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S. S. PUTNAM.

Machine for Forging Horseshoe Nails.

No. 207,444. Patented Aug. 27, 1878.

Fig. 1.

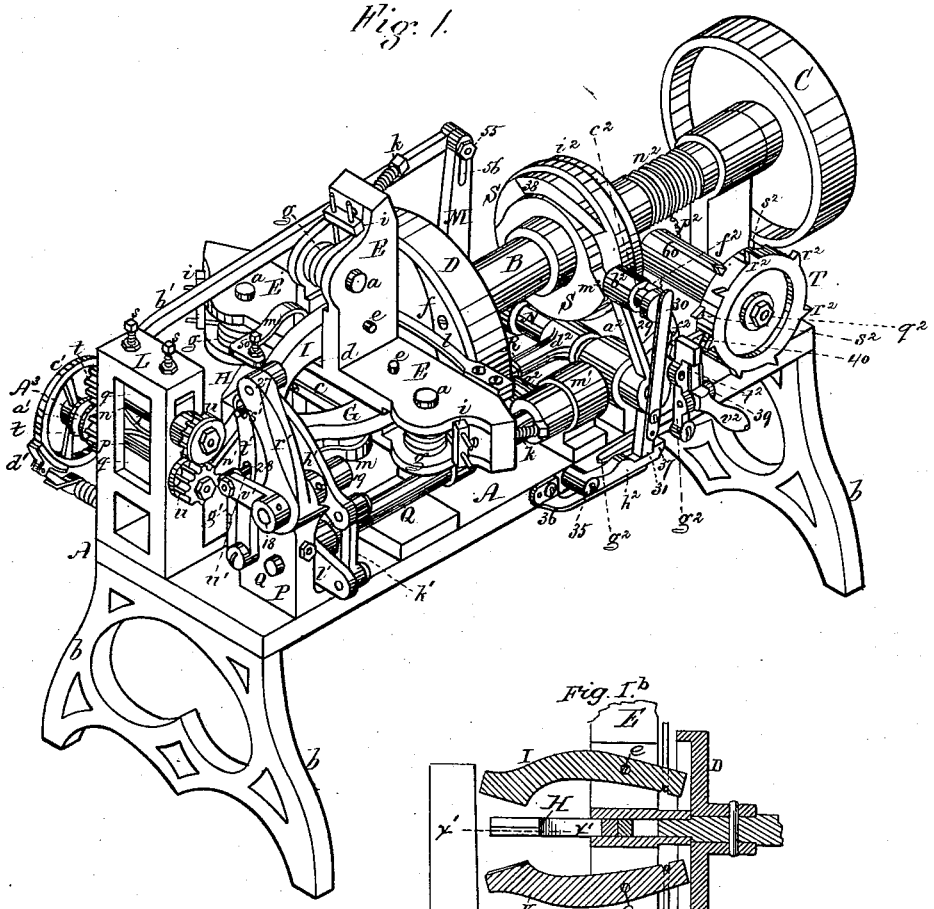

Fig. 1b.

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Atty's

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Fig. 2.

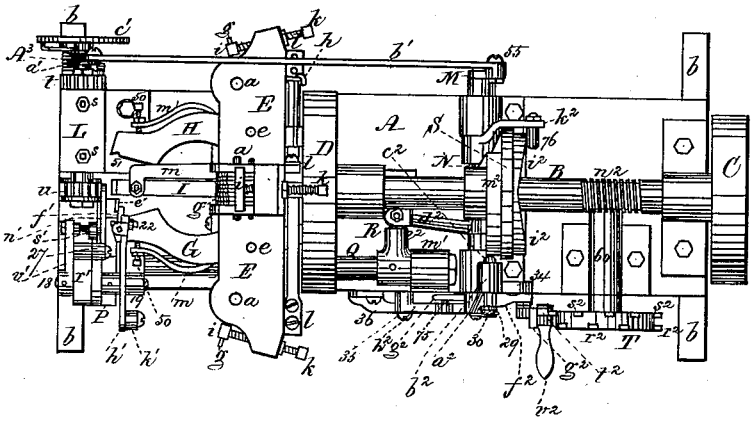

Fig. 8.

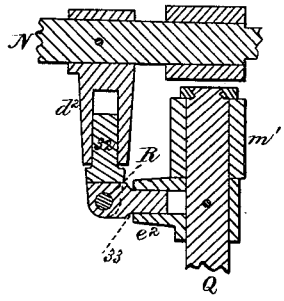

Fig. 9.

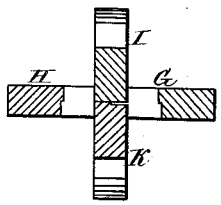

Fig. 10.

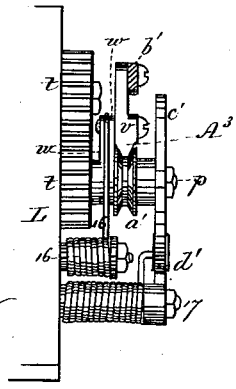

Fig. 11.

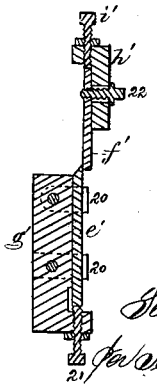

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Fig. 3.

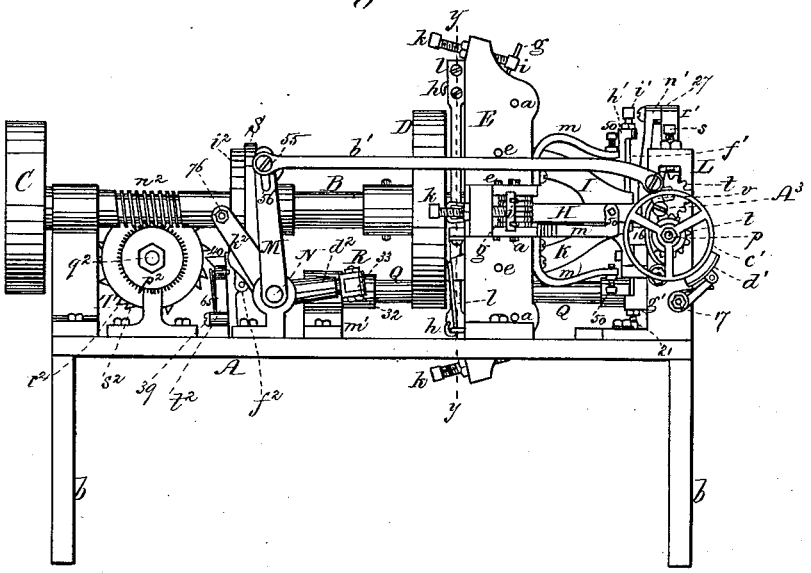

Fig. 4.

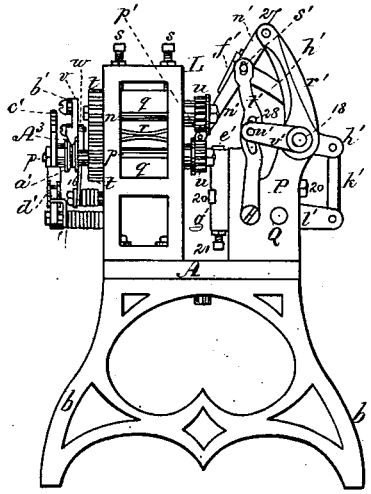

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Fig. 5.

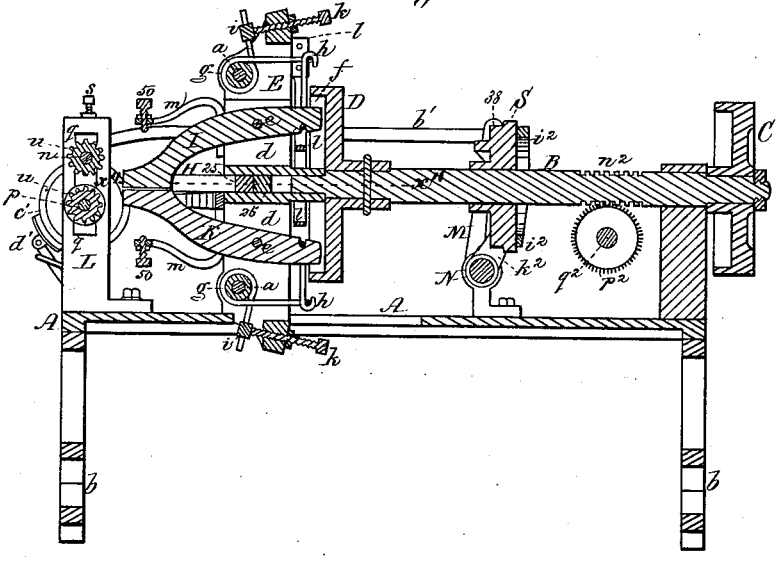

Fig. 6.

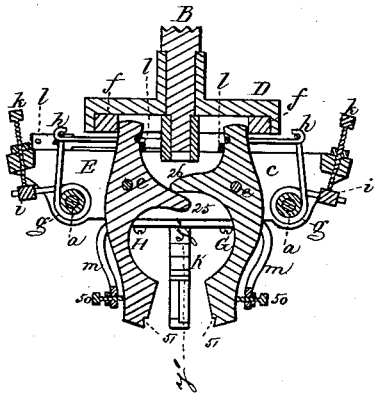

Fig. 7.

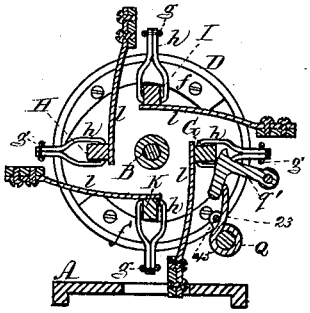

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Fig: 12.

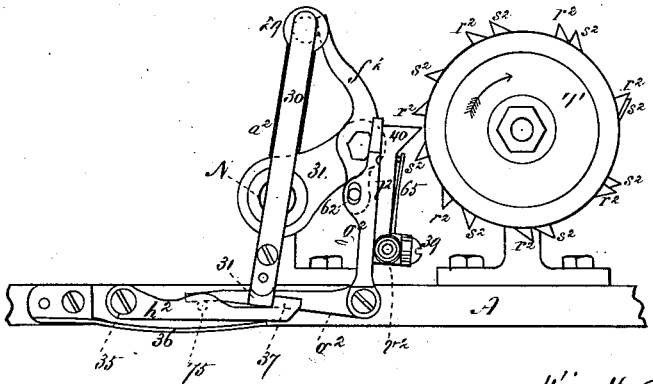


Fig: 13.

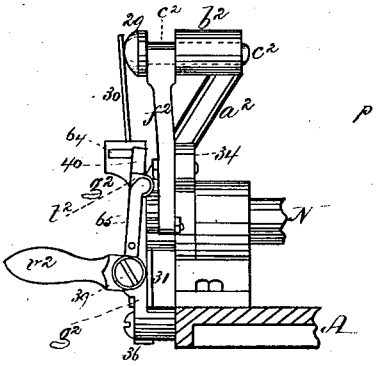


Fig: 16.

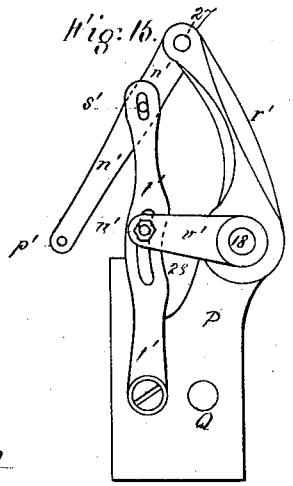
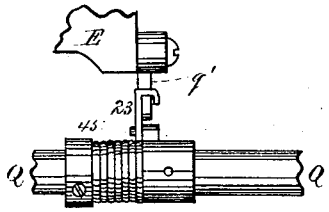


Fig: 14.



Witnesses,
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Inventor,
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Attys.

UNITED STATES PATENT OFFICE.

SILAS S. PUTNAM, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO THE PUTNAM NAIL COMPANY, OF SAME PLACE.

IMPROVEMENT IN MACHINES FOR FORGING HORSESHOE-NAILS.

Specification forming part of Letters Patent No. **207,444**, dated August 27, 1878; application filed June 4, 1877.

To all whom it may concern:

Be it known that I, SILAS S. PUTNAM, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Machines for Making Horseshoe-Nails, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a perspective view of my improved machine; Fig. 1ᵇ, a detail referred to. Fig. 2 is a plan of the machine. Fig. 3 is an elevation of one side of the same. Fig. 4 is a front elevation of the same. Fig. 5 is a longitudinal vertical section through the center of the same. Fig. 6 is a horizontal section on the line *x x* of Fig. 5. Fig. 7 is a transverse vertical section on the line *y y* of Fig. 3. Figs. 8, 9, 10, 11, 12, 13, 14, and 15 are details enlarged.

My invention relates to that class of nail-machines in which the nail is formed by means of spring-hammers, arranged and operating in pairs; and consists in a mechanism of improved construction for locking the side hammers while open, and preventing them from striking a blow while the nail is being cut off.

My invention also consists in the construction of the mechanism for operating the guide for the nail-rod, by means of which it is moved to one side, and, after the nail has been severed, returned to its original position.

My invention also consists in a mechanism of peculiar construction for changing at the will of the operator the automatic action of the machine while it is in motion, in order to vary the number of blows to which the nail is subjected while being formed.

My invention also consists in a joint of peculiar construction for connecting the two rock-shafts of the machine, which are at right angles to each other, in such manner as to diminish friction and wear.

My invention also consists in a mechanism for locking and holding the two rock-shafts and mechanism connected therewith while the nail is being formed by the hammers; and my invention also consists in other details, hereinafter described and claimed.

My invention also consists in the combination, with the hammers, the faces of which are so constructed as to allow the nail to be formed on one side of and below a line passing centrally between them, the side hammers being constructed to meet on one side of this central line, and the vertical hammers below the said line, whereby the amount which the nail-rod is bent in the operation of bringing it into line with the cutters and severing the nail therefrom is reduced to a minimum, of the feed-rolls, guide-lever, and cutters.

To enable others skilled in the art to understand and use my invention, I will proceed to describe the manner in which I have carried it out.

In the said drawings, A represents the bed of the machine, which is supported on legs *b*. B is the driving-shaft, which runs in suitable bearings, and carries at one end the driving-pulley C and at the opposite end a cam-wheel, D. From the bed A rises a frame, E, made in the form of a cross, the center of which forms a bearing for the inner end of the driving-shaft B. In the frame E are formed three slots, one horizontal one, *c*, and two vertical ones, *d*, in which are placed the hammers G H I K, which vibrate on pivots *e* passing through the frame.

These hammers, arranged as above described, are operated alternately in pairs by cams *f* on the inside of the rim of the wheel D, the two hammers of a pair, when released by the cams, being thrown toward each other to give the blow by coiled lever-springs *g*, which are connected with the rear ends of the hammers behind the points where they are pivoted by links *h*. Each of the springs *g* is coiled several times around a cylindrical block, held in place by a pin, *a*, the looped end of the spring being held by the hook of the link *h*, while the two opposite ends pass through a short bar, *i*, which rests against a screw, *k*, by turning which the force with which the spring is caused to act may be adjusted with a great degree of nicety, the bar *i* also serving to confine the two ends of the spring and hold them in place.

By thus connecting the springs with the hammers at points behind their pivots instead of in front thereof, they are removed from those portions of the hammers which become heated from contact with the hot nail-rod, and the

liability of the temper of the springs being injured from this cause is thus avoided, as is also the cutting or wearing away of the ends of the springs heretofore caused by the introduction between them and the hammers on which they slide of the flying scale from the nail-rod, which combines with the oil used for lubricating, and forms a destructive grit.

Each of the hammers is provided with a flat auxiliary spring, *l*, one end of which is secured to the frame E, the opposite end extending out into a position to be struck by the rear end of the hammer a short time before the latter is drawn back to its full extent, the momentum of the hammers when running at a high speed being sufficient to assist in bending back the springs; and by the employment of these auxiliary springs, which remain in contact with and act upon the rear ends of the hammers during a portion only of their throw, I am enabled to use much lighter main-springs *g* than would otherwise be required, and thus reduce the friction on the cams and lessen the power necessary to drive the machine.

The lower half of the face of each of the two side hammers G H is cut away slightly, and the face of the lower hammer, K, is cut away slightly on one side, while the upper hammer, I, has a perfectly smooth face, as seen in Fig. 9, so that when the two hammers of a pair come together a space will be left corresponding in form to that of two sides of the nail, two sides of the head of which are formed in a vertical groove, 51, one-half of which is made at the outer end of the face of each side-hammer, so as to leave a space when these hammers are brought together of a width corresponding to that of the head of the nail. The upper inclined side of the head of the nail is formed in a space left between the beveled outer edge of the face of the lower hammer and the smooth face of the upper hammer, and the required shape is thus given to the nail, which is formed as far as possible on one side of a line passing centrally between the four hammers, to diminish as far as practicable the amount of lateral movement necessary to be given to the rod to bring it into line with the cutters when the finished nail is to be severed, and the bending of the rod is thus in a great measure avoided.

In order that the nail may be thus formed on one side of the center, the side hammers G H are necessarily constructed and arranged to meet on one side of a vertical plane passing centrally through the upper and lower hammers; and these hammers I K are constructed and arranged to meet on a line below a horizontal plane passing centrally between the four hammers, and consequently, when the end of the rod is moved laterally into line with the cutters, it requires to be bent down a less distance to bring it into contact with the edge of the stationary lower cutter (which must necessarily lie below the plane of the under surface of the side hammers) than would be the case if the nail were formed in the usual central position.

By thus reducing to a minimum the amount which the rod is bent in the operations of bringing it into line with the cutters and severing the nail therefrom, the liability of its being bent out of shape in returning it to its original position, and the consequent feeding in of unequal lengths of the rod, which would cause the nails to vary in length and be thus rendered unsalable, is entirely avoided.

To accomplish the object sought—that is, to reduce to a minimum the amount which the nail-rod is bent in the operation of bringing it into line with the cutters—I make the curved arm of the upper vertical hammer longer in its curve than the lower arm, as shown in Fig. 1^b, whereby the faces of the hammers will meet on the line x' x', below the center-line of the side hammers. This construction is also illustrated in Fig. 5, where the upper vertical hammer, embracing the larger segment of the inner curve, meets the lower hammer on a line below x'' x''. In constructing the side hammers I make the hammer opposite to the cutter of a longer curve than the hammer on the cutter side of the machine, as is shown in Fig. 6, whereby the faces are caused to meet on the line y' y', and to one side of the center of the vertical hammers.

m m m m are stationary curved spring-arms, which are secured to the front of the frame E, each arm being provided at its outer end with a set-screw, 50, which serves as a stop to prevent the adjacent hammer from being thrown back too far by its own momentum, and also causes the direction of motion of the hammer to be instantly reversed after it is released by the cam; and by constructing these arms so as to yield slightly the concussion is greatly diminished.

I will now proceed to describe the manner in which the nail-rod is fed into the machine.

n p are two horizontal shafts, which run in long bearings *q*, the ends of which slide in slots in a frame, L, the shafts being kept apart by the double spring *r*, and their distance from each other being regulated by screws *s*. Each of these shafts carries at one end a gear, *t*, by which the motion of the lower one is communicated to the other, and at their opposite ends they carry the toothed feed-wheels *u*, by which the nail-rod is seized and carried into the machine. The teeth of the wheels *u* slightly indent the heated rod and prevent all liability of slip, whereby the certainty of feeding in the same length of rod each time is insured, and it will be seen that the heated rod is cooled less by the contact of the points of the teeth than if smooth rolls were employed, as with the latter a larger surface must necessarily be in contact with the heated iron. The teeth of the wheels *u* also serve to hold the rod firmly in place while it is being operated

upon by the hammers. The lower shaft, p, is revolved intermittingly, so as to produce the feed at the required times, by means of a friction-clutch, A^3, consisting of a lever, v, Fig. 10, which is pivoted to an arm, w, applied to the shaft p so as to move independently thereof, the short arm of the lever v being made with tapering sides and fitting into a correspondingly-shaped groove in the periphery of a collar, a^1, firmly secured upon the shaft p.

The lever v is operated by a connecting-rod, b^1, attached to its upper end, the opposite end of the rod b^1 being attached by a screw, 55, and slot 56 to the upper end of an arm or crank, M, secured to a rock-shaft, N, which is supported in bearings rising from the bed A, and is rocked at the required time by mechanism to be hereinafter described; and thus at each forward movement of the rod b^1 the clutch is advanced to take a fresh hold upon the collar a^1, while each backward movement of the rod b^1 causes the clutch to turn the shafts n p and toothed feed-wheels u a sufficient distance to feed the nail-rod forward the exact amount required for the next nail. The arm w is held up in the proper position to enable the clutch-lever to act on the grooved collar a^1 by means of a spring, 16.

c^1 is a wheel attached to the outer end of the shaft p, and against the periphery of this wheel bears a spring friction-brake, d^1, which is secured to the outer end of a stud, 17, and by this means the shaft p is prevented from being turned in the wrong direction by the friction-clutch as it is advanced to take a fresh hold, and is also prevented from being moved beyond the proper point by its own momentum and that of the parts connected therewith.

The employment of a friction-clutch for operating the feed-wheels, instead of a ratchet-wheel and pawl, enables me to adjust the amount of feed with the utmost nicety by merely changing the position of the screw 55 in the slot 56 of the crank M, which is a great advantage, as it avoids the delay heretofore occasioned in removing one ratchet-wheel and replacing it by another having teeth at a greater or less distance apart.

I will now proceed to describe the manner in which the finished nail is cut off after being formed by the hammers.

e^1 f^1 are the cutters, the lower one, e^1, of which is stationary, and is secured within a groove in a block, g^1, attached to a standard, P, rising from the bed A, while the upper one, f^1 is attached to one end of a lever, h^1, which is secured to a short shaft, 18, having its bearings in the standard P and a support, 19, attached thereto. The lower cutter, e^1, is held in place by two screw-clamps, 20, Fig. 11, and is made adjustable vertically by a screw, 21. The upper cutter, f^1, is secured to its lever h^1 by a clamping-screw, 22, and is made adjustable in the direction of its length by a set-screw, i^1, passing through a projection at the upper end of the lever.

The lower end of this lever h^1 is connected by a rod, k^1, with a crank, l', secured to a long horizontal rock-shaft, Q, one end of which is supported in a bearing in the standard P, and the other end in a bearing, m^1, rising from the bed A; and when this shaft Q is rocked by mechanism to be hereinafter described the cutter f^1 is carried down past the stationary cutter e^1 to sever the nail from the rod, after which it is returned to its normal position by the counter movement of the shaft Q.

When the nail is finished and ready to be severed from the nail-rod it is moved to one side out of the path of the vertical hammers and over the stationary cutter e^1 (just before the cutter f^1 is brought down) by the movement of a lever, n^1, at the lower end of which is a circular opening, p^1, which serves as a guide for the nail-rod, which is fed through it by the wheels u, the side hammers being locked while separated to their full extent and held apart until the cutting off is completed by a stop-lever, q^1, Figs. 7 and 14, which is pivoted to the frame E, and is moved at the required time into a position to intercept the hammer G by an arm, 23, the lower portion of which is secured to and coiled around the rock-shaft Q, so as to form a spring. This spring-arm 23 is held back out of contact with the lever q^1 by a pin, 45, projecting from a collar on the shaft Q, and is only brought up against the lever q^1 to cause the latter to intercept the side hammer G when the shaft Q is rocked; and by thus operating the stop-lever by means of a spring-arm instead of a rigid one, it will yield in case it should from any cause come into contact with the hammer G before the proper time, and the liability of breakage or excessive friction is thus avoided.

The hammer H is provided with a projecting portion, 25, which bears against a corresponding projection, 26, on the hammer G, and thus the locking of the hammer G, as above described, serves also to lock the hammer H, both hammers being held apart until the arm 23 is withdrawn by the rocking of the shaft Q, so as to allow the lever q^1 to drop down by its own weight out of the path of the hammer G. The lever n^1 is pivoted at 27 to the upper end of a stationary curved arm, r^1, projecting up from the standard P, and is provided with a pin, s^1, which passes through a slot in the upper end of a lever, t^1, the lower end of which is pivoted to the standard P. At the center of this lever t^1 is a curved slot, 28, into which fits a pin, w', projecting from the outer end of a crank, v^1, secured to the outer end of the shaft 18, and thus through the connections described, as the shaft 18 is rocked to depress the cutter-lever h^1, the guide-lever n^1, and with it the nail-rod, is moved to one side into line with the cutters just before the upper cutter, f^1, is carried down past the cutter e^1, and as soon as the nail has been severed from the rod the lever n^1 is returned to its original position, which takes

place simultaneously with the ascent of the lever h^1. The nail-rod is thus returned to its proper central position opposite the hammers immediately after the nail has been severed and before being again fed forward, which prevents any liability of its being crippled or bent by contact with the cutters.

I will now proceed to describe the manner in which the number of blows to which the nail is subjected previous to being cut off may be varied at the will of the operator.

a^2, Figs. 1 and 13, is an inclined arm, which is firmly secured to one end of the rock-shaft N, and carries at its upper end a short tube or bearing, b^2, in which slides a horizontal pin, c^2, provided with a head, 29, against which rests a flat spring, 30, the lower end of which is attached to an arm, 31, also secured to the shaft N, and forming a prolongation of the arm a^2. This shaft N is connected with the rock-shaft Q, so as to move simultaneously therewith, by a joint, R, composed of two short rods, 32 and 33, Fig. 8, pivoted together and sliding in hollow arms d^2 e^2, secured the former to the shaft N and the latter to the shaft Q, and by this means the motion of one shaft is communicated to the other with much less friction and wear than if segments of bevel-gears were employed.

While the hammers are operating upon the nail-rod the pin c^2 is held back in the position seen in Figs. 1 and 13 against the resistance of the spring 30 by a curved lever, f^2, Figs. 1 and 12, the flattened upper end of which fits between the head 29 of the pin c^2 and the end of the bearing b^2.

The lever f^2 is pivoted to a stationary arm, 34, and its lower end is provided with a pin, which fits into a slot, 62, Fig. 12, in the upright arm of a bent lever, g^2, which is pivoted to the bed A, the horizontal arm of this lever resting on a pin, 75, projecting from the inner side of a lever, h^2, which is pivoted to the bed A at 35, and is held up in the position seen in Figs. 1 and 12 by a flat spring, 36, which, through the connections described, serves to keep the end of the lever f^2 between the head of the pin c^2 and the bearing b^2.

At the outer end of the lever h^2 is a projection, 37, against which abuts the lower end of the arm 31, a latch being thus formed, by means of which the shafts N and Q and mechanism connected therewith are firmly locked while the nail is being forged.

When the upright arm of the lever g^2 is pressed against the resistance of the spring 36 by mechanism to be presently described, the lever f^2 is moved so as to withdraw its upper end from between the bearing b^2 and the head 29, when the pin c^2 is instantly thrown forward by the spring 30 until its head strikes against the bearing b^2. This movement of the lever g^2 causes its horizontal arm to press upon the pin 75, projecting from the inner side of the lever h^2, and depress the latter against the resistance of the spring 36, so as to unlock the latch, and thus leave the shafts N Q free to be moved. Immediately after the pin c^2 has been thrown forward by its spring 30 its inner end (which now projects out some distance from the inner end of the bearing b^2) is struck by a cam, 38, on a wheel, S, secured to the driving-shaft B, and as this wheel revolves the cam moves the arm a^2, and thus rocks the shaft N, which advances the rod b^1 and causes the friction-clutch A^3 to take a fresh hold on the collar a^1 of the shaft p. This movement of the shaft N is communicated through the joint R to the shaft Q, and thus, through the connections described, the side hammers are locked, the guide-lever n^1 moved to one side, and the cutter f^1 brought down to sever the nail from the rod. As soon as this has taken place a cam, i^2, on the opposite side of the wheel S moves a pin, 76, projecting from the upper end of an arm, k^2, secured to the shaft N, and by means of this cam the shafts N Q are returned to their original positions, the counter movement of the shaft N and corresponding movement of the rod b^1 causing the friction-clutch A^3 to turn the shaft p and wheels n so as to feed the nail-rod forward, as before described, while the counter movement of the shaft Q causes the spring-arm 23 to be withdrawn, so that the stop-lever q^1 will drop down and unlock the side hammers, this dropping of the stop-lever q^1 taking place in time to allow the side hammers to act in their turn upon the nail-rod.

At the same time that the spring-arm 23 is withdrawn the cutter f^1 is raised and the guide-lever n^1 moved back, so as to return the nail-rod to its proper position between the feed-wheels u. Another cam, m^2, on the wheel S now comes into contact with the inner end of the pin c^2, and forces it back against the resistance of the spring 30, in which position it is held (as the wheel S continues to revolve) by the concentric portion of the cam m^2 until the upper end of the lever f^2 is thrown by the spring 36 between the head 29 and the bearing b^2, and the pin c^2 is thus held back out of reach of the cam 38 until the lever f^2 is again tripped. This lever f^2 is tripped or withdrawn when it is desired to bring the above-described mechanism into action in the following manner: On the driving-shaft B is a worm, n^2, which engages with and slowly rotates a worm-wheel, p^2, secured to the end of a horizontal shaft, q^2, which is supported in a long bearing, 60, at the top of a standard rising from the bed A. To the outer end of the shaft q^2 is secured a wheel, T, the periphery of which is provided on its opposite edges with two sets or rows of teeth or projections, r^2 s^2, the form of each tooth being that of a right-angled triangle. t^2 is a lever, which is pivoted at 39 to one side of the lever g^2, and is provided at its upper end with an angular projection, 40, which extends out into a position to be struck successively by the teeth r^2 or s^2 of the wheel T, and thus as the inclined side of a tooth comes into

contact with the inclined side of the projection 40 the lever g^2 is pressed out from the periphery of the wheel T, and the lever f^2 tripped to release the pin c^2, as before described. As soon as the tooth of the wheel T has passed out of contact with the projection 40 (which does not take place until after the nail has been severed and the shafts N Q returned to their normal positions) the lever g^2 is moved back to its original position by the spring 36, which causes the lever f^2 to catch and hold back the pin c^2 until it is again tripped by the next succeeding tooth of the wheel T. This same movement of the lever g^2 allows the lever h^2 to be raised by the spring 36, so that its projection 37 will catch the end of the arm 31, and thus lock the shafts N Q, as required.

The lever t^2 is provided with a handle, v^2, by which it can be moved on its pivot so as to bring its projection 40 opposite either series of teeth r^2 or s^2, the upper end of the lever being steadied and its motion limited in either direction by a pin, which projects into a slot, 64, at the upper end of the lever g^2. (See Fig. 13.) When the lever t^2 is in position opposite either series of teeth it is held by a friction-pin, which is forced by a spring, 65, into a notch at either side of the lever g^2, these notches being rounded, so as to force back the pin when pressure is applied to the handle v^2.

The outer teeth, r^2, are placed farther apart than the inner teeth, s^2, there being seven of the former and eight of the latter, while the worm-wheel p^2 is provided with fifty-six teeth, it being absolutely necessary that the number of the teeth of the wheel p^2 should be a common multiple of the numbers of the two series of teeth r^2 s^2, in order that the movements of the several parts of the machine may be properly timed with respect to each other, and all liability of interference avoided.

When the projection 40 of the lever t^2 is in a position to be struck by the teeth r^2 the nail will be subjected to the action of the hammers during eight revolutions of the driving-shaft B; but, if it should be found that this number of blows draws out the nail too much, owing to the nail-rod being too hot, it is simply necessary to move the lever t^2 by means of its handle v^2, while the machine is in operation, so as to bring the projection 40 opposite to the teeth s^2, which will cause the nail to be subjected to the action of the hammers during seven revolutions only of the driving-shaft, while if the heat of the nail-rod should become lessened, so that seven revolutions would not produce a nail of sufficient length, the lever t^2 can be instantly moved back to increase the number of blows of the hammers.

It will be seen that a variation of one revolution only can be made, as above described; but this change in the number of blows of the hammers is sufficient for all practical purposes when the heat of the iron is nearly uniform; but the wheel T may be removed and another substituted having a different combination of teeth; but in such case a worm-gear, p^2, must be employed, the number of whose teeth is the common multiple of the numbers of the two series of teeth on the wheel T. For instance, the wheel T may have five teeth on one edge and six teeth on the other, in which case the wheel p^2 would be provided with thirty teeth; and by this means I am enabled to regulate the number of blows according to the heat of the nail-rod with such accuracy as to insure the formation of a perfect nail.

It is evident that the wheel T may be provided with more than two series of teeth without departing from the spirit of my invention; but a worm-wheel, p^2, must in such case be employed the number of whose teeth is the common multiple of the numbers of the several series of teeth on the wheel T.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The stop-lever g^1, operated by the spring-arm 23 on the shaft Q, in combination with the side hammers, provided with the projecting portions 25 and 26, the said stop-lever locking the side hammers while open and holding them apart while the nail is being cut off, substantially as herein described.

2. The guide-lever n^1, with its pin s^1, slotted lever t^1, pin u', and crank v^1, operated by the shaft Q, in combination with the hammers and the cutters, substantially as described.

3. The mechanism for varying the number of blows of the hammers, consisting, essentially, of the toothed wheel T, levers t^2 g^2 f^2, pin c^2, with its spring 30, arm a^2, connected shafts N Q, cam-wheel S, and arm k^2, operating substantially as set forth.

4. The wheel T, having two or more series of teeth, r^2 s^2, for setting in operation the mechanism for varying the number of blows of the hammers, in combination with and operated by a wheel, p^2, the number of the teeth of which is a common multiple of the numbers of the different series of teeth on the wheel T, substantially as described.

5. The combination of the hammers with the mechanism for varying the numbers of their blows, the guide-lever n^1 and its operative mechanism, and the cutters, substantially as described.

6. The shafts N Q, connected by a joint, R, composed of the rods 32 and 33, pivoted together, and sliding within hollow arms d^2 e^2, substantially as described.

7. The lever g^2, in combination with the lever h^2, with its pin 75, projection 37, and spring 36, and the shaft N, with its arm 31, all constructed to operate substantially in the manner and for the purpose set forth.

8. The hammers G H I K, having their faces so formed as to allow the nail being made on one side of and below a line passing centrally between the four hammers, the hammers G H being so constructed and arranged as to meet on

a line on one side of a vertical plane passing through the center of the upper and lower hammers, and the hammers I K meeting on a line below a horizontal plane passing through the centers of the side hammers, in order to reduce to a minimum the amount which the nail-rod is bent in the operations of bringing it into line with the cutters and severing the nail therefrom, in combination with the feed-rolls, guide-lever, and cutters, substantially as described.

Witness my hand this 25th day of May, A. D. 1877.

SILAS S. PUTNAM.

In presence of—
P. E. TESCHEMACHER,
N. W. STEARNS.