(Model.)

5 Sheets—Sheet 1.

W. A. D. BOWMAN & A. W. ALMQVIST.

MACHINE FOR MAKING SPIKES.

No. 250,491. Patented Dec. 6, 1881.

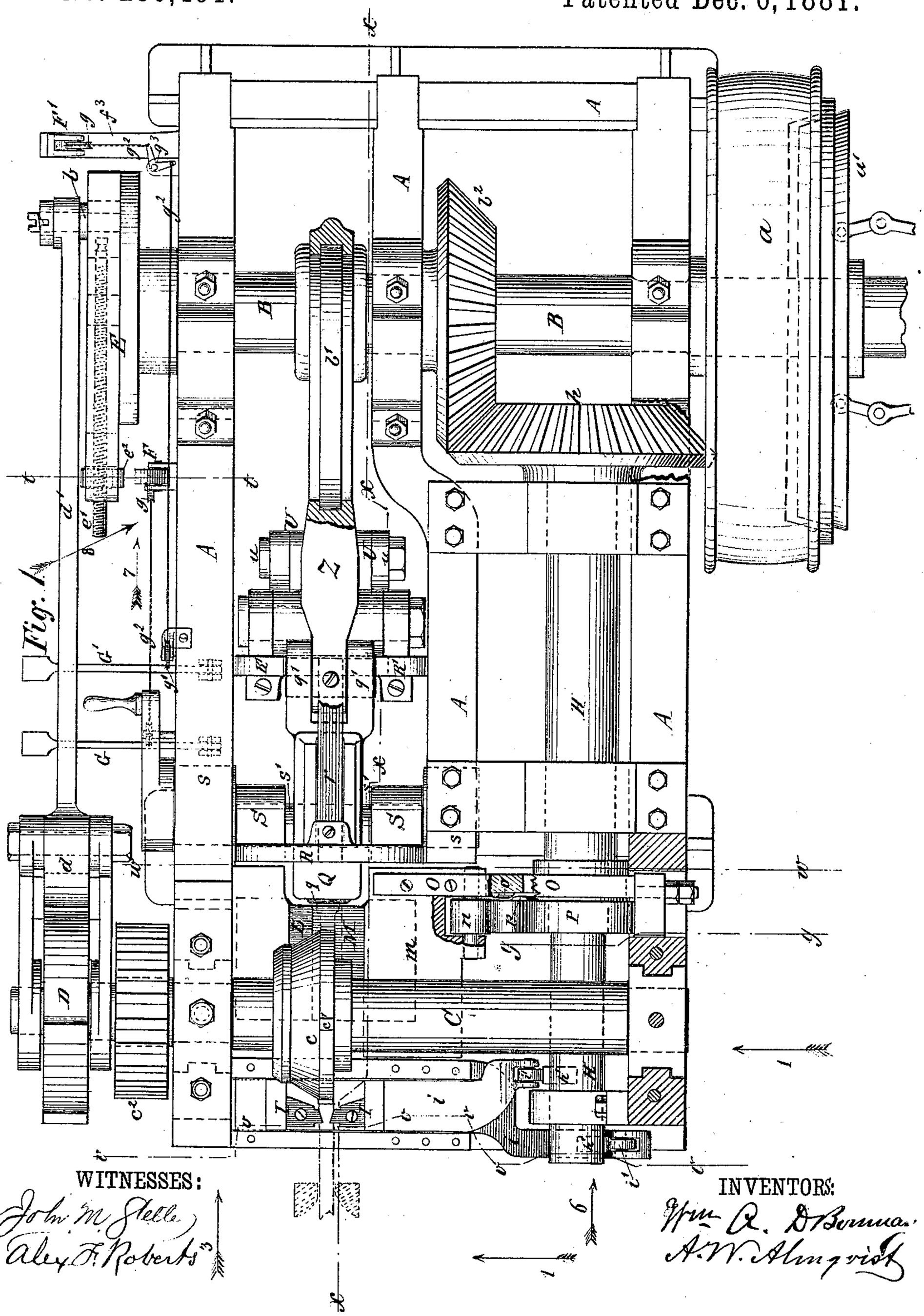

Fig. 1.

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(Model.) 5 Sheets—Sheet 2.

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Fig. 2

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(Model.) 5 Sheets—Sheet 3.

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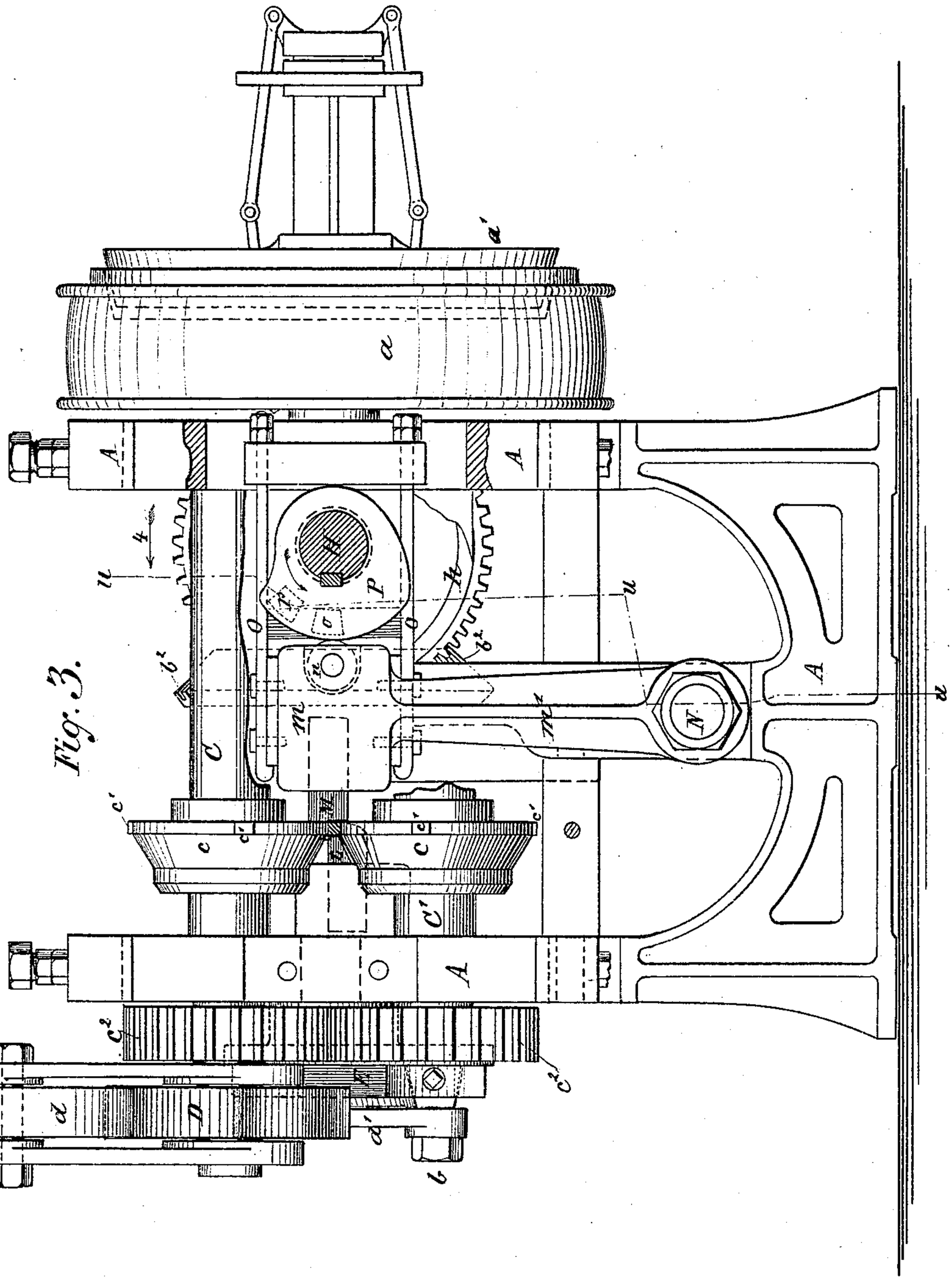

Fig. 3.

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MACHINE FOR MAKING SPIKES.

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Fig. 4

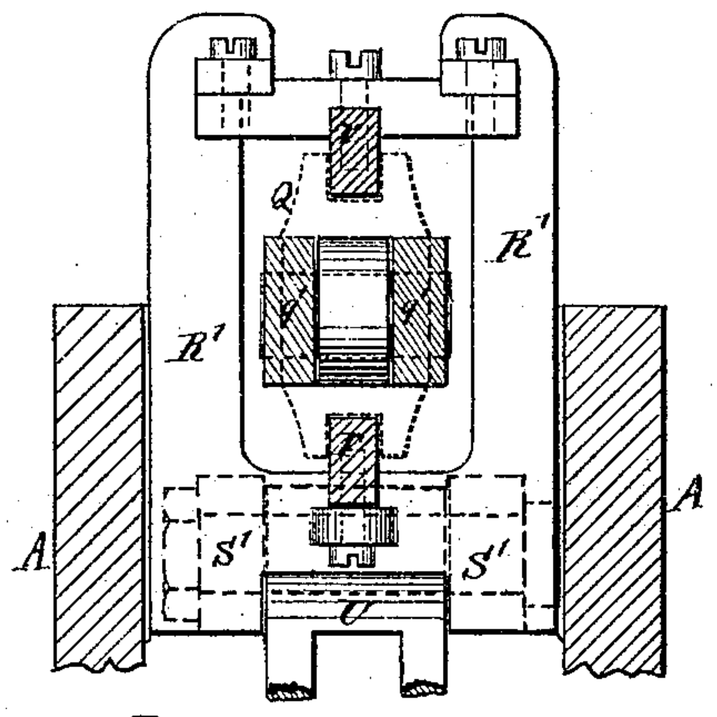


Fig. 5

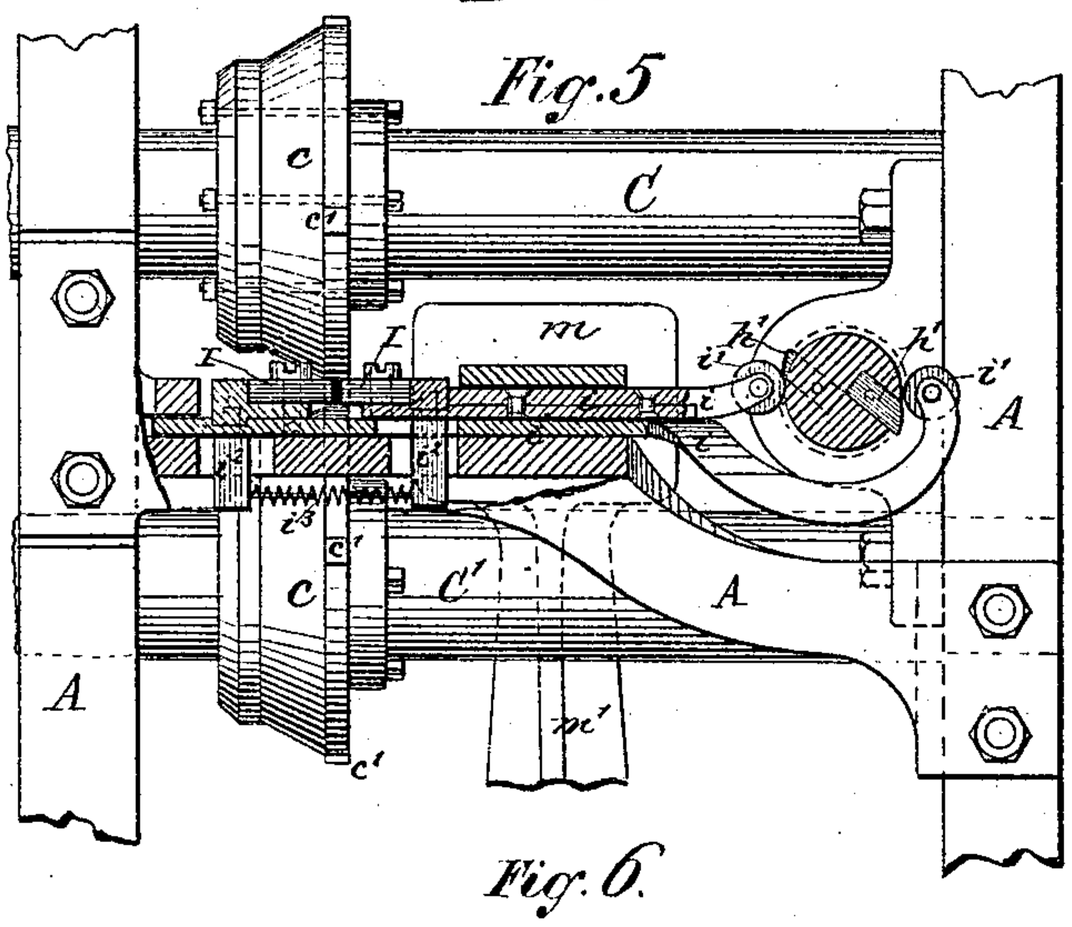
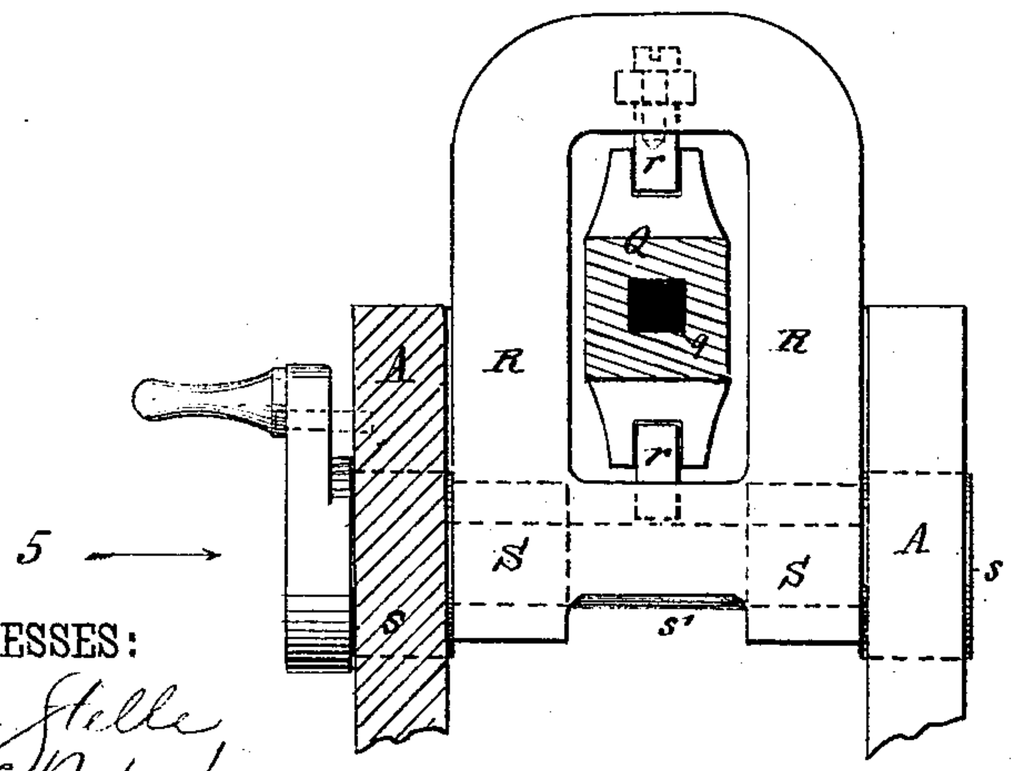


Fig. 6.



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W. A. D. BOWMAN & A. W. ALMQVIST.

MACHINE FOR MAKING SPIKES.

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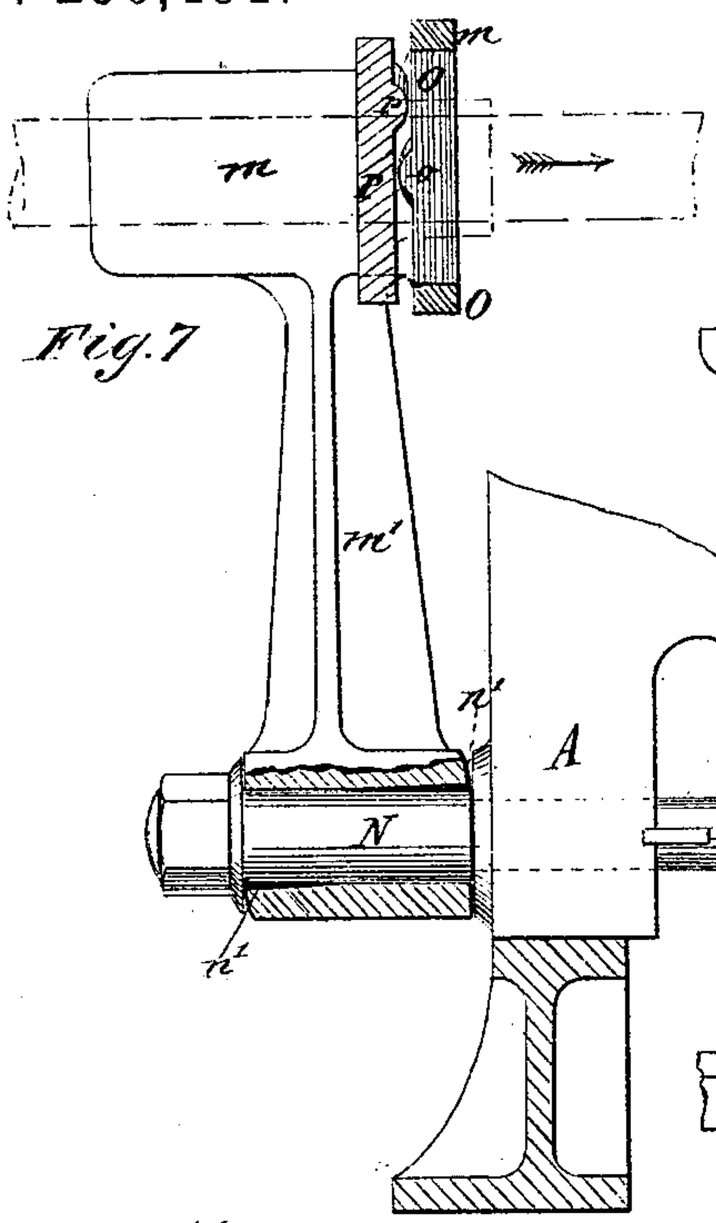


Fig. 7

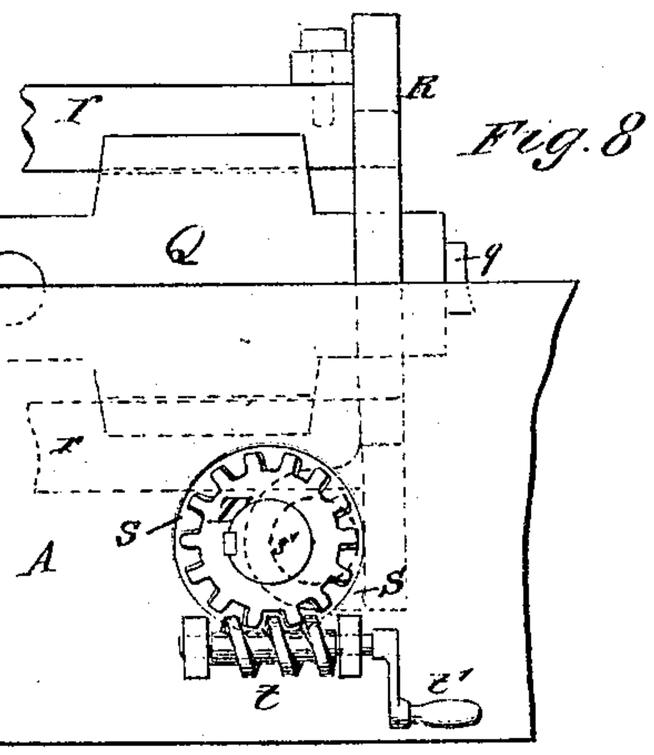


Fig. 8

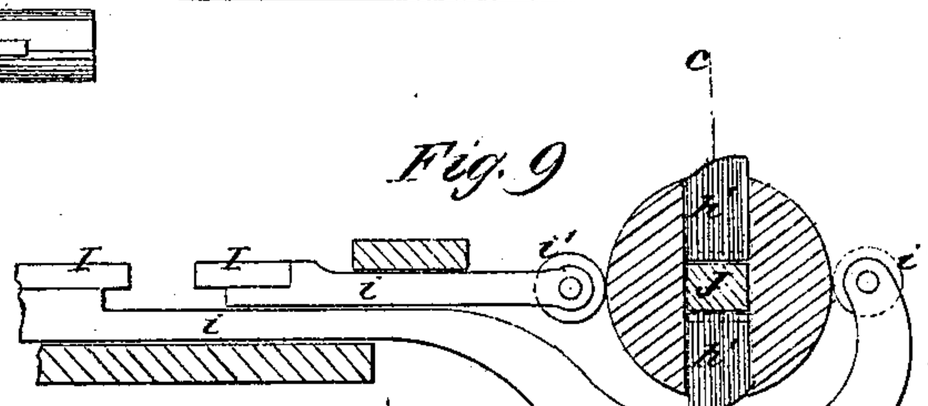


Fig. 9

Fig. 11

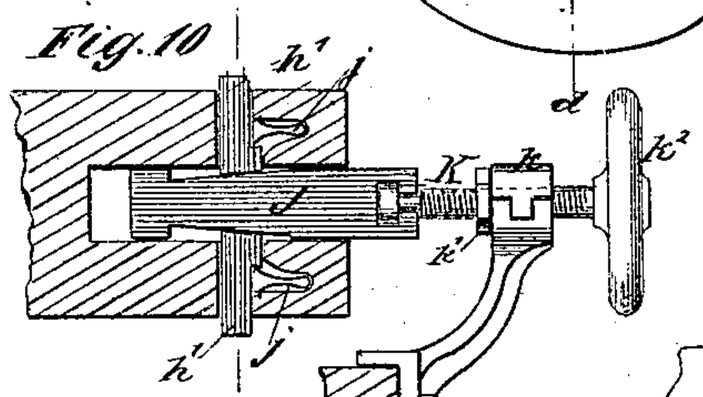


Fig. 10

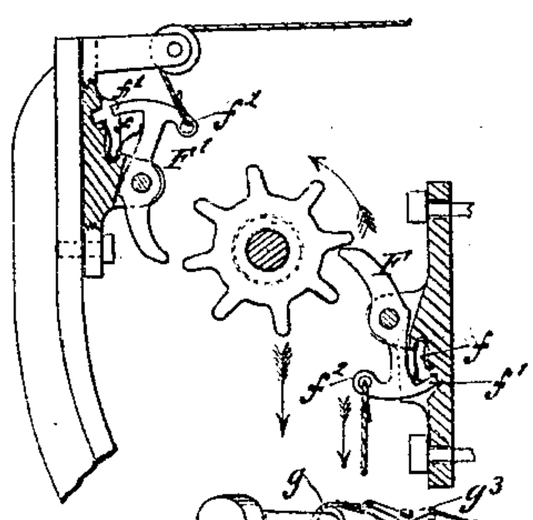


Fig. 12

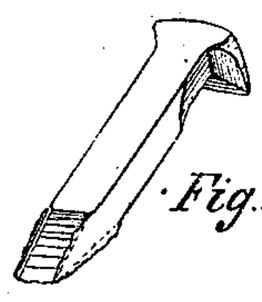
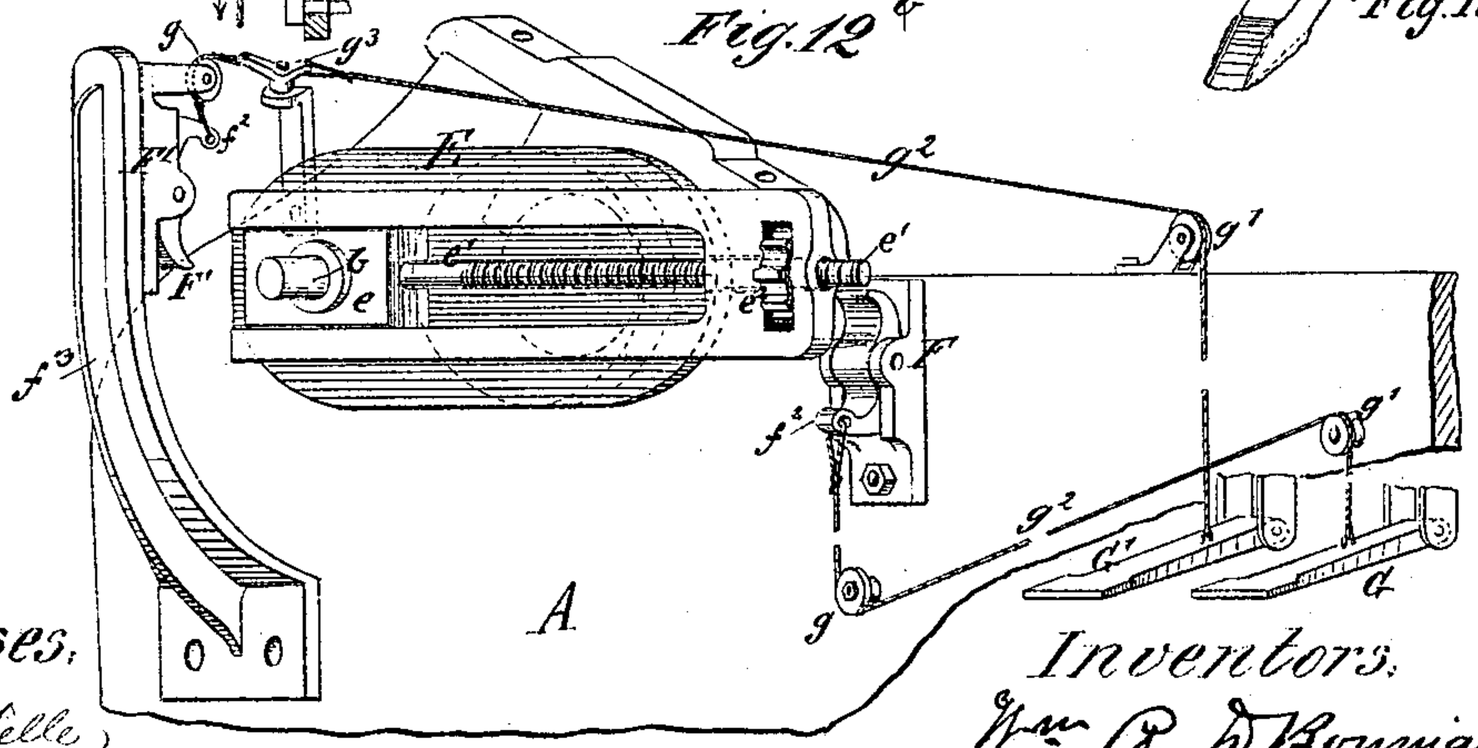


Fig. 13



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UNITED STATES PATENT OFFICE.

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MACHINE FOR MAKING SPIKES.

SPECIFICATION forming part of Letters Patent No. 250,491, dated December 6, 1881.

Application filed May 7, 1881. (Model.)

To all whom it may concern:

Be it known that we, WILLIAM A. D. BOWMAN, of Jersey City, in the county of Hudson and State of New Jersey, and AUGUST W. ALMQVIST, of the city of Brooklyn, in the county of Kings and State of New York, have invented a new and useful Improvement in Spike-Machines, of which the following is a specification.

The object of our invention is to provide new and improved mechanism that will insure the manufacture rapidly and automatically of spikes whose shanks shall be of uniform thickness from the head to the beginning of the taper toward the point, of uniform width from the head to the extreme end of the point, and entirely free from grades or so-called "fins." By even the most improved machinery hitherto in use for the manufacture of spikes no article having the above requisites has as yet been produced.

To prevent the spike-blank from sliding under the pressure of the header, it has been clamped in a V-shaped or tapering die, from which it receives a similar shape, thus lessening its thickness just at the point where it is subjected to the greatest strain and wear when in use. The action of the pointing-dies naturally causes the point to spread, making it wider than the shank, which obviously materially lessens the capacity of the wood fibers for retaining the spike when driven.

To prevent the point from spreading, internally-geared side rings, revolving with the pointing-dies, have been arranged to press upon the two opposite vertical sides of the spike-bar while the point is being formed. (See Patent No. 185,652.) But, as it is impossible to prevent a certain amount of lateral springing or yielding of the rings, and thus also impossible to maintain the same width of the groove between them when the point is being formed as when no strain is applied, it follows that the pointing-dies, which should exactly fill the width of the groove, do not fill it when under the pressure of forming the point. The latter spreads slightly, the metal is forced into the small crevices between the die and the rings, and sharp fins are formed on the side edges of the point, which fins tear the fibers of the wood in which such a spike is driven and impair the needful retaining friction just as effectually as the widening of the point sought to be avoided by the use of the said side rings. Attempts have been made to remove the said fins by conveying the spikes with constant tumbling motion through a revolving drum, but without satisfactory result. Equally futile have been the attempts heretofore made to sever the pointed spike-blank from the bar when the pointing-dies have become a little worn on their points, so as not to cut completely through the bar.

The present invention is designed to overcome the said several objections, and, in addition, to render the most important working parts, which need more or less frequent regulation, adjustable to a nicety while the machine is in full motion, thereby not only facilitating the (for such adjustment) needful observation of their effect upon the product, but also effecting a great saving in time and labor.

To this end the invention comprises, first, the combination, with the vertical pointing-dies, of a pair of horizontal or lateral indentation dies, adjustable during motion, to indent the bar on opposite sides, and thus reduce its width, before it is acted on by the pointing-dies, and the combination of devices by which the depth of the indentation may be so adjusted that the subsequent action of the pointing-dies will spread the point to the exact normal width of the spike-bar; second, a laterally or transversely movable griping-die and means for operating the same, which works in conjunction with a stationary heading-die to grasp diagonally-opposite angles of the pointed blank along the entire shank part of the latter, (whose point meanwhile is held in the then pausing dies which formed it,) and to thus retain the blank in position while the header operates upon it, and which immediately thereafter receives a sudden slight longitudinal movement parallel with the bar, by which the completed spike is severed from the bar (if yet adhering to it at the point) and thrown out of the machine; third, the combination of devices for adjusting the height and inclination

of the heading-tool while the machine is in motion; fourth, the combination of devices by which, during motion of the machine, the length of the crank which governs the movement of the feeding-wheel and pointing-dies may be varied and minutely adjusted.

In the accompanying five sheets of drawings, Figure 1 represents a top or plan view of our improved spike-machine, partly in section. Fig. 2 is a longitudinal vertical section taken on the line *x x* of Fig. 1, and seen in the direction indicated by the arrows 1, the griping and heading dies being sectioned in the vertical plane of the cutting-wheels and the die-box broken away and its position dotted in outline. Fig. 3 is a front view, seen as indicated by arrow 3, partly in section on the line *y y* of Fig. 1, the attachment for making the side indentations being removed. Fig. 4 is a detail section of the spike-heading device, taken on the line *z z* of Fig. 2, and seen in direction of arrow 2. Fig. 5 is a sectional front view on the broken lines *v v* of Figs. 1 and 2, seen as indicated by arrow 3, and showing the side-indentation device. Fig. 6 is a detail sectional front view of the spike-heading device, taken on the lines *w w* of Figs. 1 and 2, seen in direction of arrow 3. Fig. 7 is a detail section on the line *u u* of Fig. 3, seen in direction of arrow 4, and showing the device whereby the spike, when made, is severed from the spike-bar and discharged. Fig. 8 is a detail side view, seen in direction of arrow 5 in Fig. 6, showing the device for changing the elevation of the heading-tool. Fig. 9 is a detail cross-section of the cam-shaft operating the side-indentation dies, seen in direction of arrow 6 in Fig. 1, the section being taken on the line *a b* of Fig 10. Fig. 10 is a longitudinal section of the same, taken on the line *c d* of Fig. 9, showing the device for adjusting the throw of the cams for the side-indentation dies. Fig. 11 is a detail sectional view, mainly on the line *t t* of Fig. 1, seen in direction of arrow 7, and illustrating the manner and device for changing the length of the feed-crank to the cutting and feeding dies. Fig. 12 is a detail perspective view of the complete mechanism for changing the length of the feed-crank, the same being seen in direction of the oblique arrow 8 in Fig. 1. Fig. 13 is a perspective view explaining the defects of the spike as now made by the best automatic machines.

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

A designates the frame-work of the machine, and may be of any construction so long as it affords suitable bearings for all the working parts.

B is the main shaft, receiving motion from an engine or other motor through a belt over a pulley, *a*, which also acts as fly-wheel, and runs loose upon the shaft B until fastened by contact with a friction-clutch, *a'*, fitted to slide upon a feather on the shaft, and tightened against the wheel *a* by a toggle-joint, as shown in the drawings. Under the strain of an accidental excess of resistance to the adjusted power the wheel *a* will turn upon the shaft, overcoming the friction of the clutch, and thus save the machine from breaking.

C C′ are the ordinary shafts, (parallel with the main shaft.) upon which are secured the feed-wheels *c*, provided with pointing-dies *c'*, for feeding in the spike-bar, forming the point, and cutting off the blank from the bar in the usual manner. The shafts C C′ are mounted in bearings adjustable by screws, so that the distance between them may be regulated to suit sets of wheels of various sizes having a greater or less number of dies *c c'*, as they have sometimes to be exchanged when it is required to cut blanks for longer or shorter spikes. They are also provided with cog-wheels c^2, gearing together to communicate motion from one shaft to the other. The necessary intermittent motion may be communicated to either shaft by a ratchet-wheel, D, pawl *d*, and connecting-rod *d'*, in the usual way, from the wrist-pin *b* of a crank-disk, E, attached on the end of the main shaft B. The pin *b* is secured to a block, *e*, fitted to slide in a radial slot upon the face of the crank-disk E, and a screw, *e'*, swiveled or fastened by one end in the block *e*, extends thence diametrically across the disk E, its other end being threaded through a suitable nut-wheel or circumferentially-toothed nut, e^2, held from axial movement in a cross-slot through the crank-disk E. The teeth of the nut-wheel e^2 protrude from opposite ends of the slot sufficiently to strike against one or the other of two stationary pawls, F F′, once during each revolution of the shaft B, and be rotated when the said pawl or catch is thrown forward for that purpose through a space equal to the pitch of the wheel e^2, thus sliding the crank-pin *b* a very slight distance nearer to or farther from the center of shaft B, and proportionately shortening or lengthening the crank, in order to turn the shafts C C′ exactly so far that the feed-wheels *c* will have passed that point at which their diameters form one vertical line just sufficiently to retain hold on the spike-bar after the blank has been severed from it by the pointing-dies *c'*.

The wheel e^2 may be fastened so as not to turn upon the screw-rod *e'*, and the latter be threaded through the block *e*, instead of through the wheel e^2, and the same object will be accomplished.

Figs. 1, 11, and 12 illustrate plainly how to vary the length of throw of the crank with the machine in motion. If *e'* be a right-handed screw, the pawl F will serve to lengthen and the pawl F′ to shorten the crank. The pawls are both alike, except in position, that of F′ being inverted as compared to that of F, the latter being attached directly to the frame A and acting on the nut-wheel e^2 during its downward travel, and the former being attached to an extra bracket, f^3, bolted to the frame A, and acting on the nut-wheel e^2 during its upward travel and at the point of its circumference diametrically opposite to that at which the pawl F

acts. In its normal position the pawl is thrown back from the path of the wheel and from contact with its teeth by a spring, *f*, pressing outward the tail end of the pawl. On the said tail end is a cross-piece, to whose outer end, f^2, is attached a cord, g^2, by pulling which the pawl is thrown forward, and whose inner end, f', serves as a stop against the frame or bracket to receive the strain on the pawl and prevent it from being thrown forward too far. The cords g^2 are guided, by suitably-arranged pulleys $g\ g'$, to treadles G G′, which are in position to be conveniently depressed by the foot, a bell-crank, g^3, being connected to the cord of the pawl F′ to transmit the motion in the proper direction. To suitably lengthen or shorten the crank while the machine is in motion, it is thus only necessary to depress the treadles G or G′, respectively, during one or more revolutions of the crank.

Upon the main shaft B are secured an eccentric, b', which transmits motion to the heading-tool, and a conical cog-wheel, b^2, which transmits motion, by means of another conical cog-wheel, *h*, to a shaft, H, at right angles to the main shaft B. The shaft H gives motion to the side-indentation dies and to the griping-die.

I are the side-indentation dies. These are secured to slides *i*, arranged in suitable guides in the main frame, or in an auxiliary frame, to move simultaneously in opposite directions by the action of two diametrically-opposite cams, h', placed in the shaft H, said slides being provided with end rollers, i', to lessen the friction against the cams, and one of the slides having its roller supported by an arm or extension curved around the semicircle of the shaft H, as shown in Figs. 1, 5, and 9, so as to present the rollers to the action of the cams in the proper positions, as aforesaid. When the rollers, during the revolution of the shaft H, have passed their actuating-cams h', the dies I are withdrawn from the indentation made by them in the spike-bar by the pressure of a spring or springs, i^3, expanding between two studs or shoulders, i^2, attached to the slides *i*, as seen in Fig. 5. The distance between the lines in which the side-indentation dies I and the pointing-dies c' operate upon the spike-bar should be exactly equal to the distance between two adjacent pairs of pointing-dies, in order that the vertical impression made by the latter shall be in exactly the same plane of cross-section as the horizontal impression made by the pair of side-indentation dies I.

The cams and rollers $h'\ i'$ may be arranged relatively to the shaft H at an axial distance of the latter apart from each other, as shown in Fig. 1; but in order to better illustrate the adjustment of the throw of the cams we have shown them as arranged in the same diametrical line of the shaft in Figs. 9 and 10. If so arranged, they will cause the indentation-dies to act twice instead of once for each revolution of the shaft.

In a square axial socket in the end of the shaft H is fitted a square prismatic sliding block, J, having two of its opposite sides wedge-shaped, as shown in the drawings, and in contact with the correspondingly-beveled inner ends of the cams h', the latter being fitted to slide in suitable grooves radiating from the said axial socket. The cams are kept in contact with the block J as against the centrifugal force due to the rotary motion of the shaft by the centripetal expansion of springs *j* acting against shoulders at the inner ends of the cams, as in Fig. 10, in a manner similar to that of ordinary expanding cutters. The outer end of the block J has a cross-slot shaped, as shown, suitably to receive and swivel to it the end of a screw, K, which is held in a threaded bearing or nut, *k*, made whole or in two parts, and bracketed or fastened directly to the frame A of the machine. The screw K has a hand-wheel, k^2, by turning which the block J may be slid outward or inward to respectively shorten or lengthen the projection of the cams h', and thereby to regulate the depth of indentations desired to be made in the sides of the spike-bar. To prevent the screw from accidental turning, it is provided with an extra tightening-nut, k', as shown in Fig. 10.

It is evident that by this device the depth of the side indentations may be regulated and adjusted to great nicety, even while the machine is in full motion, and so that the subsequent action of the pointing-dies will spread the point end of the spike-shank to resume the normal width of the spike-bar.

The pointing-dies, not being limited by side rings to work in a groove of the exact width of the bar, may be made wide enough to operate satisfactorily upon bars of any size used in making spikes, and, there being no side pressure counteracting their action, no fins or grades are formed on the edges of the point.

Each die I may be provided with a horizontal projection at right angles to its face, to overlap the horizontal sides of the bar and prevent them from upsetting, thereby somewhat relieving the work of the pointing-dies.

It is also evident that by giving sufficient depth of throw to the side dies, I, a pyramidical or so-called "square" point may be formed, if so desired. While the point is being formed the spike-blank shown in Figs. 2 and 3 rests in the stationary heading-die L, where it is held by the movable griping-die M while the heading-tool operates upon it. These dies are secured in sockets in such a manner that they may be removed and replaced by others when required, and along their faces are formed rectangular V-grooves, embracing diagonally-opposite angles of the blank, the groove in the die L being of suitable size to fit the lower horizontal and one of the vertical sides of the blank without projecting beyond them, and the groove in the upper die, M, being of proper size to cover the opposite horizontal and vertical sides of the blank and to project beyond them sufficiently to overlap the edges of the die L, and thus to completely inclose the en-

tire intended shank part of the blank while the head is being formed upon it, the pointing-dies in the meantime pausing and keeping the just-completed point firmly between them. By thus holding the blank with uniform pressure throughout its entire length while the header operates it is evident that the defects shown in Fig. 13 are obviated. The head being formed, the griping-die M moves with a sudden jerk in the direction of the then withdrawing header, thereby severing the completed spike from the spike-bar and throwing it off from the die L onto the ground under the machine.

In order to grasp two sides of the blank at once without sliding in contact on either, the griping-die M is secured in a die-holder, *m*, which is provided with a downward-projecting rocking arm, *m'*, pivoted upon a stud, N, to the frame A.

To the die-holder *m* is secured a yoke, O, in which works in contact, at two opposite sides, a cam, P, keyed upon the shaft H, a roller, *n*, being pivoted in the holder *m* in working contact with the cam P, so as to reduce friction. Upon the side of the cam P is a roller or curviform rise, *p*, which once for each revolution of the cam strikes a similar raised portion or roller, *o*, upon the side of the yoke O, thereby producing a motion of the yoke and griping-die at right angles to that produced by the cam P. By pivoting the arm *m'* as shown, the griping-die moves in a circle, closing upon the blank with a slightly downward motion and receding with an upward motion, thus respectively grasping and releasing the two adjacent sides of the blank simultaneously and insuring a square gripe without any tendency to turn the blank, and thereby twist its point.

The operation of the cam P is easily understood by reference to Figs. 1, 3, and 7, particularly Fig. 3. The cam P is in the position corresponding to that of the die M when the spike-head has just been formed and the header is about to recede, and, moving in the direction of the arrow marked on it, it is just about to very slightly slacken the hold of the die M upon the spike, to allow of the side movement caused by the contact between the cam portions *p* and *o*, whereby the spike is severed from the bar (if adhering to it) and dropped.

To allow the arm *m'* to oscillate lengthwise upon the stud N when the severing-cam *p* is acting, the bore of the hub of the said rocking arm is slightly enlarged at *n'* above and below the stud at diagonally-opposite places, as shown in Fig. 7.

Q is the header, being a heavy cast-iron cross-head, having lugs on its rear end, which form a jaw, *q'*, in which is pivoted the rod Z of the eccentric *b'*, by the revolution of which the header is caused to slide between an upper and a lower guide, *r*, secured to a double yoke, R R', said yoke being composed of the front yoke, R, and the rear yoke, R'.

In a socket in the front end of the cross-head Q is secured the punch or heading-tool proper, *q*, which is adjustable in the said socket by a transverse key, as usual.

The front yoke, R, is supported by pivotal lugs S upon the crank *s'* of a crank-shaft, *s*, which has its bearings in the frame A. In order to allow of making the yoke the full width between the bearings, and thereby steady it by and between the frame portions A, the crank-pin *s'* is made to extend throughout the same width, and the shaft *s* is made large enough in diameter to include also the crank-pin within its circumference; but these proportions may be varied so long as the axis of the crank lies sufficiently eccentric to that of the shaft.

Upon one end of the shaft *s*, outside of the frame A, is fastened a worm-wheel, T, gearing in a screw or worm, *t*, revoluble by the hand-crank *t'* in suitable bearings upon the frame A. By turning the handle *t'* the front end, R, of the yoke R R' may thus be raised and lowered at will, even during full run of the machine, to incline the guides *r*, and give an oblique direction to the blow of the header.

Between lugs S' upon the rear yoke, R', is pivoted, at *u*, the upper end of the upper link, U, of a toggle-joint, whose lower link, V, is pivoted with its lower end, at *v*, to the frame A. The two links are pivoted, at *w*, together and to a short center rod or hub, W, in which is swiveled, at *w'*, a rod, X, reaching to the front of the machine. The rod X is partly threaded and fitted to turn in a threaded nut, which is suitably secured to the frame, at *x*, in a manner to allow of a slight longitudinal oscillation of the rod X.

By turning the hand-wheel Y, secured upon the outer end of the rod X, the toggle-joint U V may be straightened or made to form a greater or less angle, thereby raising or lowering the rear end, R', of the yoke R R' at will, even during the full run of the machine.

It is evident that by the combination of the said crank-shaft and toggle-joint the header may be adjusted into horizontal position or upward or downward inclination at any desired elevation, thus enabling it to form the head wholly or partly upon one side of the spike-blank or equally on both sides thereof.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination, with a pair of vertical pointing-dies, of a pair of horizontal or lateral indentation dies, arranged to indent the spike-bar on opposite sides and reduce its width before it is acted on by the pointing-dies, substantially as and for the purpose set forth.

2. The combination, with a pair of vertical pointing-dies, of a pair of horizontal or lateral indentation dies, adjustable during motion of the machine, to regulate the depth of indentation, substantially as and for the purpose set forth.

3. The combination, with the sliding indentation-dies I, of the cams *h'*, fitted to slide transversely in the revolving shaft H, the axial ex-

panding block J, and the adjusting-screw K, swiveled to the said block and mounted in the stationary bearing-nut *k*, substantially as and for the purpose set forth.

4. The combination of the blank-supporting heading-die L and the laterally or transversely movable griping-die M, working in conjunction to grasp diagonally-opposite angles of the pointed blank along the entire shank part of the latter, and thus retain it in position while the spike-head is being formed, substantially as specified.

5. The upright rocking arm *m'*, pivoted at its lower end, and provided at its upper end with a laterally-projecting die-holder or cross-head, *m*, carrying the griping-die M, in combination with the cam P, actuating that end of the holder which is opposite to the die M, and with the stationary heading-die L, for the purpose of griping the blank with an obliquely-descending movement, as specified.

6. In combination with the heading-die L, the griping-die M, and a mechanism to impart to the said griping-die the successive transverse and longitudinal movements described, so as to cause it to grasp the blank for heading and eject the spike when completed.

7. In combination with the griping-die M and a revolving cam, P, arranged to move the said griping-die in a direction at right angles to the spike-bar, a severing-cam, *p*, arranged to move the griping-die successively in a direction parallel with the spike-bar, substantially as specified.

8. The revolving cam P, having a curviform rise or roller, *p*, upon its side, in combination with the holder *m* of the griping-die, having suitable working-surfaces, *n o*, arranged to be acted on successively in directions transverse to and parallel with the spike-bar, substantially as and for the purpose set forth.

9. The yoke R R', having guides *r*, and the header Q, arranged to slide in said guides, in combination with the crank-shaft *s s'* and the worm-gear T *t*, for adjusting the elevation of the front end, R, of said yoke, as hereinbefore set forth.

10. The yoke R R', having guides *r*, and the header Q, arranged to slide in said guides, in combination with the toggle-links U V, center pivoting-hub, W, and the swiveled screw-rod X, for adjusting the elevation of the rear end, R', of said yoke, as hereinbefore set forth.

11. The combination of the yoke R R', having guides *r*, the sliding header Q, the eccentric *b'* Z, the crank-shaft *s s'*, worm-gear T *t*, toggle-joint U V W, and swiveled screw-rod X, substantially as and for the purpose set forth.

12. The combination of the crank-adjusting screw *e'* and the toothed wheel e^2 upon the said screw with the stationary pawls F F', kept automatically from contact with the said wheel and provided with means for projecting them at will, to intercept and turn the said wheel a little for one revolution of the crank, to vary the length of the throw while the machine is in motion, substantially as and for the purpose set forth.

W. A. D. BOWMAN.
AUGUST W. ALMQVIST.

Witnesses:
HENRY SELLMAN,
JOHN M. STELLE.