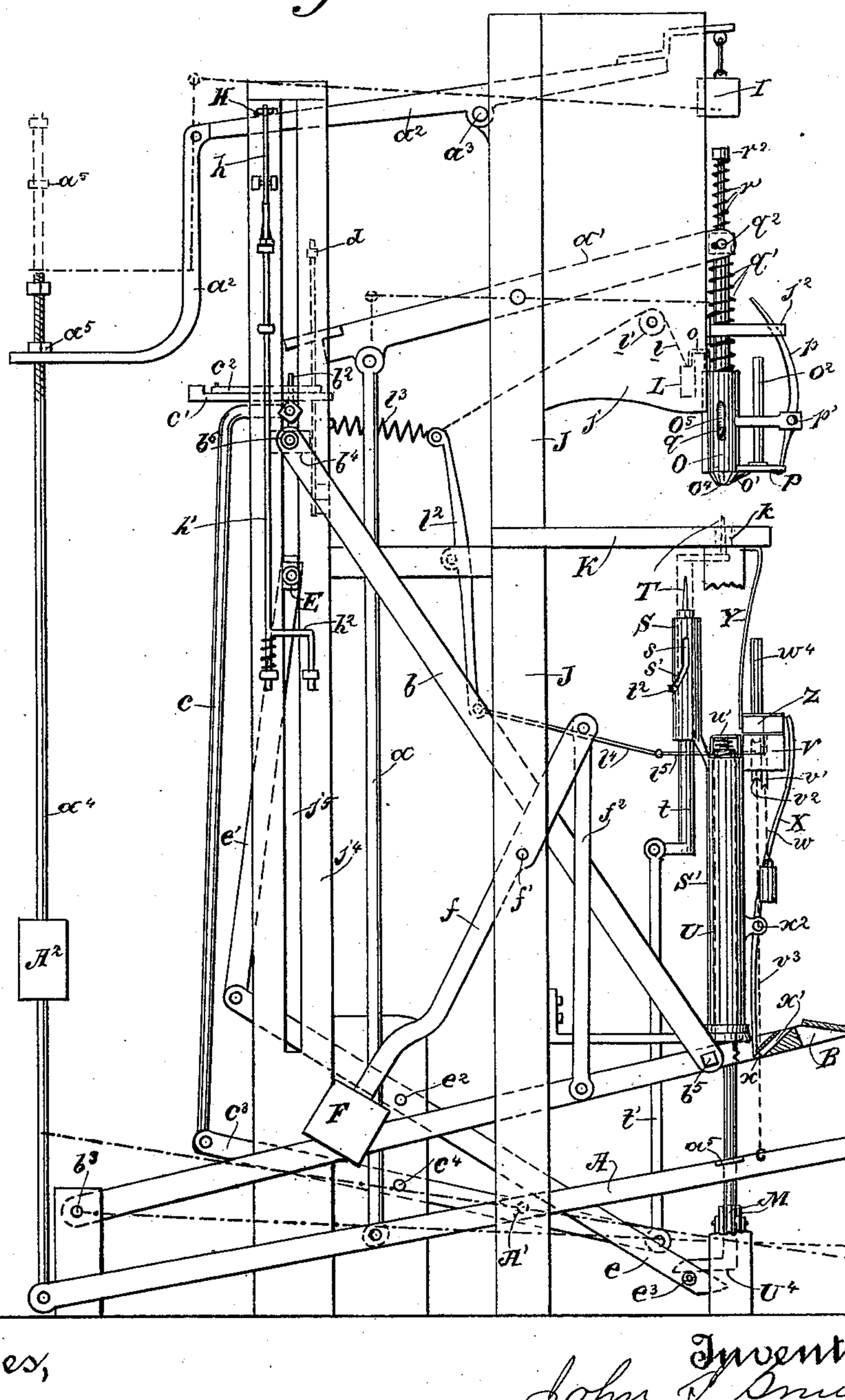
(No Model.) 3 Sheets—Sheet 1.

J. I. SMITH.

RIVETING MACHINE.

No. 534,527. Patented Feb. 19, 1895.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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RIVETING MACHINE.

No. 534,527. Patented Feb. 19, 1895.

Fig. 2.

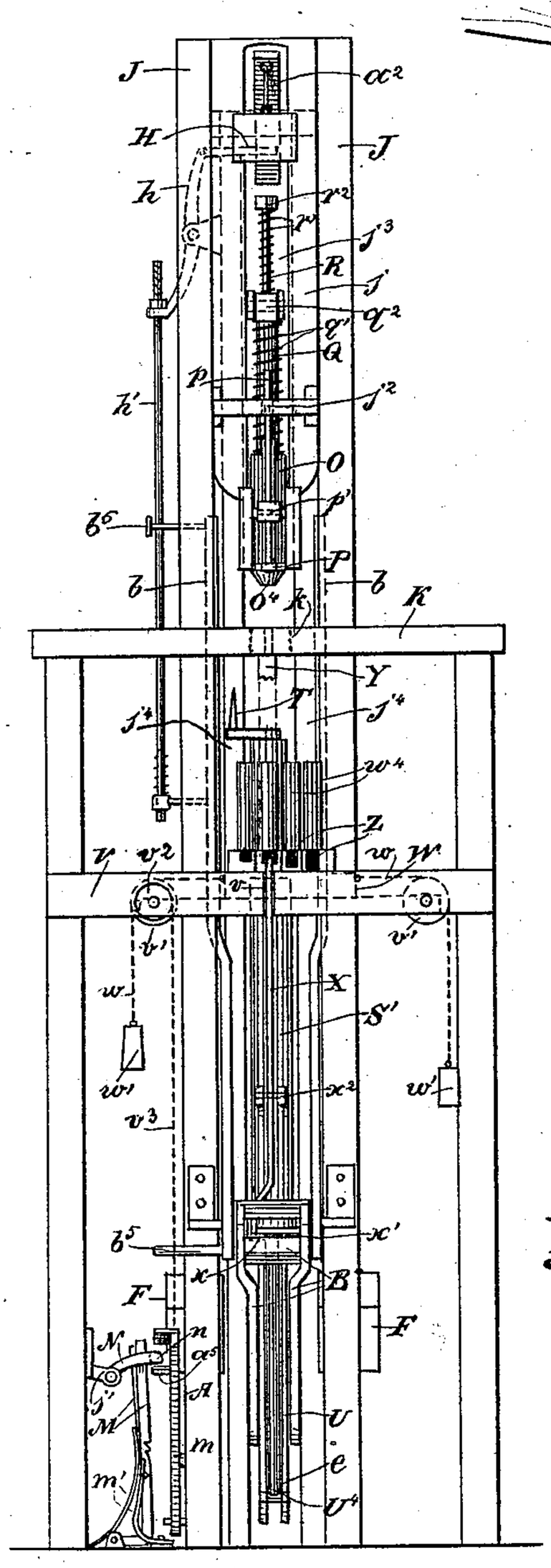

Fig. 3.

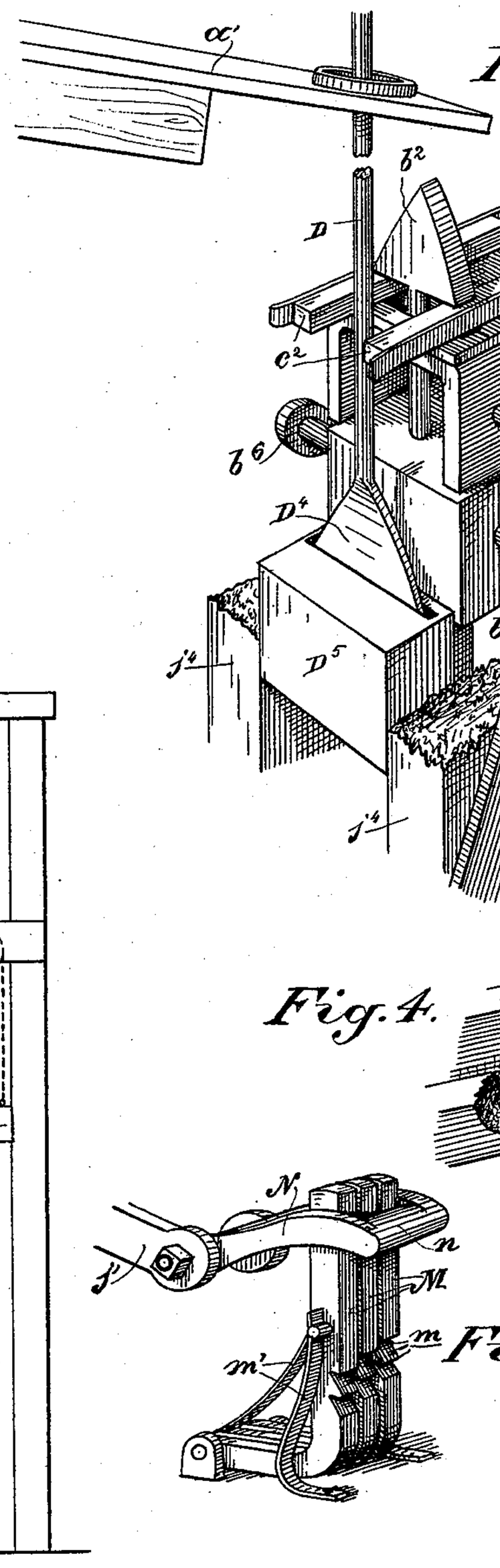

Fig. 4.

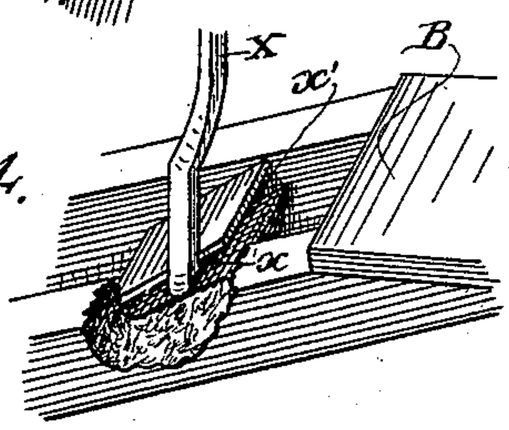

Fig. 5.

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RIVETING MACHINE.

No. 534,527. Patented Feb. 19, 1895.

Fig. 6.

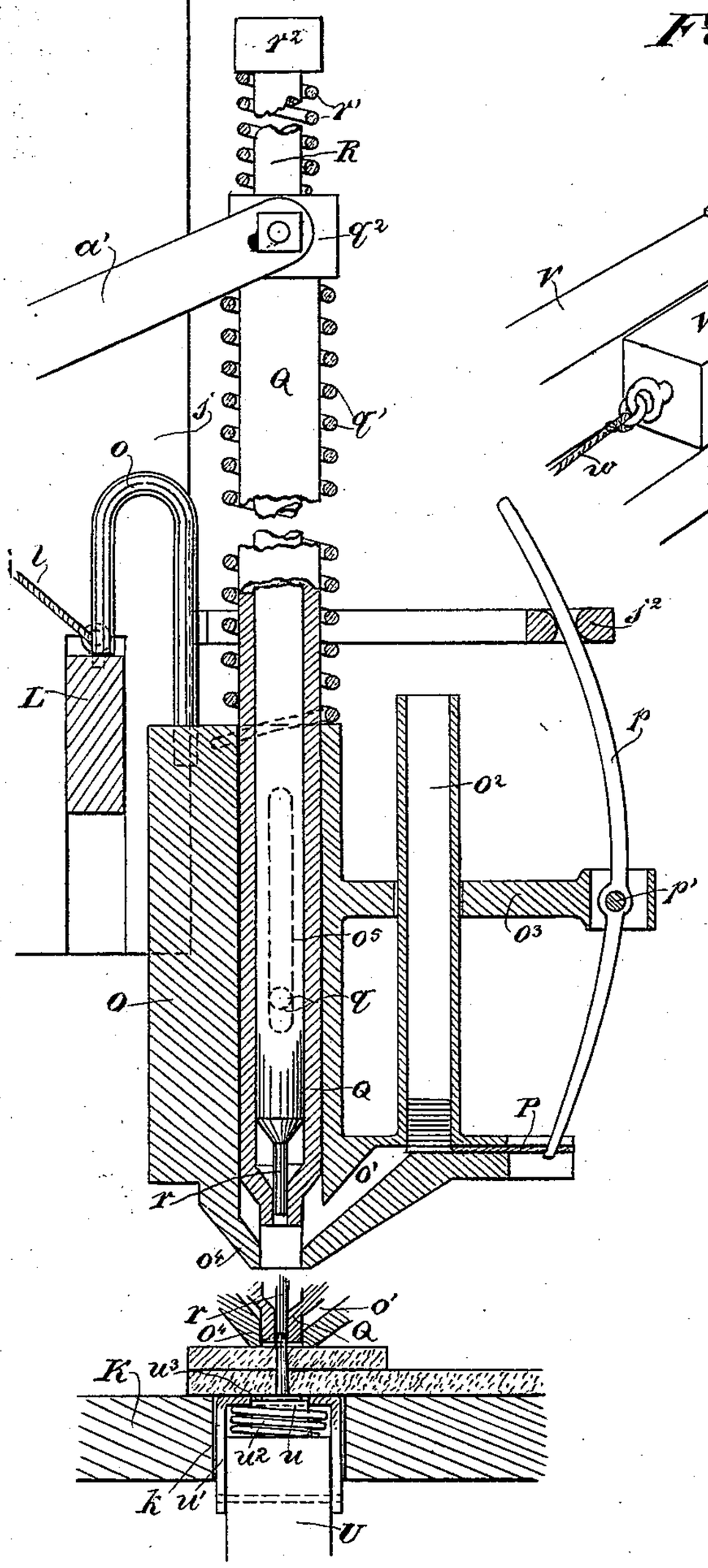


Fig. 7.

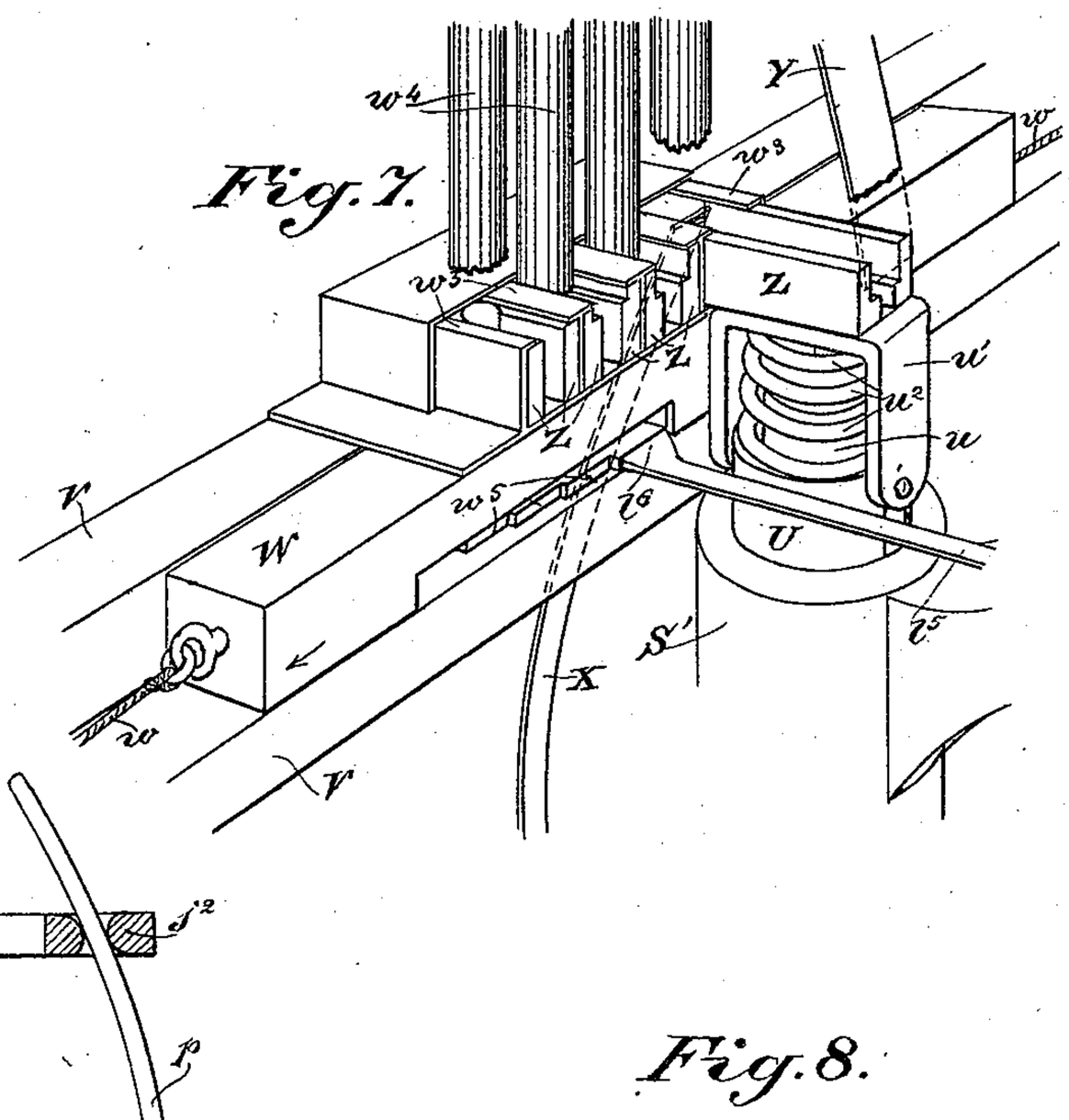
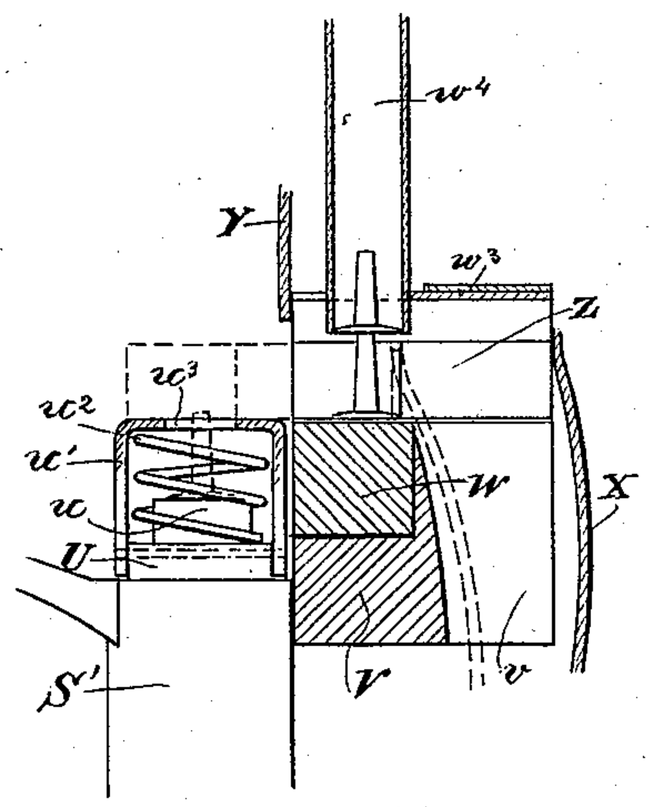


Fig. 8.



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UNITED STATES PATENT OFFICE.

JOHN I. SMITH, OF CHICO, CALIFORNIA.

RIVETING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 534,527, dated February 19, 1895.

Application filed May 2, 1894. Serial No. 509,817. (No model.)

To all whom it may concern:

Be it known that I, JOHN I. SMITH, a citizen of the United States, residing at Chico, Butte county, State of California, have invented an Improvement in Riveting-Machines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to a machine for feeding rivets and washers to the point where they are to be used to secure the parts of a belt or other object together.

It consists in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a side elevation and general view of the apparatus. Fig. 2 is a front elevation. Fig. 3 is a detail view of the awl releasing device. Fig. 4 is a detail for operating the feed device. Fig. 5 is a detail view of the retaining pawls. Fig. 6 is an enlarged vertical section of the washer and rivet feeding device. Fig. 7 is a detail view showing the construction of the parts for feeding rivets of different sizes. Fig. 8 is a vertical longitudinal section of the same.

The object of my invention is to provide an apparatus which is designed to deliver metallic washers beneath a hollow presser foot by which they are held in position upon the part to be riveted, a mechanism by which a hole is punched through the parts in line with the hole in the center of the washer, a mechanism by which a rivet of the proper size is advanced into the hole after the perforating punch has been withdrawn, and a mechanism by which the end of the rivet is upset and headed down upon the washer, with intermediate devices whereby the work is effected.

In carrying out this object I employ a supporting post or frame J having fixed upon it a table K adapted to receive the material to be riveted, as shown plainly in Fig. 6. Above this table is a vertically sliding receiver O having the lower end contracted into a cone-shape, as shown at o^4, and with a central opening made through it which connects with a larger cylindrical opening in the interior of the receiver O adapted to receive a tubular sliding presser foot Q, and within this again is contained the vertically sliding hammer r. The receiver O is movable upon a guide j projecting from the front of the post or support J. The whole of this portion of the device is suspended by a lever arm a' centrally fulcrumed upon the post J and having one end connected with the upper part of the tubular presser foot Q by a pivot pin as shown at q^2. The opposite end of this lever is connected by a rod a with the treadle A fulcrumed to the post J, as shown at A', and having a foot-piece at the front adapted for the foot of the operator, and when this lever is depressed the receiver O and connected parts are lowered to the table. When it is released the receiver and presser foot are raised upwardly again. The hollow cylindrical presser foot Q is surrounded by a spiral spring q', the upper end of which abuts against the enlargement at q^2, and the lower end against the top of the receiver O. Above the part q^2 projects the shank R of the hammer r terminating in the head r^2, and this shank is surrounded by a spring r' which lies between the heads r^2 and q^2, thus normally holding the hammer r in an elevated position, but when compressed allowing its shank R to slide downward within the sliding guide O so as to act upon the rivet at the proper time as will be hereinafter described.

o^2 is a tubular reservoir for the washers or burrs which are contained in it resting upon the bottom and in line with an inclined passage o' through which they are successively delivered so that they will slide down and fall upon the surface of the part to be riveted which lies upon the table K directly beneath the opening o^4 of the receiver O. In order to feed these washers I have shown a lever arm p fulcrumed at p' to a fixed arm o^3 which projects outwardly from the side of the receiver O, and through which the washer holder o^2 extends above the part to which it is attached. Connected with the lower end of the arm p is a slide P and the upper end of the arm p passes through a slot in an arm j^2 which is fixed in a stationary manner to the part j of the frame-work. It will be seen from this construction that when the part O slides downwardly, the movement of the upper end of the lever arm p through the slot in the arm j^2 will advance the lower end of the arm p and with it the slide P so as to force a single

washer into the chute o' through which it passes and is delivered upon the surface to be riveted, and within the opening o^4 in the bottom of the receiver O. The operation of these parts will be as follows:—The presser foot Q and plunger R are suspended from the end of the lever arm a'. Now, when the foot of the operator is placed upon the outer end of the treadle A, it tilts the treadle about its fulcrum point A', and through the connecting rod a, forces the rear end of the lever a' upwardly. The first portion of this movement lowers the receiver O, with its connections, to the face of the material to be riveted by means of the spring q' which has its upper end attached to q^2, and its lower end to the receiver O, the latter being, therefore, simply suspended from the lever a' by means of this spring. This first movement also causes the bent arm p to be thrown outwardly by sliding through j^2, and, consequently, a burr or washer is pushed down and delivered upon the material to be riveted, and held in place by the opening o^4. A pin q projecting outwardly from presser Q travels in a slot o^5 in the receiver O to guide its movement. The continued motion of the lever arm a' then compresses the spring q' and through its connection at q^2 with the hollow sliding presser foot Q, it forces this down upon the washer already in the opening o^4 and holds it in place.

The next operation is to perforate the leather or other material in line with the hole in the washer. This is effected from below by means of a punch T which is fixed vertically upon the upper end of a crank arm which is shown in Fig. 1. The shank t to which this crank arm is fixed passes down through a guide S which has a slot s made in one side. The upper portion of this slot is vertical and the lower portion is diagonal as shown at s', and a pin t^2 projecting from the shank t of the punch T enters this slot. It will be manifest that when the punch shank is raised that the travel of the pin t^2 in the inclined slot s' will first act to turn the shank t and with it the crank arm carrying the perforated punch T a quarter of a revolution. This brings the punch T in line beneath an opening k made in the table K, just in line beneath the material to be perforated, and beneath the washer which has already been set in place as previously described. The further upward movement of this punch perforates a hole through the material, and directly in line with the hole in the center of the washer. The punch on being withdrawn is first drawn straight downward by reason of the straight portion of the slot s, and is afterward turned a quarter of a revolution by means of the inclined portion of the slot s' so that the punch and its crank arm are turned out of line of the washer, and they then stand in the position shown in full lines in Fig. 1. This punch is actuated by means of a foot lever B, a connecting rod b which connects with a cross head b^4, a rod c, a lever arm c^3 connected with the lower end of the rod c and fulcrumed to the frame as shown at c^4, and a connecting rod t' extending from the lever c^3 and connecting with the shank of the punch. The parts are now in readiness to receive the rivet. These rivets are contained in vertical tubes W^4, and are delivered from either of these tubes into horizontal carriers Z which in turn deliver the rivets upon a vertically reciprocating head u, the shank U of which extends down through a cylindrical guide S'. When the rivet has thus been delivered upon the reciprocating plunger, as will be hereinafter more fully described, it is forced upwardly through the opening k in the table K, and through the hole previously punched in the leather or other material, the upper end passing through the hole in the washer which, as previously described, is held firmly in place within the opening o^4, and in line with the rivet. The rivet being in this position, the plunger R with the riveting end r at the bottom, is forced downwardly to give a sudden stroke upon the upwardly projecting end of the rivet by means of a weight or hammer I which has hitherto remained suspended above the head r^2, but which, being now released, as will be hereinafter described, falls upon this head, and compressing the spring r' forces the riveting plunger down, so that its shank r makes a sudden blow and upsets the point of the rivet, securing it firmly within the washer and through the parts which are to be secured. When the rivet is delivered upon the head u of the reciprocating plunger U, it falls through an opening u^3 in the top of a hollow casing u' within which is a coiled spring u^2 surrounding the head of the plunger, with the upper end normally resting against the interior of the casing u'. The casing u' is forced back and the spring u^2 is compressed, as shown in Fig. 6, when the plunger U moves up, and the rivet is thus forced up through the opening u^3. The casing u' is first carried up by the movement of the plunger into the opening k in the table K until its upper surface rests against the bottom of the material to be riveted, and the rivet is then forced through the material and the plunger holds it up while the opposite end is headed and upset as previously described.

As various sizes of rivets are to be used in this apparatus, I have shown several rivet carrying tubes W^4, arranged as shown in Fig. 7. Each of these tubes is adapted to deliver a rivet into a transverse chamber w^3, one of which chambers is situated beneath each of the tubes w^4, and each chamber contains a transversely movable carrier Z. These chambers and tubes are mounted upon a sliding bar W traveling in a guide or channel in a horizontal supporting beam V. To the ends of bar W are attached ropes w and they are led over pulleys v' and have unequal weights w' attached to their ends. These pulleys are located in the cross timber V, and one of them has another pulley v^2 fixed rigidly to it. A rope v^3 is wound around some distance over

the face of v' and then made fast to it. The other end of this cord is connected with the lever A. Now, when A is depressed v' and v^2 will be rotated toward the right and one weight will be raised and the opposite one will descend, and, consequently, pull the carriage W to the right. The release of lever A will allow the weights to return the carrier W to its normal position. This downward movement of lever A, therefore, regulates the side movement of bar W, and this movement is again governed in the following manner:— To one side and in line with the travel of lever A are placed three or more swinging notched levers M, each having notches m in their faces at different elevations to form a continuous rack, and springs m' hold them in contact with a lug a^5 on lever A when engaged with either one of them. The upper ends of these bars pass through a yoke N, the open end of which is fulcrumed upon a bracket j' (Fig. 5) and the bar n which crosses the front of the levers M, is engaged and pressed down by a projection b^5 upon the foot-lever B when the latter is depressed. This act is a subsequent one, and serves to press the levers M back until they free the lever A and allow it to rise again. Before this takes place, however, the remainder of the operation, which is effected by the depression of the lever A, will be described. These notches are so arranged that the vertical distance between them represents the thickness of the material to be riveted, and, consequently, the size of the rivet to be used. To place, for instance, the lever A into a seven-eighths inch notch will allow the receiver O to descend down to the material which is seven-eighths of an inch thick. This movement of the receiver O will also depress the sliding block L traveling in guide slots in the guide j by means of a bent arm o attached to receiver O, and resting with its other end upon the block L. From this block extends a rope l over a guide pulley l' to a lever l^2, and to the other end of this lever is fixed a link l^4, the latter forming connection with a sliding pawl l^5 properly guided, the end l^6 of it engaging teeth w^5 in the form of offsets made in the lower part of bar W. These teeth w^5 are equal in number to the amount of tubes or different sizes of rivets to be used. Now, this depressing of block L will draw the upper end of lever l^2 inwardly, the lower end outwardly, and pawl l^6 also just so far out that when the bar W is now moved by this same movement of lever A, the teeth will pass by the pawl till the one comes which is in line with the pawl, and the movement of the bar W is now stopped, and the tube with the respective rivets for seven-eighths inch leather is now brought in the center and opposite the plunger U. A spring l^3 returns the parts to their initial position again. The foot of the operator is now placed upon the foot-lever B, and this lever is depressed. At the first movement of the lever B, the following action takes place:

X is a curved lever arm fulcrumed at x^2, and having at the lower end an arm or lug x which enters an inclined slot x' made between plates upon the foot lever B as shown in Figs. 1 and 4. The upper end of this lever is in such position that the rivet carrier Z, standing beneath the rivet tube which has been previously brought into line, will be advanced by the movement of the lever X through a slot v made in the timber V, and moved over the opening w^3 in the casing w'. When this carrier Z has thus been moved from beneath the tube, it carries with it a rivet which has dropped from the tube into the carrier, and this rivet, when it reaches the proper position, drops through the opening w^3 within the coil or circle of the spring w^2, and its head rests upon the plunger head u. A spring Y extends down from the table K and always in front of that carrier Z which is placed in the center to feed and press it back after having delivered a rivet to allow the plunger to pass up and also to receive another charge. The lower end of the plunger shank is bent or has an extension at right angles as shown at U^4.

The lever e fulcrumed at e^2 is forked and has a cross piece in the shape of a friction roller e^3 in its lower end upon which this foot U^4 rests, and when the lever e is tilted so as to raise this end, the plunger is raised with it and the rivet is introduced into the material upon the table, as has been previously described.

The movement of the lever e is effected as follows: When the foot-lever B commences its downward movement, as previously described, it acts to pull downward the diagonal connecting link b. This pulls down the cross-head b^4 traveling in the guiding slot j^5 in the frame timbers j^4, as shown in Fig. 1, until the cross-head comes in contact with the sliding cross-head E moving in the same slot. A connecting rod e' extends from this cross-head to the rear end of the lever e and when the cross-head b^4 has come in contact with the cross-head E, as the foot lever B is moved downward, and after the operation of placing the rivet upon the plunger head has been effected, the plunger will be raised to place the rivet in the material. The continued downward movement of the cross-head b^4 brings its extension b^6 in contact with an arm h^2 projecting from a vertical sliding rod h'.

Coming back now to the movement of the foot lever A which was first depressed, the depression of the front end of this lever, raises the rear end, and with it a vertically moving rod a^4 which carries a weight A^2. The upper end of the rod a^4, passes through the extension of a lever a^2 which is fulcrumed at a^3 in the upper part of the frame and which carries at its front end a weight or hammer I in line above the head r^2 of the riveting bar. This lever is maintained in its position by a lever h having a latch H normally projecting over the rear part of the lever a^2 and holding

it down with the hammer I suspended above the riveting bar. The lever being thus held when the rod a^4 is pushed up through the rear extension of the lever a^2, the nut or collar a^5 is also pushed up to some distance above the arm a^2, and remains in this position while the foot lever A is locked in its depressed position.

Now, returning to the movement of the rod h'. When it is moved down by the projection b^6 it acts upon the lever h (Fig. 2) to disengage the catch or lock H, and this releases the lever a^2 which immediately turns about its fulcrum pin a^3 and allows the weight I to fall upon the head of the riveting punch. As the foot lever B is moved still farther down, the projection b^5 acts upon the tilting yoke N, as previously described, to force the locking levers M back, and this releases the lever A which immediately turns about its fulcrum pin A', the front end rising and the rear end being depressed by the action of the weight A^2. This weight is heavy enough to act through the lever a^2, when the collar a^5 descends upon its rear end, and raise the lighter weight I to its normal position.

F is a weight fixed upon the end of a lever f which is fulcrumed as shown at f' and is connected with the foot-lever B by a connecting rod f^2, and this weight acts to return the foot-lever B to its normal position when released. When the foot-lever B is first depressed and pulling upon the connecting rod b, draws the cross-head b^4 down, which is then connected with the rod c, it pushes the latter with its connections down with it, and through lever c^3 and connecting rod t' it pushes the punch or awl T upward, turning it at the same time so that it passes through the leather or other material as has been previously described. This action being completed, it is necessary to release the awl, and allow it to turn out of the way before the plunger carrying the rivet is forced up. This is done as follows:

b^2 is a spear-head having a shank connecting with the cross-head b^4. Above this cross-head is an independent block c' to which the connecting rod c is attached. Upon the top of the plate c' are two horizontally separable spring-actuated arms c^2 which are normally held in such position that the straight edges of the bottom of the spear-head b^2 rest upon them, and as the shank of the spear-head is connected with the cross-head b^4, it will be seen that the cross-head will be thus connected through the block c' with the connecting rod c, and that the downward movement of the cross-head will be imparted to this connecting rod and through it and its connections to the punch. After the punch has been pushed through the material, it is necessary to retract it before the rivet is set, and while the foot-lever B still continues its movement, and this is effected as follows:

D is a rod having upon its lower end a triangular or diverging sided plate D^4 which is held in place in a slot in the top of a block D^5 fixed between the guide posts j^4. The ends of the arms c^2 project upon each side of the shaft D and as the cross-head b^4 and the block c' with its arms c^2 are drawn down, the arms c^2 will reach the triangular plate D^4 just after the rivet hole has been punched. The arms c^2 moving down along the diverging sides of D^4, will be separated and will allow the spear-head b^2 to pass between them, and this releases the block c' from its connection with the cross-head b^4. As soon as this release takes place, the weight of the parts connected with the punch will cause the latter to drop and at the same time turn out of the line of the rivet setting punch, while the cross-head b^4 is allowed to continue its downward movement with the foot-lever B to complete the other operations.

The amount of downward movement to be given to the cross-head c' is dependent upon the thickness of the material to be punched through, and to regulate this the part D^4 of rod D is either raised or lowered in its support to the exact amount necessary for that special thickness by the ascending end of lever a' which, encircling the rod D, travels upward on it till it strikes the nut d (Fig. 1) and carries it up with it till the receiver O rests upon the material to be punched, and thus raises D^4 just so much that the awl can penetrate that respective thickness, and be released and allowed to immediately retreat before the plunger U arrives. This latter movement is also included in the operation of the lever A and forms part of the setting of the device before the act of riveting itself has commenced.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a riveting mechanism, the combination of a table or support for the parts to be riveted, a reciprocating hollow receiver adapted to press upon the parts to be riveted, having a washer magazine movable with it, mechanism actuated by the movement of the receiver to feed the washers successively into the latter, and means for perforating the parts, for setting the rivet through the perforation and washer, and for heading the rivet after being set.

2. In a riveting machine, a vertically reciprocating hollow receiver adapted to press upon the material to be riveted, a receptacle for washers movable with the receiver, mechanism for delivering washers within the lower end of this receiver whereby they are centered, a concentric interior hollow presser foot adapted to rest upon the washer thus placed and hold it in position, a reciprocating punch movable within this presser foot, a mechanism by which the material is perforated in line with the hole in the washer, and a rivet inserted from below, and a mechanism for forcing the rivet punch down upon the point of the rivet to form a head thereon.

3. In a riveting machine, the table support-

ing the material, a vertically reciprocating hollow receiver adapted to rest upon the material, a reservoir movable with the receiver and containing washers and an inclined passage from said chamber to the opening in the bottom of the receiver whereby washers may be passed singly from their reservoir to a position within the receiver, a slide moving transversely across the bottom of the washer reservoir adapted to force the washers singly into the delivery chute, a lever arm carried by an arm from said receiver and connected with said slide, and a stationary arm by which said lever is actuated when the parts move downward so as to force the washers singly into the chute.

4. In a riveting machine, a table for supporting the material to be riveted, a vertically moving receiver, a washer reservoir connected to and movable with the receiver, a chute connecting the reservoir with the circular opening at the bottom of the receiver, and a mechanism for delivering the washers singly into this opening, a hollow presser foot movable within the receiver adapted to hold the washer in its position, an actuating lever connected with the shank of the presser foot and a spiral spring surrounding the shank between the top of the receiver and the actuating lever, whereby the receiver is moved down to rest upon the material, and a washer is delivered into the opening at this lower end, and the presser foot is afterward moved downward to hold the washer in place by the action of the lever and the yielding of the spring, the parts being returned to their normal positions when released by the reflex action of the spring.

5. In a riveting machine, a table supporting the parts to be riveted, a vertically moving hollow receiver mechanism whereby it is moved downward to rest upon the material, a washer reservoir connected to and movable with the receiver, and a mechanism whereby the washers are delivered singly within this receiver upon the material, a presser foot, a lever by which it is moved down after the washer is placed to hold the latter in position, an upwardly moving awl or punch acting through an opening in the table to perforate the material in line with the center of the washer, an upwardly moving plunger by which a rivet is inserted through the material and washer from below, a riveting punch movable within the hollow presser foot so that its point rests upon the upwardly projecting end of the rivet, and a hammer suspended above the head of the punch with mechanism whereby the hammer is released after the rivet and washer are placed, whereby the end of the rivet is upset and headed upon the washer.

6. In a riveting machine, the receiver adapted to receive a washer in its interior and retain it upon the material to be riveted, a washer reservoir connected to and movable with the receiver, a presser foot by which the washer is held in place, a riveting punch movable through the hollow presser foot and spiral springs, one surrounding the presser foot shank above the receiver, and the other spring surrounding the shank of the riveting punch above the presser foot and adapted to raise the punch within the presser foot.

7. In a riveting machine, mechanism for placing the washers and holding them in position above the table and upon the top of the material to be riveted, a perforating punch fixed upon a crank arm which projects to one side of a vertically moving slide, a cam guide within which said slide moves whereby the slide is first turned a quarter of a revolution so as to bring the punch in line beneath the material and the center of the washer, and its movement is afterward continued vertically so as to perforate the material in line with the hole in the washer, a mechanism by which the punch is retracted and turned a quarter of a revolution to be out of line with the rivet opening, a plunger movable in line with said rivet opening, a mechanism by which the rivets are fed singly upon the head of said plunger, and a mechanism whereby said plunger is moved upwardly to force the rivet through the material and superposed washer.

8. In a riveting machine, a table upon which the material to be riveted is supported, a mechanism whereby the washers are placed and held upon the material above the table comprising a vertically reciprocating hollow receiver into which the washers are successively fed, and a concentric presser foot adapted to rest upon the washer and hold it in place a punch and mechanism whereby it is first turned into line beneath the center of the washer and is afterward advanced to perforate a hole in the material in line with the center of the washer, a mechanism whereby the punch is retracted and turned out of line, a rivet setting punch concentric with and within the hollow presser foot, and standing in line with the washer, a rivet feeding tube and transversely moving slide, and actuating mechanism whereby a rivet is removed from the tube and transferred to the head of the plunger, and mechanism whereby the plunger is advanced upwardly to force the rivet through the hole previously made in the material.

9. A rivet feeding mechanism for a riveting machine consisting of a tube within which the rivets are contained, a transversely moving carrier reciprocating beneath the tube and adapted to remove the rivets singly, a vertically reciprocating hollow receiver into which the rivets are successively fed, said receiver adapted to press upon the material to be riveted a vertically moving plunger reciprocable in line with the part to be riveted and adapted to receive the rivet from the carrier, a hollow casing on said plunger having an internal spring surrounding the head thereof, and having an opening in its top, a foot lever and an intermediate lever actuated from the

foot lever adapted to move the carrier and the rivet whenever the foot lever is depressed.

10. In a riveting machine, tubes carrying rivets of different sizes, a slide upon which said tubes are supported and by which they are movable transversely, carriers situated beneath the tubes and adapted to receive rivets, a mechanism by which either of the carriers with its rivet is moved transversely so as to deliver the rivet upon the head of the rivet setting plunger, a mechanism by which either of the tubes is brought in line with the plunger, consisting of a plate w^5 having offsets corresponding with the different rivet tubes, and a stop bar L^6 adapted to engage either of the offsets to retain either of the tubes in position to deliver its rivet to the rivet setter.

11. In a riveting machine, mechanism comprising a vertically reciprocating hollow receiver and a concentric internal hollow presser foot for delivering and holding the washers upon the top of the material to be riveted, a punch and means whereby it is adapted to be moved into line beneath the material and the center of the washer, and afterward forced through the material, then retracted and turned out of line, a rivet setting plunger reciprocating below the material in line with the hole thus made, a mechanism whereby rivets are fed singly upon the head of said plunger to be forced through the material and the washer, a rivet heading punch within and concentric with the hollow presser foot, a weight suspended above the rivet heading punch, a lever and tripping mechanism whereby the weight is released to fall upon the riveting punch.

12. In a riveting machine, the transversely movable rivet carrying tubes, and mechanism by which rivets are delivered singly from either tube to the carrying and setting punch, a plate w^5 with steps or offsets corresponding with the rivet tubes, a stop bar L^6 adapted to engage either of the offsets and arrest the plate with the desired rivet tube in position, and connections between the stop bar, and the vertically sliding receiver which rests upon the surface of the material to be riveted, whereby the rivet carrying tube presented corresponds with the thickness of the material.

13. The fulcrumed lever a^2 and riveting weight or hammer I, the vertical rod a^4 movable through the rear end of the lever a^2 and having an adjustable nut or collar above the lever, a weight greater than that of the hammer secured to the rod, a foot lever by which this weight and rod are raised, and a device to release the lever a^2 and allow the hammer to fall, and subsequently to release the foot lever and greater weight, whereby the lever a^2 is caused to again raise the hammer.

14. The foot lever B, the lever c^3, connections between said levers, the perforating punch connected with the lever c^3 whereby it is forced up through the material when the foot lever is depressed, and means for permitting the punch to be withdrawn during the downward movement of the foot lever comprising a spear-head interposed in the connections between the levers B and c^3, spring-actuated arms below the bottom of the said head, and the diverging plate in the path of the said arms for separating them whereby the spear-head is released.

In witness whereof I have hereunto set my hand.

JOHN I. SMITH.

Witnesses:
S. H. NOURSE,
H. F. ASCHECK.