

**M. BRAY.**  
**MACHINE FOR MAKING RIVETS.**  
 No. 188,772. Patented March 27, 1877.

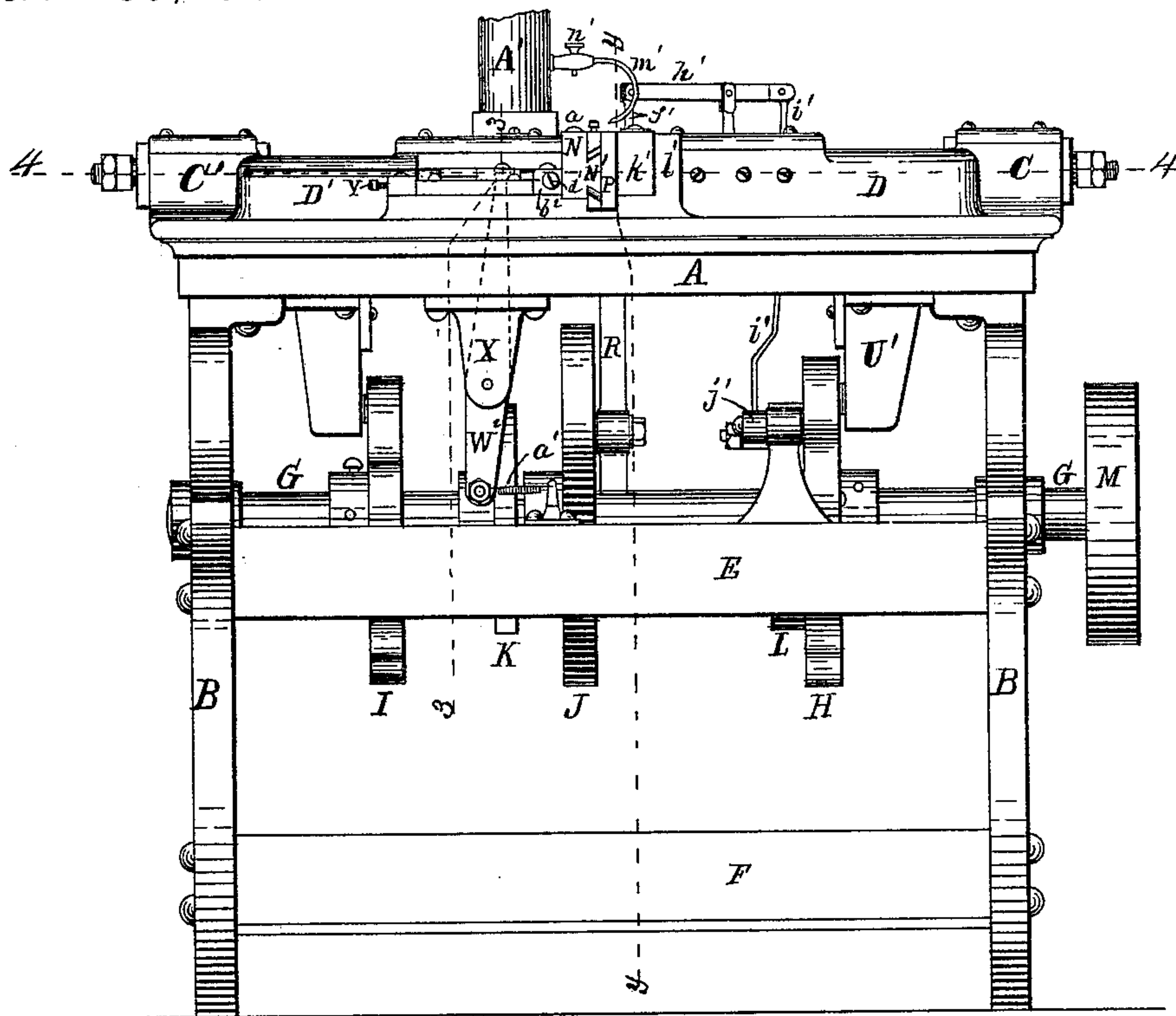


FIG. 2

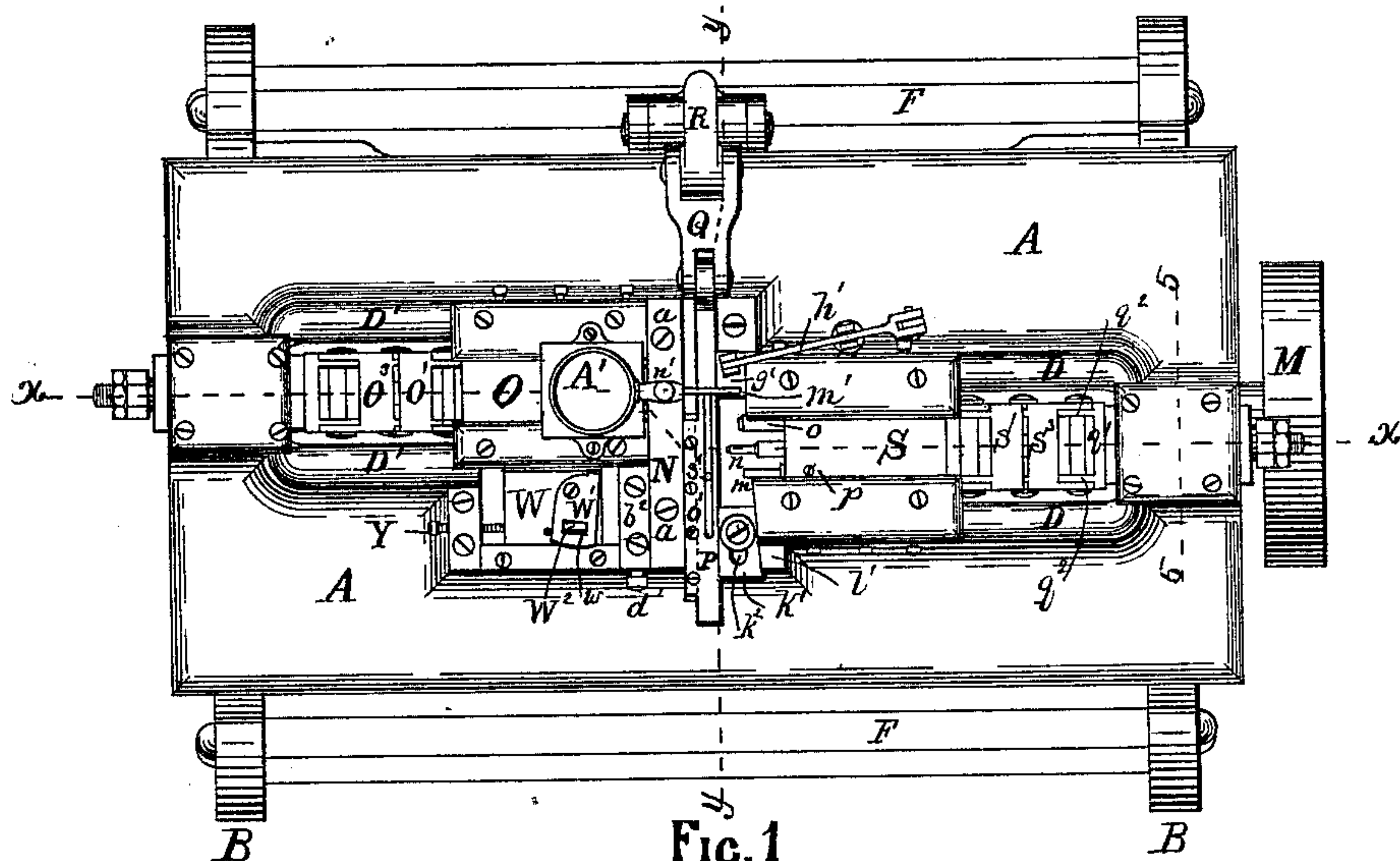


FIG. 1

WITNESSES.

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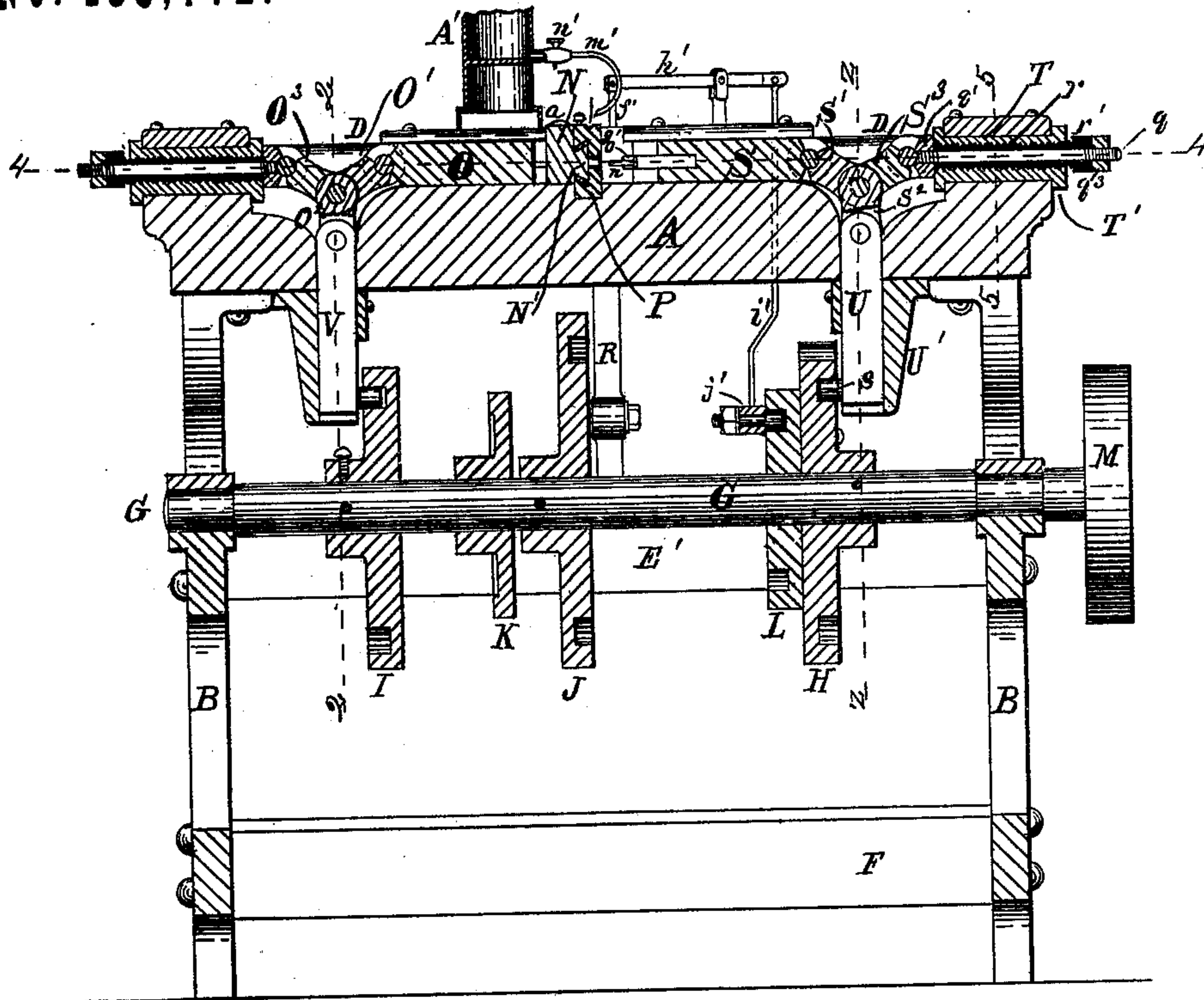


FIG. 3

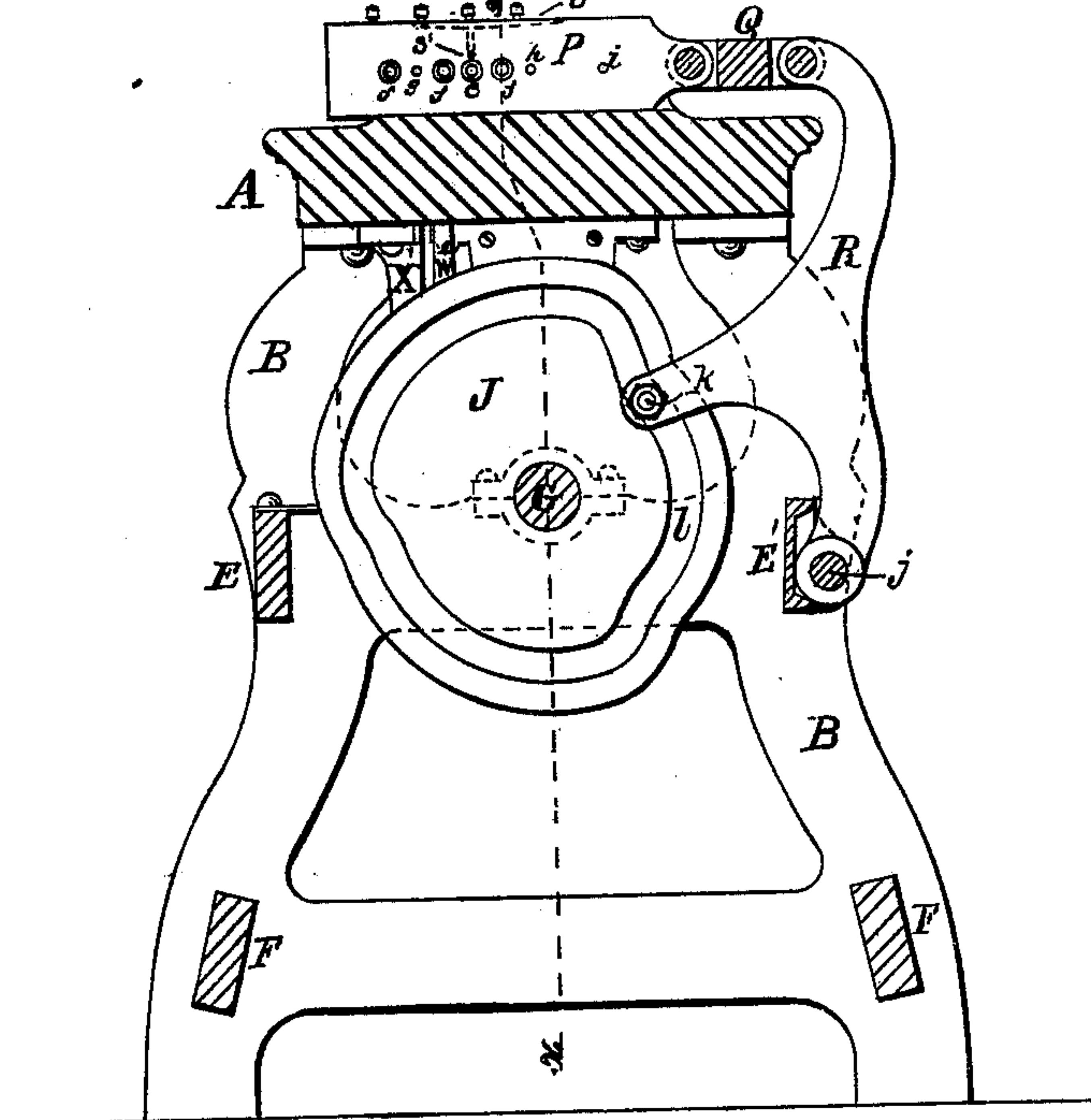


FIG. 4

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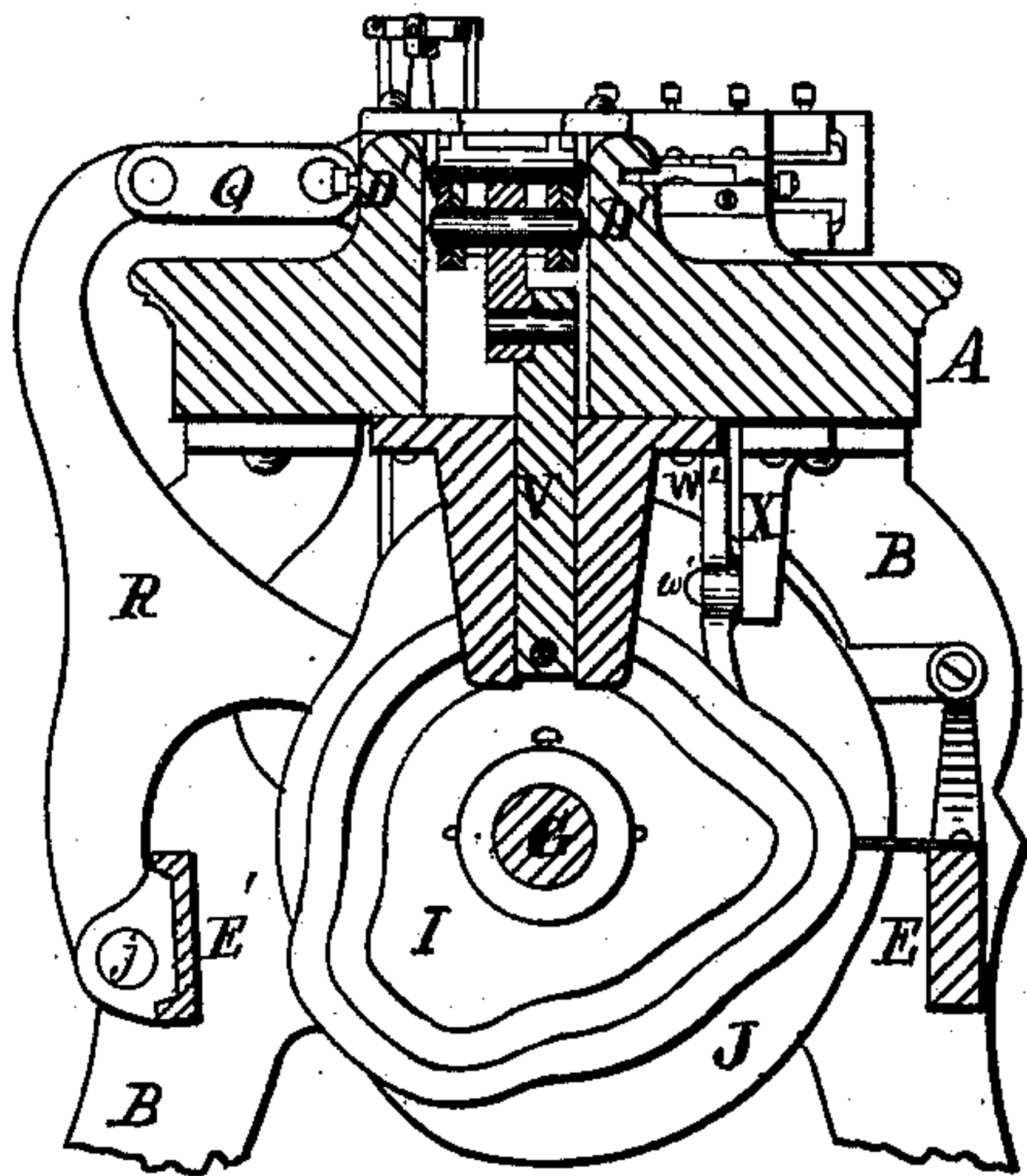


FIG. 6

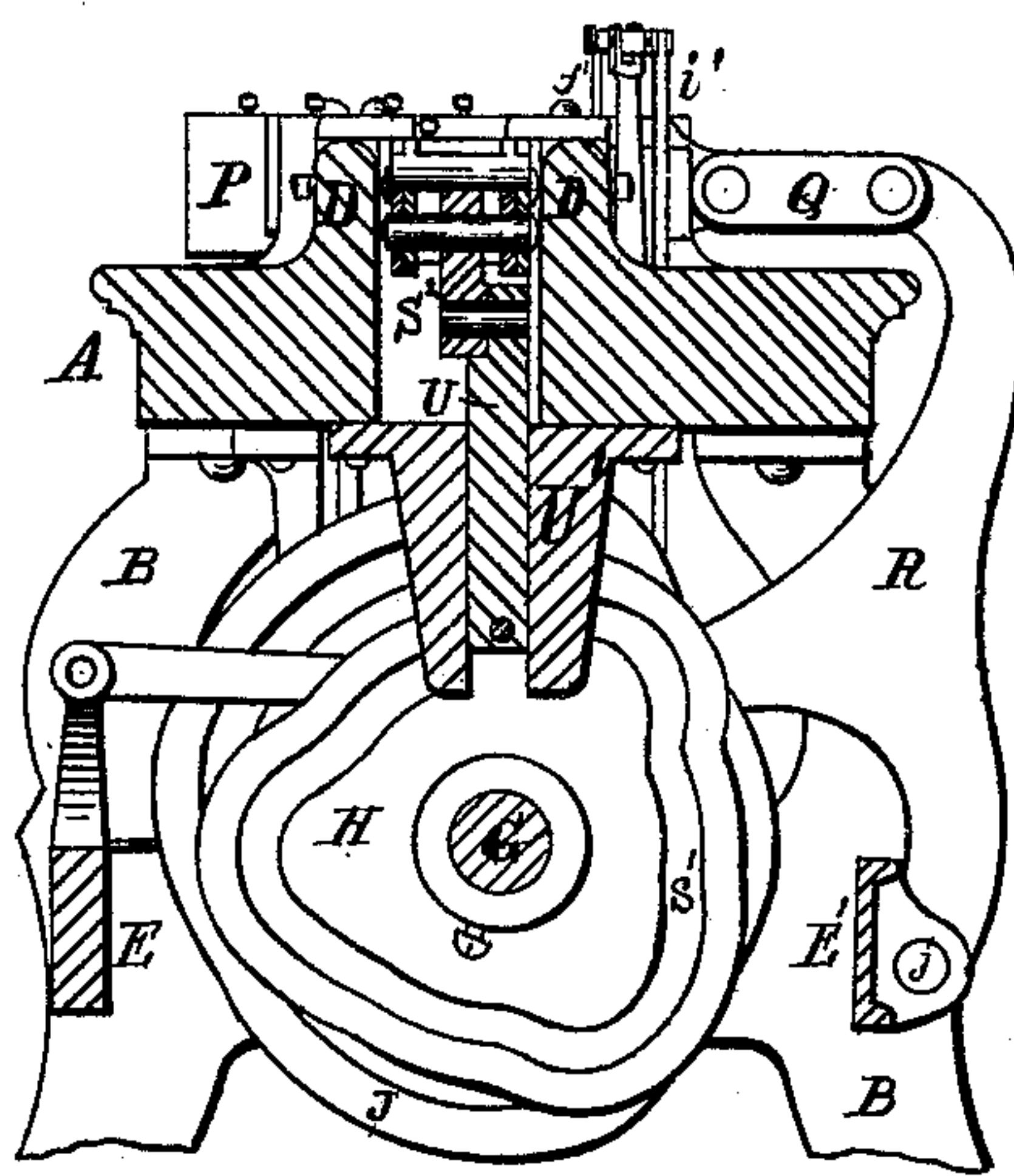


FIG. 5

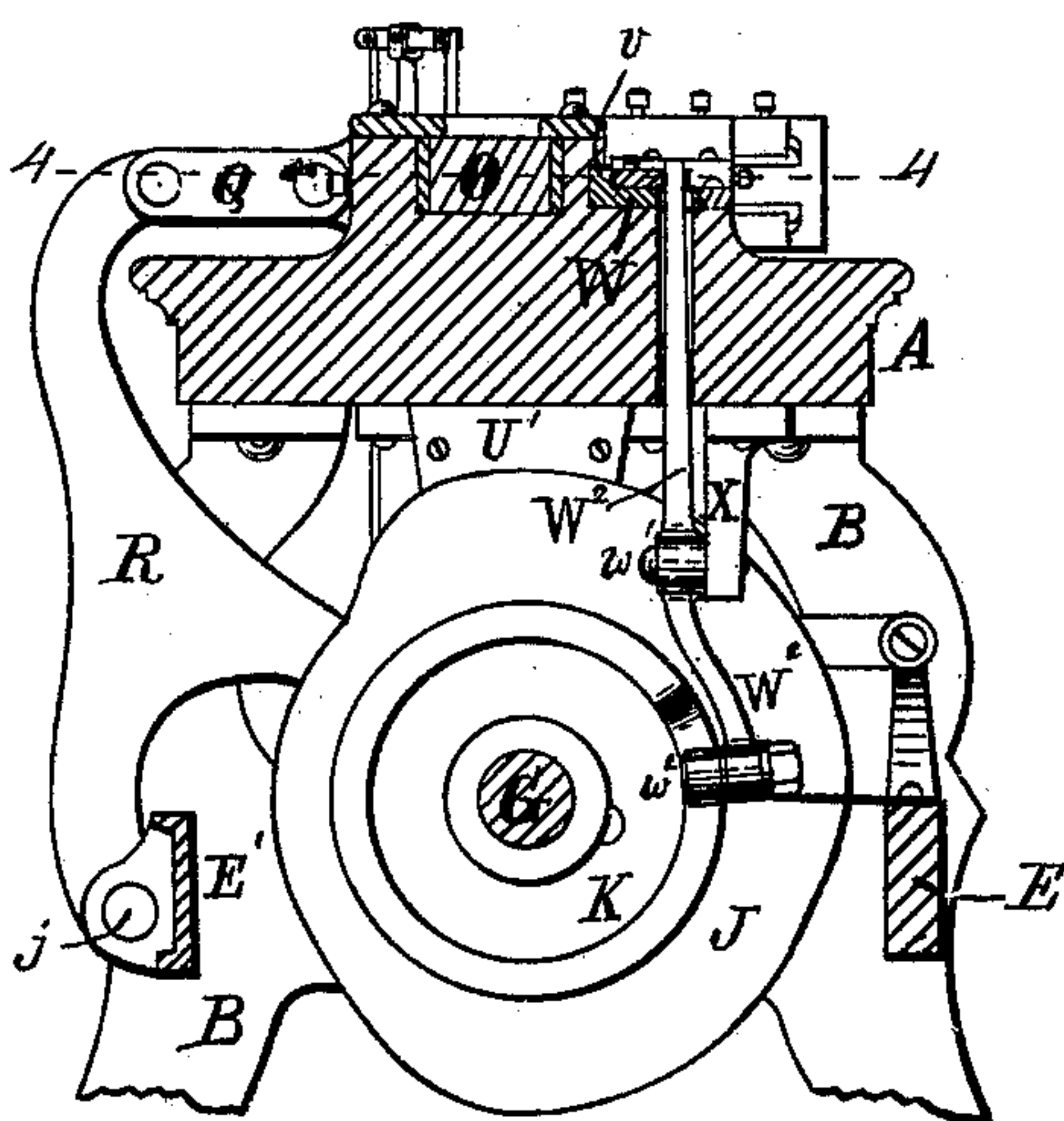


FIG. 7

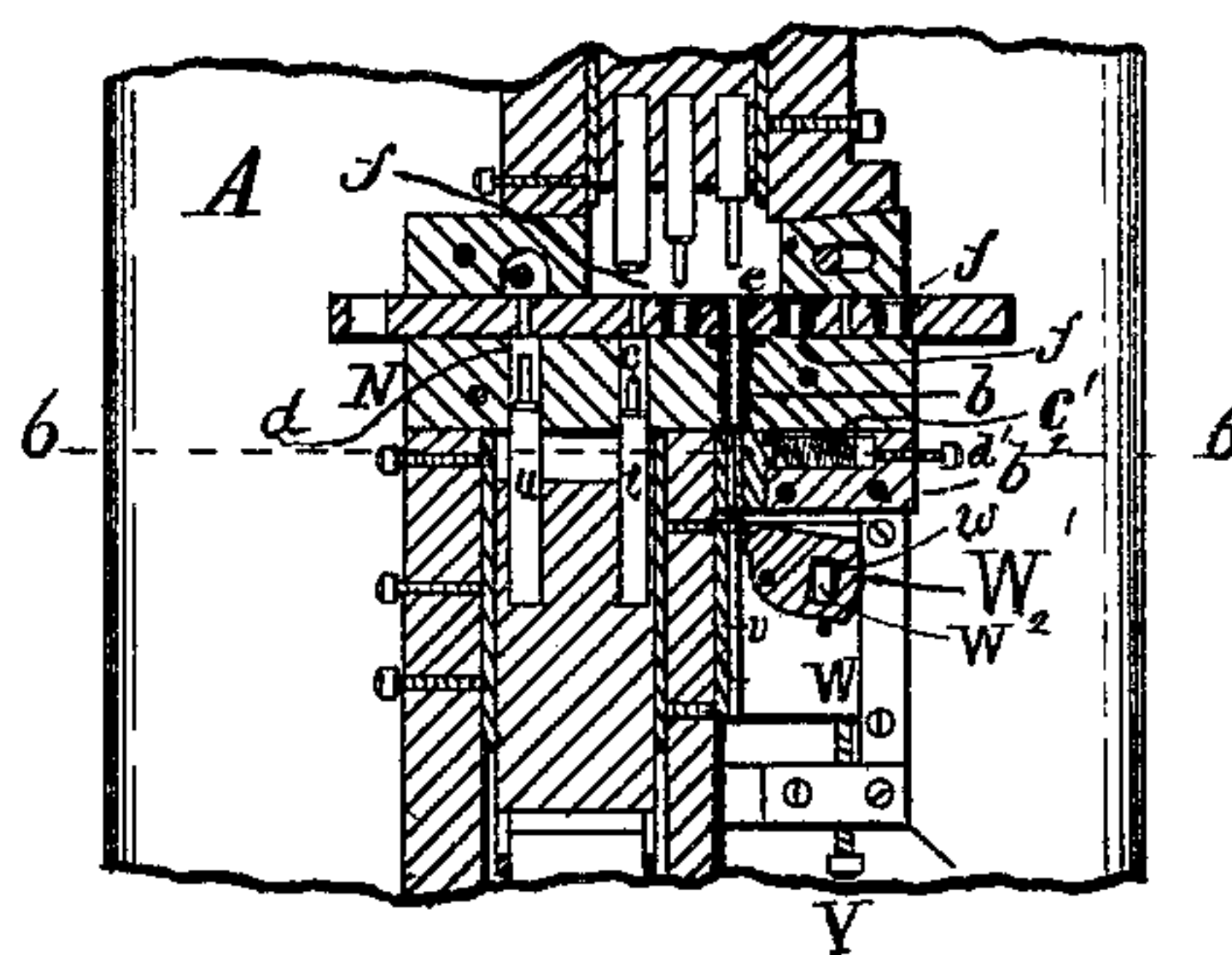


FIG. 8

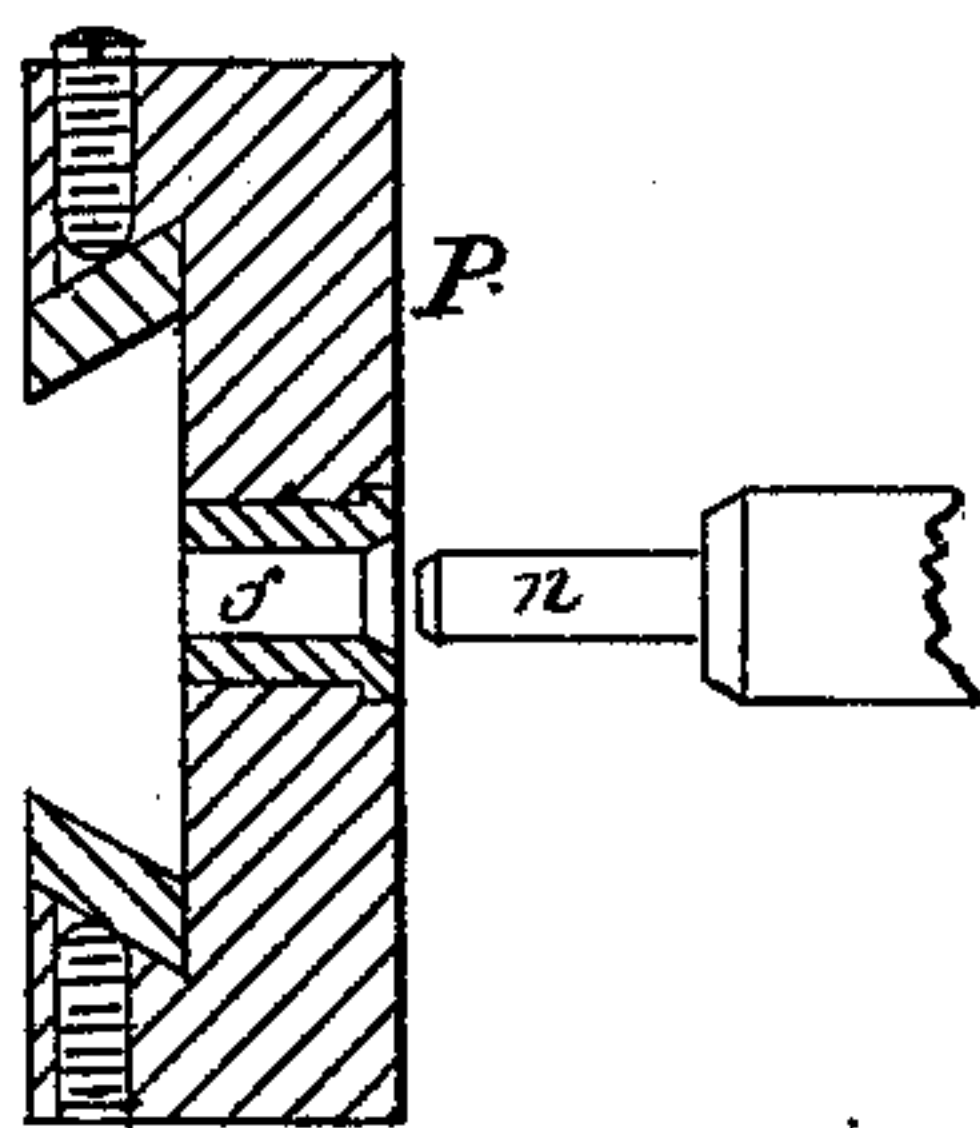


FIG. 10

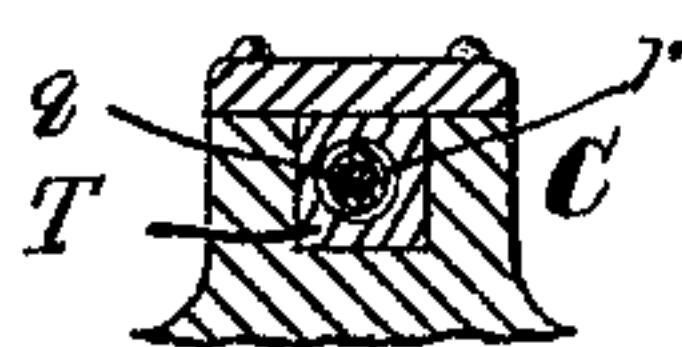


FIG. 9

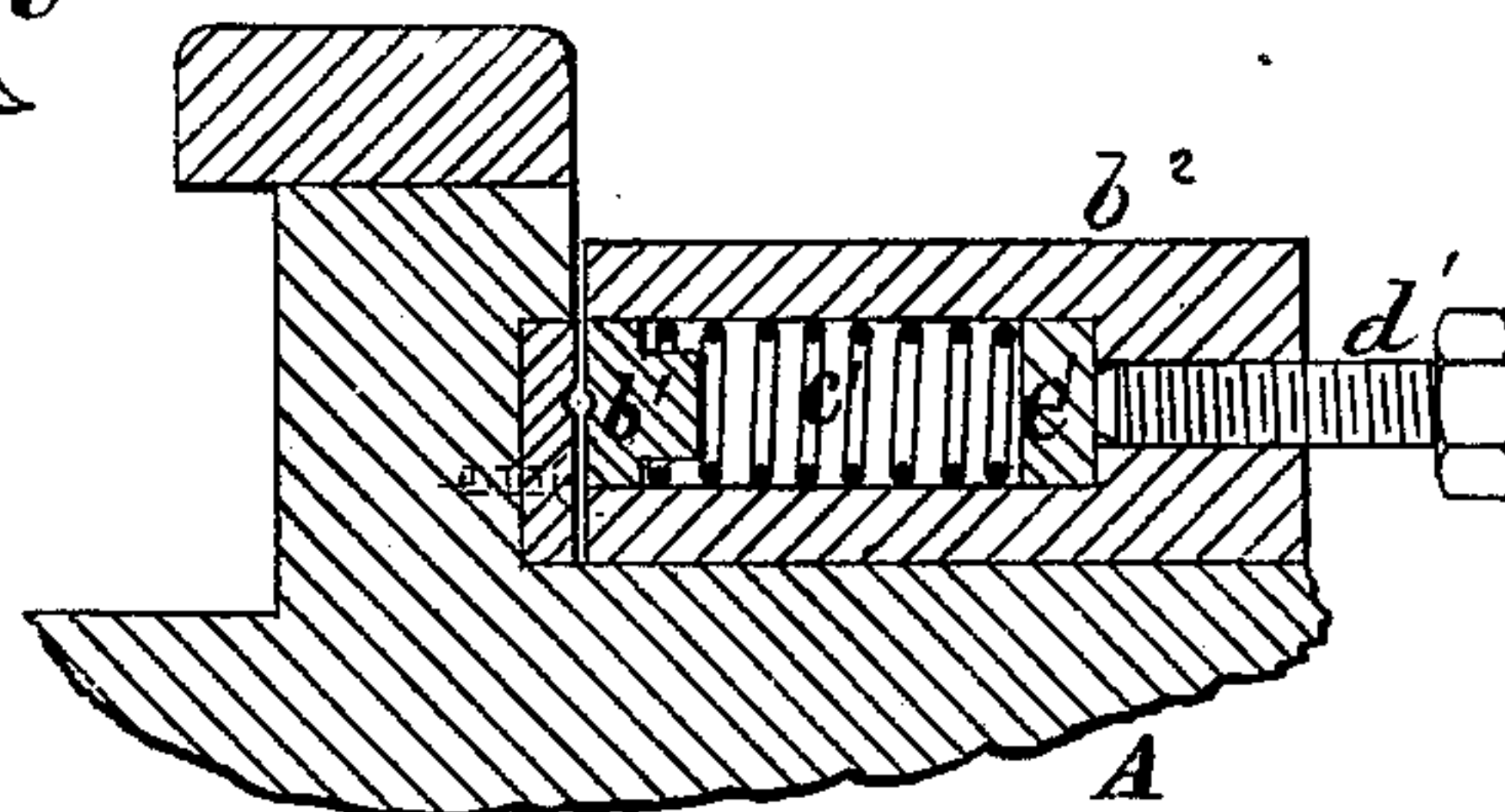


FIG. 11

WITNESSES.

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# UNITED STATES PATENT OFFICE.

MELLEN BRAY, OF NEWTON, MASSACHUSETTS.

## IMPROVEMENT IN MACHINES FOR MAKING RIVETS.

Specification forming part of Letters Patent No. **188,772**, dated March 27, 1877; application filed October 2, 1876.

*To all whom it may concern:*

Be it known that I, MELLEN BRAY, of Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Machines for Making Rivets, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to a machine for making solid rivets, and especially to the arrangement and mode of operating the feeding, cutting, and heading devices; and it consists, first, in the use, in combination with a fixed or stationary annular cutting-die, through which the wire from which the rivets are to be made is fed, of a movable annular die mounted in a carrier, to which is imparted an intermittent reciprocating motion in such a manner that the first movement of said movable die shall sever a blank from the end of the wire and convey it, still retained in the die, into a position between the heading-tools, where it remains in a state of rest till the heading-tools have acted thereon, and then, by a further movement in the same direction, said die carries the headed rivet to a position in front of the discharge-plunger, which forces the rivet from the die while said die is in a state of rest, and then the die is returned by a single movement to its first position, in line with the stationary cutting-die, ready to receive the wire from which, by the next forward movement of the movable die, is to be cut another blank, to form the next rivet.

My invention further consists in the combination, with a stationary cutting-die, and a movable annular die mounted in a carrier, adapted to be intermittently moved into three different positions in succession, and remain in a state of rest for a limited time in each of said three positions, to permit the feeding of the wire into said die, the heading of the rivet therein, and the discharge of the rivet therefrom, respectively, of three annular hardened-steel bushings, set at suitable intervals in said die-carrier, and having the mouths of the openings therein made conical or tapering outward, and a single register-pin, having its front end correspondingly tapered, and adapted to be reciprocated intermittently, in a line at right angles to the motion of the die-car-

rier, and to enter in succession each of said bushings, for the purpose of correcting any inequalities in the movement of the die-carrier, caused by the spring of the parts or wear of the joints, and thus cause a correct register of the movable annular die relative to the several tools co-operating therewith in the three different positions.

My invention further consists in the combination of an annular die, mounted in a carrier adapted to be moved, intermittently, into three different positions in succession, and remain in a state of rest for a limited time in each of said positions, and a cross-head or slide, adapted to be reciprocated intermittently in a line at right angles to the motion of the die-carrier, and carrying in its front end a gage-pin, to determine the length of blank to be cut from the wire, a register-pin, to correct the position of the die, and a heading-hammer or swage-die.

My invention further consists in the combination of an annular die, mounted in a carrier adapted to be intermittently moved into three different positions in succession, and remain in a state of rest for a limited time in each of said positions, and a pair of cross-heads or slides, one upon each side of said die-carrier, and adapted to be intermittently reciprocated toward and from said die carrier, one of said cross-heads having set in its front end a gage-pin, a register-pin, and a heading or swage die, and the other having set in its front end a locating-plunger, in line with the heading die, and adapted to enter the annular die and force the blank partially out of said die into position to be acted upon by the heading-die, and a discharge-plunger, adapted to enter the annular die when moved to its third position, and force therefrom the finished rivet.

My invention further consists in the combination of a die-carrier or slide fitted to move in a right line upon a dovetailed or equivalent bearing, a cam having three throws—*i. e.*, two rises and one fall—arranged about equidistant from each other, with a stand-still or concentric portion between each two throws, and a cam-lever connected to said die-carrier, and adapted to impart thereto a motion corresponding to the throws of said cam.



My invention further consists in the combination of a reciprocating cross-head or sliding plunger, carrying in its front end a register-pin and a heading-die, a pair of toggle-links, jointed together and connected at one end to said cross-head, and at the other to a fixed portion of the frame; a revolving cam having six throws—i. e., three rises and three falls—said rises being arranged about equidistant from each other, with a stand-still or concentric portion between the base of each rise and the base of the preceding fall; and a sliding or reciprocating plunger provided with a cam-truck at its lower end, and connected at its upper end with the central joint of the toggle, all so arranged that an intermittent reciprocating motion is imparted to said cross-head, and power sufficient is exerted to head the rivet with ease.

My invention further consists in connecting the stationary or fulcrum end of the toggle-joint, for operating the heading and discharge cross-heads, to the bed or table of the machine by means of central bolt, having a forked head at one end, to receive the toggle-link, and a binding-nut and screw-thread at the other end, in combination with a sleeve or tubular bolt, adapted to inclose the shank of said forked bolt, and of a length sufficient to cover said forked bolt between its forked head and the binding-nut, said tubular bolt being provided at one end with a hexagonal or other prismatic-shaped section, to which a wrench may be applied, and the remaining portion of its exterior surface having formed thereon a screw-thread to fit a corresponding female screw-thread or nut formed in a portion of the bed or table, or a block of metal secured thereto.

My invention further consists in the combination of a reciprocating cross-head or slide, carrying in its front end a locating-pin to force the blank partially out of the die preparatory to the rivet being headed, and a discharge-plunger to force the headed rivet from the die; a pair of toggle-links, pivoted together and connected at one end to said cross-head, and at the other end to the bed or table of the machine; a rotating cam having four throws—i. e., two rises and two falls, of equal height—the bases of said rises being distant from each other about one hundred and twenty degrees in one direction, or about two hundred and forty degrees in the other, with a stand-still between the base of each rise and the preceding fall; and a reciprocating plunger, arranged in a position radial to the axis of motion of said cam, and provided at its lower end with a truck or stud, to be acted upon by said cam, and connected at its upper end to the central joint of said toggle, in such a manner that the reciprocation of the radial plunger will cause an alternate straightening and bending of the toggle-joint, and thereby cause a reciprocating motion of the cross-head with sufficient force to force the rivet from the die after it

has been swaged therein by the action of the heading-tools.

My invention further consists in the combination of a sliding plate, having upon one side of its upper surface a raised rib, to serve as a fixed jaw, a pawl or movable jaw pivoted to the upper surface of said sliding plate, a lever mounted upon a suitable fulcrum-pin, and connected at one end to said pawl or movable jaw, in such a manner that a movement of the end of said lever in the direction of the motion to be imparted to the sliding plate will cause said pawl to be oscillated about its fulcrum-pin till its toe or point engages with the raised lip or stationary jaw, or a wire interposed between the two jaws, when the slide will be moved forward, and a cam for imparting to said lever a single vibration in each direction at each revolution of the cam-shaft.

My invention further consists in the use, in combination with the feed devices described in the last paragraph, of a fixed jaw and a movable jaw, operated by a spring, and adapted to press against the wire and hold it from being drawn back when the feed devices are moved back to take a new hold upon the wire for the next forward movement.

My invention further consists in the combination of a sliding feed-plate, carrying a fixed and a pivoted jaw to gripe the wire, a vibrating lever, an open side or face cam, adapted to move said lever in one direction, a spring for moving it in the opposite direction, and a screw stop-bolt, adapted to limit and vary the distance to which the feed-jaws can be moved back, and thereby determining the length of the blank to be cut from the wire at each operation of the cutting-dies.

My invention further consists in the use, in combination with a fixed or stationary bar, having set therein a stationary annular die and an intermittently-reciprocating die-carrier, of an adjustable block or abutment, bearing upon one side against the face of the movable die-carrier opposite the face of the die which does the cutting, and its opposite side, which is beveled or slightly wedge-shaped, bears against a correspondingly-beveled surface of the casting of the bed or table, said abutment being secured in place by a screw-bolt passing through an oblong slot in said abutment and tapped into the table below, all so arranged as to resist the tendency of the dies to separate in the direction in which the wire is fed—caused by the dies becoming dulled and the resistance presented by the wire—said abutment being adjusted by moving horizontally toward the center of the machine, to compensate for the wear of the parts.

My invention further consists in the combination, with a stationary cutting-die, a movable annular die, and an intermittently-operating feeding device, of a gage-pin, so mounted in an intermittently-reciprocating cross-head that it may be adjusted to project a greater or less distance therefrom, so that its end may



approach within a greater or less distance of the cutting-faces of the dies at each advance of said gage-pin, according as a long or short rivet is being made.

My invention further consists in the use, in combination with the intermittently-reciprocating die-carrier, and the discharge-plunger for forcing the rivet from the die, of a knock-off plunger, having a reciprocating motion imparted thereto in a direction at right angles to the motion of the discharge-plunger, as will be further described.

My invention further consists in the use, in combination with a solid annular die and a reciprocating swage or heading die, of a locating-pin having a conical point located in line with said heading-die, and adapted to form in the end of the rivet-shank a conical recess.

My invention further consists in the use, in combination with a solid annular die, in which rivets are formed from blanks in a cold state by pressure, and from which the finished rivets are forced endwise, of an oil-tank provided with a discharge-pipe and cock for regulating the flow of oil, all so arranged that said annular die and the rivet-blank shall be lubricated before the heading of each rivet.

My invention further consists in forming, in the upper edge of the reciprocating die-carrier, a channel-way of a length somewhat greater than the movement of said carrier, the bottom of which is inclined toward the center, and communicating with a vertical oil-hole extending downward into said carrier, and opening through the front face thereof, just above the annular die, in combination with a fixed oil-tank and discharge-pipe.

Figure 1 is a plan of my improved rivet-making machine. Fig. 2 is a front elevation. Fig. 3 is a longitudinal vertical section on line *xx* on Figs. 1 and 4. Fig. 4 is a vertical transverse section on line *yy* on Figs. 1 and 2. Fig. 5 is a vertical transverse section on line *zz* on Fig. 3. Fig. 6 is a vertical transverse section on line 2 2 on Fig. 3. Fig. 7 is a vertical transverse section on line 3 3 on Fig. 2. Fig. 8 is a partial horizontal section on line 4 4 on Figs. 2 and 7. Fig. 9 is a partial transverse section on line 5 5 on Figs. 1 and 3. Fig. 10 is a vertical section through die-carrier and register, bushing, and showing a portion of the register-pin in position to enter said bushing, drawn to an enlarged scale; and Fig. 11 is a partial section on line 6 6 on Fig. 8, also enlarged.

A is the bed of the machine, supported on the end frames B B, and having cast upon its upper surface the raised boxes C and C', one at each end of said bed, and the raised ribs D D', extending from either side of each of said boxes C and C', toward the center of the length of the bed, parallel to each other, as shown in Fig. 1.

The end frames B B are tied together by the tie-girts E E' and F F'.

G is the driving-shaft, mounted in suitable

bearings on the end frames B B, and having mounted thereon the cams H, I, J, K, and L, and the driving-pulley M.

N is a bar of metal, secured to the upper surface of the bed A by the screw-bolts *a a*, said bar extending transversely of said bed, and located near the center of the length of the bed, and close against the inner ends of the bearings, in which the cross-head O moves, and having formed upon its opposite side the dovetailed rib N', upon which is fitted, so as to be moved endwise thereon, the die-carrier P.

The bar N has set therein the annular cutting-die *b*, and is provided with the holes *c* and *d* for the passage of the blank-locator and discharge-plunger, as shown in Fig. 8.

The die-carrier P has set therein the annular die *e*, adapted to cut the blank from the wire, hold it while being headed, and convey the finished rivet to the place of discharge, and the hardened-steel bushings *f f f*, having the inner corners of their outer faces beveled, as shown, and adapted to engage successively with the register-pin *n*, to correct any inequalities in the movements of the die-carrier P, and is also provided with the holes *g*, *h*, and *i*, for the passage of the locating-plunger *t* or discharge plunger *u* in the different positions of the die-carrier P, as shown in Fig. 4.

The rear end of the die-carrier P is connected by the link Q to the upper end of the cam-lever R, which is pivoted at *j* to the rear upper girt E', and carries at *k* a truck, which fits into the path *l* of the cam J, as shown in Fig. 4.

The path *l* of the cam J has three throws—*i. e.*, two rises and one fall—arranged about equidistant from each other, about the axis of the cam, with a stand-still or concentric section between each two of said throws, all so constructed and arranged that a complete revolution of the cam J, acting upon the truck *k* on the lever R, will cause the die-carrier to be moved from its position with the die *e* in line with the fixed die *b*, as shown in the drawings, toward the rear of the machine till the die *e* has cut a blank from the wire and carried it into a position in front of the swage *o* for forming the head, remain in a state of rest till the rivet is headed, then move in the same direction again till the die *e* is brought in front of the discharge-plunger *u*, remain in a state of rest till the rivet is discharged, and then move toward the front of the machine till the die *e* returns to its starting-point in line with the die *b*.

O and S are two cross-heads, arranged in the same horizontal plane, one upon each side of the bar N, and the die-carrier P mounted thereon, and adapted to be reciprocated toward and from said bar and die-carrier.

The cross-head S has set in the end thereof toward the die-carrier the gage-pin *m*, register-pin *n*, and the swage-die *o*, for forming the head of the rivet, the gage-pin *m* being so fitted that it may be adjusted to any desired



position, and held in place by the set-screw  $p$ , for the purpose of varying the length of the piece of wire to be cut from the rod at each revolution of the cam-shaft.

To the opposite end of the cross-head  $S$  is pivoted one end of the toggle-link  $S^1$ , which, in turn, is also pivoted to the connecting-rod  $S^2$  and the toggle-link  $S^3$ , the opposite end of which is pivoted to the ears  $q^2$   $q^2$ , formed upon the head  $q^1$  of the bolt  $q$ , upon the outer end of which is formed a screw-thread, to which is fitted the nut  $q^3$ .

A sleeve,  $r$ , provided with a hexagonal or other prismatic-shaped head,  $r'$ , and having formed upon its exterior surface a male screw-thread, encompasses the bolt  $q$ , between the head  $q^1$  and the nut  $q^3$ , and is screwed into the removable block  $T$ , provided at either end with the lips  $T'$ , to embrace the two ends of the box  $C$ , cast upon the upper side of the bed  $A$ . The object of the sleeve  $r$  is to enable the bolt  $q$ , and, through it and the connecting-toggle, the cross-head  $S$ , to be adjusted to bring the dies or plungers carried thereby into proper relative position to the die-carrier  $P$  and the die  $e$  mounted therein.

The lower end of the connecting rod or link  $S^2$  is pivoted to the upper end of the bar  $U$ , fitted to slide vertically in the bearing  $U'$ , secured to the under side of the bed, as shown, and carrying at its lower end the truck  $s$ , which fits into the path  $s^1$  of the cam  $H$ .

The cam  $H$  has six throws—*i. e.*, three rises and three falls—arranged with the extremes of the outward throws (which also marks the commencements of the falls) about one hundred and twenty degrees from each other, with a stand-still or concentric section between the commencement of each rise and the termination of the preceding fall, as shown in Fig. 5.

The cross-head  $O$  has set in its forward end the pin  $t$ , having a conical point, and designed to locate the blank in the die preparatory to forming the head, and to form a counter-sunk recess in the end of the rivet-shank, the axis of said pin coinciding with the axis of the heading swage-die  $o$ , and also the discharge-pin  $u$ , adapted to force the finished rivet from the die.

An intermittent reciprocating motion is imparted to the cross-head  $O$  by means of the cam  $I$ , vertically-sliding rod  $V$ , connecting-rod  $O^2$ , and toggle-links  $O^1$  and  $O^3$ , all being constructed, arranged, and connected together substantially in the same manner as described in connection with the cross-head  $S$  and its operating devices, except that the cam  $I$  has but four throws—*i. e.*, two rises and two falls—as shown in Fig. 6.

$W$  is a sliding plate, provided with the raised rib or fixed jaw  $v$ , and fitted to a suitable bearing in the upper surface of the bed  $A$ , in which it may be moved alternately in opposite directions in a line at right angles to the motion of the die-carrier  $P$ , and parallel

with the line of movement of the cross-heads  $O$  and  $S$ .

To the upper side of the plate  $W$  is pivoted the movable jaw  $W^1$ , having formed in its outer end the slot or perforation  $w$ , which engages with the upper end of the lever  $W^2$ , pivoted at  $w^1$  to the stand  $X$ , and carrying at its lower end the truck  $w^2$ , which is acted upon by the side cam  $K$ , to impart to said lever a vibratory motion, and through it to the movable jaw a slight vibratory motion, to cause it to engage with the wire or rod from which the rivets are to be made, interposed between said movable jaw and the fixed jaw  $v$ , and force it against said fixed jaw; and then, by a further motion of said lever, cause both jaws and the wire firmly gripped between them to be moved forward till a sufficient length of the wire to form a rivet has entered the die  $e$ , when the reverse motion of the lever  $W^2$  first causes the movable jaw to be vibrated to release its gripe from the wire, and then moves both jaws back to the starting-point without affecting the position of the wire, the length of the backward motion of the jaws, and consequently the length of wire fed forward at each forward motion of the jaws, being controlled and regulated by the screw-stop  $Y$ , as shown in Figs. 1 and 8.

The backward motion of the feed-jaws is caused by the spring  $a'$ .

The wire is fed forward against the resistance of the jaw  $b^1$ , inclosed in the block  $b^2$ , and forced against the wire by the spring  $c'$ , the tension of which may be regulated at will by the set-screw  $d'$ , acting upon the follower  $e'$ , as shown in Figs. 8 and 11, the pressure of the jaw  $b^1$  effectually holding the wire in place while the feed-jaws are being moved back, and during the process of severing the blank from the wire by the action of the cutting-dies.

A knock-off plunger,  $f'$ , is fitted to a bearing in the block  $g'$ , just above the point where the rivet is discharged from the die, and has imparted thereto, by the lever  $h'$ , link  $i'$ , cam-lever  $j'$ , and cam  $L$ , a vertical reciprocating motion, so timed that the downward stroke takes place just after the rivet has been forced from the die, and disconnects the rivet from the discharge-plunger before it can be drawn back into the die by said plunger, as is liable to be the case if no provision is made to guard against it.

An adjustable tapering block,  $k^1$ , is secured to the upper surface of the bed  $A$ , between the front end of the die-carrier  $P$  and the fixed abutment  $l'$ , cast upon the bed  $A$ , the face of which contiguous to said block  $k^1$  is tapered to correspond to the taper of the block, as shown in Fig. 1, said block being secured to the bed  $A$  by means of a bolt passing through the slot  $k^2$ , so that said block may be adjusted endwise to take up the wear of the die-carrier and prevent the movable die from being crowded away from the fixed cutting-die, so as to injuriously affect the proper cutting of the wire.



A' is an oil-tank placed above the cross head O, and provided with the discharge-pipe *m'* and cock *n'*, the lower end of the pipe *m'* terminating just above the die-carrier P, so that the oil flowing therefrom will fall into the channel-way *o'*, formed in the upper edge of said die-carrier, as shown in Fig. 1.

The channel-way *o'* is made of a length somewhat greater than the length of movement of the die-carrier, so that in whatever position the die-carrier may be the oil from the pipe *m* will fall into the groove or channel-way *o'*.

The channel-way *o'* is also made slightly deeper at the center of its length than at its two ends, so that all the oil which falls into said channel-way shall flow toward the center and into the oil-holes *s'*, leading therefrom to the face of the die-carrier, just above the center of the die *e*, as shown in Figs. 1 and 4, partly in dotted lines.

It has been found by practical trial that it is impracticable to head rivets cold in a solid die without the use of oil, for the reason that the metal of the rivets becomes partially welded to the die, and when the rivet is forced out of the die it very often takes with it a piece of the die.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of the fixed annular die *b*, the die-carrier P, having set therein the single annular die *e*, the lever R, connected at its movable end with the carrier P, and the cam J, having three throws, as set forth, all arranged as described, and adapted to sever a blank from the rod or wire, convey it into a position in front of the heading-plunger, remain in a state of rest till the rivet is headed, carry the finished rivet to the place of discharge, remain in a state of rest till the rivet is discharged from the die *e*, and then return the die *e* to its former position in front of the die *b*, substantially as described.

2. In combination with the stationary annular cutting-die *b*, the intermittently-reciprocating carrier P, having mounted therein a single annular cutting and forming die, *e*, and three hardened-steel bushings, *f*, having conical or funnel shaped mouths, said bushings being distinct and separate from the cutting and forming die, and a register-pin having a tapered point to engage with said bushings, and having a positive intermittent reciprocation imparted to it independent of the motion of the carrier, substantially as and for the purposes described.

3. The combination, in a rivet-making machine, of an annular die, mounted in a carrier adapted to be moved intermittently into three different positions in succession, and remain in a state of rest for a limited time in each of said positions, and a cross-head, carrying in its front end a gage-pin, a register-pin, and a heading swage or die, and adapted to be reciprocated in a direction at right angles to the motion of the die-carrier, in such a manner

that the register-pin shall engage with the carrier while it is standing still in each of its three positions, substantially as and for the purposes described.

4. The combination of the annular die *e*, mounted in the intermittently-reciprocating carrier P, the reciprocating cross-head S, carrying in its front end the gage-pin *m*, register-pin *n*, and heading-die *o'*, and the reciprocating cross-head O, carrying in its front end a locating-plunger, *t*, and the discharge-plunger *u*, all arranged and adapted to operate as and for the purposes described.

5. The combination, in a rivet-making machine, of the cross-head S, carrying in its front end the register-pin *n*, and heading-swage *o*, the toggle-links *S*<sup>1</sup> and *S*<sup>3</sup>, connecting-link *S*<sup>2</sup>, the reciprocating bar U, and cam H, all arranged and adapted to operate as and for the purposes described.

6. In combination with a pair of toggle-links, adapted to impart a reciprocating motion to the cross-head O or S, the bolt *q*, provided with the head *q*<sup>1</sup>, and ears *q*<sup>2</sup> *q*<sup>2</sup> and nut *q*<sup>3</sup>, and the sleeve *r*, provided with a hexagonal or other prismatic-shaped section at one end, and a male screw-thread fitted to, and adapted to work in, a female screw formed in a portion of the bed of the machine, or a block of metal secured thereto, substantially as described.

7. The combination, in a rivet-making machine, of the cross-head O, carrying in its front end the locating-plunger *t* and discharge plunger *u*, toggle-links O and O<sup>3</sup>, connecting-rod O<sup>2</sup>, reciprocating bar V, and the cam I, all constructed, arranged, and adapted to operate as and for the purposes described.

8. The combination, in a rivet-making machine, of the reciprocating plate W, provided with the raised rib or jaw *v*, the pivoted jaw W<sup>1</sup>, provided with the slot *w*, the lever W<sup>2</sup>, and cam K, all constructed, arranged, and adapted to operate substantially as described.

9. The combination of the plate W, provided with the raised rib or jaw *v*, the pivoted jaw W<sup>1</sup>, lever W<sup>2</sup>, cam K, the frictional pressure-jaw *b*<sup>1</sup>, and spring *c'*, substantially as described.

10. The combination of the plate W, provided with the raised jaw *v*, the pivoted jaw W<sup>1</sup>, the lever W<sup>2</sup>, cam K, spring *a'*, and the screw-stop Y, all arranged and adapted to operate as and for the purposes described.

11. The combination of the bar N, die-carrier P, abutment *l'*, and the wedge-block *k*, all arranged and adapted to operate substantially as and for the purposes specified.

12. In combination with the dies *b* and *e* and a reciprocating gripe feeding device, for intermittently feeding the wire into the dies, the gage-pin *m*, adjustably set in the automatically-reciprocating cross-head S, and adapted to approach within a greater or less distance of the cutting-surfaces of said dies, as and for the purposes described.

13. The combination of the fixed annular



die *b*, the carrier *P*, having mounted therein the annular die *e*, and adapted to be moved in succession into three different positions, the plunger *u*, set in the cross-head *O*, arranged relatively to the carrier *P* and die *b*, as shown, and the knock-off plunger *f*, all arranged and adapted to operate substantially as described.

14. The combination, in a rivet-making machine, of the solid reciprocating annular die *e*, the heading-swage *o*, and the conical-pointed reciprocating plunger *t*, all arranged and co-operating as set forth, to locate the blank in the die, form a head upon one end of said blank, and a countersunk recess in the other end, substantially as described.

15. In combination with a solid annular die,

in which the rivet-blank is held while being headed, and a reciprocating heading-swage, an oil-tank, placed above the heading-tools, and provided with a discharge-pipe, adapted to convey the oil from said tank to the heading-tools, as and for the purpose described.

16. In combination with the oil-tank *A'*, provided with the discharge-pipe *m'*, the die *e*, and reciprocating carrier *P*, the channel-way *o'*, and oil-hole *s*, all arranged and adapted to operate as and for the purposes described.

Executed at Boston, Massachusetts, this 29th day of September, 1876.

MELLEN BRAY.

Witnesses:

N. C. LOMBARD,

E. A. HEMMENWAY.