(No Model.) 3 Sheets—Sheet 1.

F. PHILIPS.

WIRE NAIL MACHINE.

No. 353,585. Patented Nov. 30, 1886.

Fig. 1.

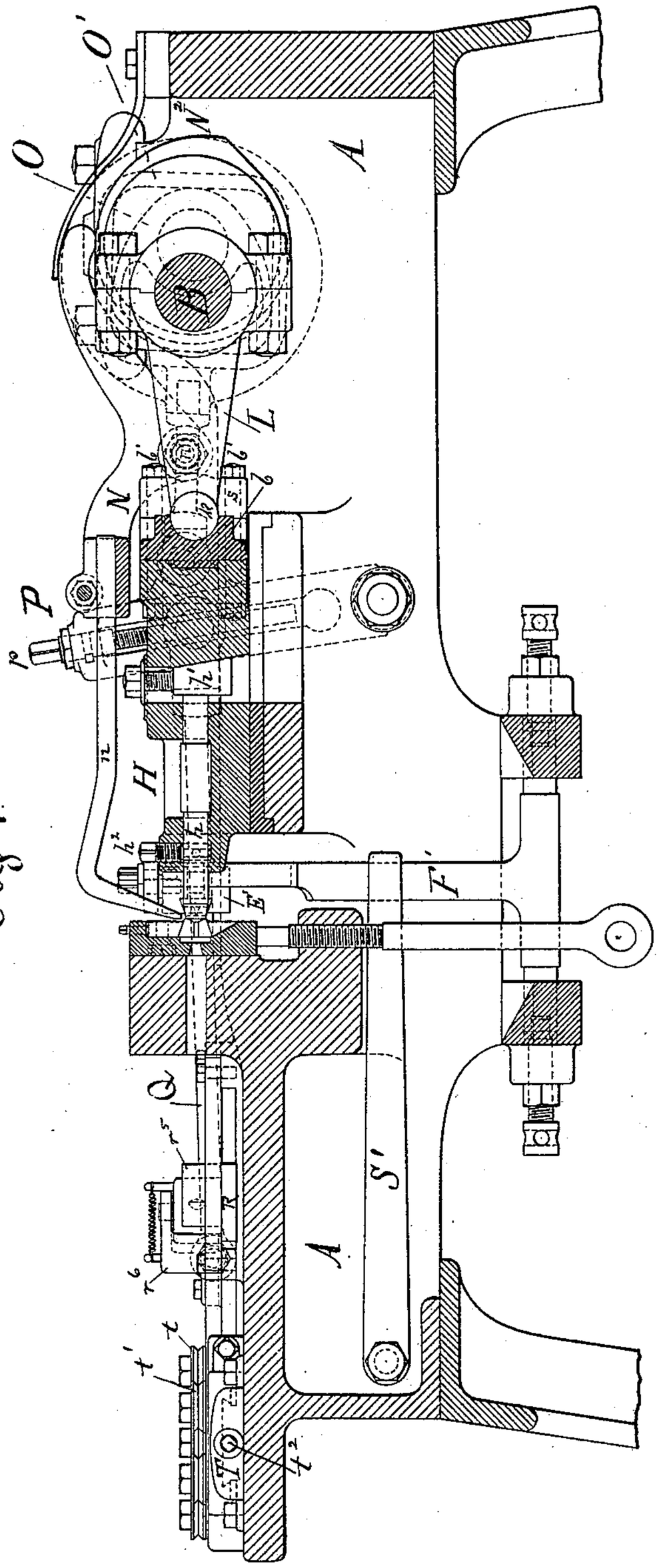
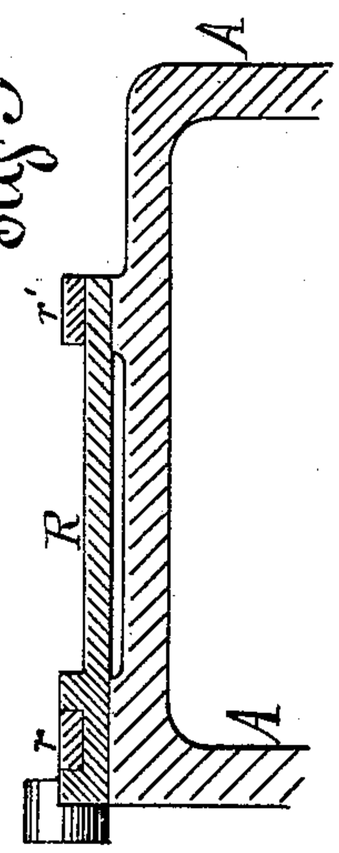


Fig. 3.



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(No Model.) 3 Sheets—Sheet 2.

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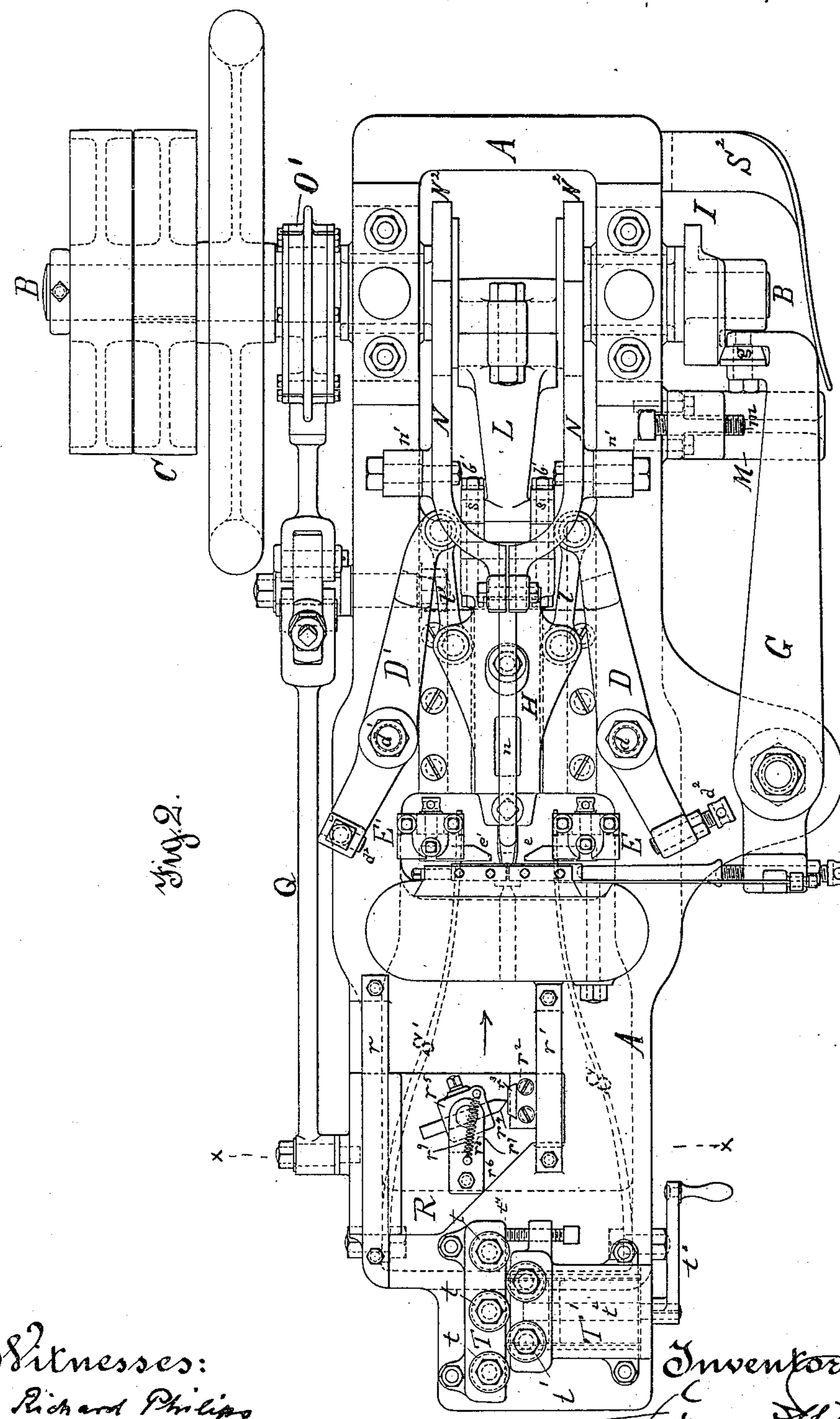

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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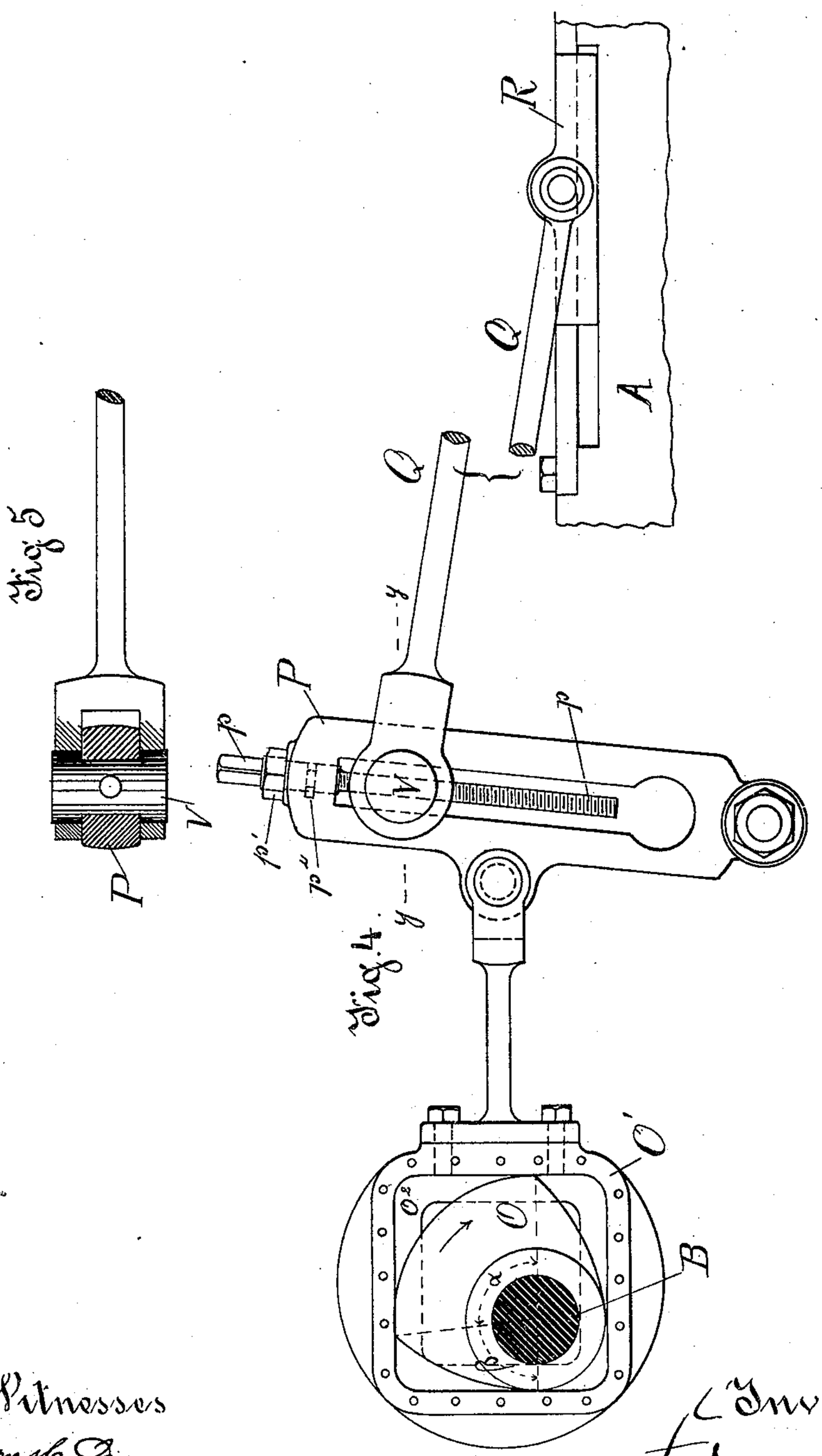

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FERDINAND PHILIPS, OF PHILADELPHIA, PENNSYLVANIA.

WIRE-NAIL MACHINE.

SPECIFICATION forming part of Letters Patent No. 353,585, dated November 30, 1886.

Application filed August 5, 1886. Serial No. 210,082. (No model.)

To all whom it may concern:

Be it known that I, FERDINAND PHILIPS, a subject of the Emperor of Germany, residing in the United States, at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Nail-Making Machines, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal sectional view through the center of the machine. Fig. 2 is a plan view; and Fig. 3 is an enlarged section in the direction *x x*, Fig. 2. Fig. 4 is a detached view of my feeding mechanism, and Fig. 5 a part section in the direction *y y* of Fig. 4.

My invention relates to that class of nail-machines which are generally known as "wire-nail" machines, in which the successive operations for the formation of a nail are as follows: The wire is gripped tightly between a pair of jaws, beyond which it projects. The projecting end is then upset and shaped into the desired form of a nail-head by the action of a header which is thrown or otherwise moved toward the gripping-jaws. The gripping-jaws next open and the hammer retracts. The wire is fed out the required length in the direction of the retraction of the hammer. A pair of nippers cut the wire and form a nail-point, leaving a certain required portion of wire projecting from the gripping-dies. The dies then grip the wire, as before, ready to receive another stroke of the hammer. The finished nails are thrown down, and the projecting end of wire is cleared of bits by the action of a knock-off immediately before the second stroke of the hammer occurs.

As the best exemplification of the best known nail-machine—the one which is almost universally known with but little difference in detail—I beg to refer to that type which is known as the "German" machine. It is fully described in the French Patent No. 4,854, issued to Qurin in 1849. It is also illustrated in the German Patents Nos. 1,301, 23,705, 18,280, 19,554, and many others, and in numerous American patents, among which No. 325,670, granted to Gedge and Meyerer; No. 342,001, granted to B. H. Gedge; No, 327,828, granted to J. M. Shiltz, are most perfect illustrations of the well-known machines referred to. The characteristic in all these machines is that a powerful spring actuates the header for the formation of the nail-head; further, that levers operating the nippers for cutting the nail-point are actuated by cams mounted upon the main shaft, and that the wire is fed by an eccentric.

The first characteristic feature mentioned in these machines involves the necessity of a draw-back cam on the main driving-shaft which retracts the header and gives tension to the spring for the next protraction of the header. It actuates at high speed against the perfectly-motionless mass of the header and the power of the spring. This feature is a constant source of repairs.

The second feature mentioned in the old machine is objectionable, inasmuch as the cutting-levers are operated toward each other for cutting by means of cams, while they are pushed back by springs. Any slight irregularity in the functions of the levers is felt by the springs. They fail to move the cutters out of the road with sufficient force and velocity to clear other operative parts in time.

The third feature—feeding by eccentric—is objectionable on the ground that the eccentric requires one hundred and eighty degrees of the revolution of the driving-shaft for feeding; but during the time of feeding all other operating parts of the machine must be idle. Consequently their numerous motions are considerably crowded during the remaining one hundred and eighty degrees of the revolution of the driving-shaft. While, therefore, the simple operation of feeding is executed by means of the easy-working crank mechanism, other more important and numerous operations are done by very hard cam mechanism and return-springs in an unmechanical manner. Almost every one of the operations, except the feeding, is attended by blows, which act in a most effective manner toward the early destruction of the operating parts, and the whole machine in general.

A further objection to the machines referred to is due to the fact that a part of the motions is obtained by positive mechanism and the other part by elastic force. The latter will act with a limited speed only, which in turn limits the speed of the parts moved by positive mechanism.

The object of my invention is to avoid all

the aforementioned defects by constructing an entirely new type of machine, having mostly positive motions, and such other elastic elements and mechanism as will advantageously work with the positive motion; also to substitute such mechanism for the various successive operations of the machine as will avoid all of the above-named troubles as much as possible, as hereinafter more fully described.

In the accompanying drawings, A is the main bed of the machine. It is provided with bearings for the reception of crank-shaft B, from which the whole machine is operated by pulley C. The crank portion of the main shaft B is in a well-known manner fitted with a connecting-link, L, which connects with the header H, to which it gives reciprocating motion. The link L terminates in a cylindrical knuckle-joint, *k*, which abuts against the header-slide H, or preferably against a removable bronze abutment, *b*, which is recessed into the header, as shown in drawings, and is connected thereto and to the link L by bolts *b'*, passing through straps *s s*, encircling the knuckle-joint *k*, as plainly shown in drawings, Figs. 1 and 2. Any other good arrangement for connecting the crank-shaft, header, and connecting-link may be adopted, such for instance as described in my Patent No. 334,464, of January 19, 1886.

The header H carries the heading-die *h*, adjustable lengthwise in some well-known manner—by a wedge, *h'*, for instance, as shown in drawings. It is held in position by set-screw h^2. The endwise motion of the header is made use of for the operation of the cutting-levers D D'. These levers are pivoted at *d d'* respectively. One end of each is provided with a set-screw, d^2, which presses against and regulates the position of the cutter-boxes E E', provided with the cutters *e e'*. The cutter-boxes E E' are carried by pivoted levers F F', one of which is shown in Fig. 1. The construction of the cutter-boxes and cutters, also their action and adjustment up and down and off and toward the gripping-jaws, are absolutely similar to the one known in the old machine, and not new. They are operated by levers D D', as said before. These levers receive their positive motion from the header, being connected thereto by means of toggle-links *l l'*. When the header recedes from the clamping-dies, the wire is fed. It follows the header. When the feed is ended, the toggle-links *l l'*, in connection with levers D D' and header H, have assumed such a position that the front or set-screwed ends of levers D D' have pushed the cutters *e e'* toward each other. Still a slight motion backward of the header is required and the cutters act upon the wire in a slow and positive manner, cutting and pointing the nail. The slow positive motion of the cutters toward each other is a great advance over the rapid and blow-like motion as heretofore practiced. It saves the machine and the tools. When the crank is over its center and the header begins its forward stroke, the levers D D' also begin to change their motion. The set-screwed ends begin to move away from each other. The cutters are then separated by means of springs S S', pressing against the levers F F'. These levers are pivoted, as shown in Fig. 1. The springs are situated in an intermediate position between the pivots and the cutters, as near the cutters as possible, in order to secure the greatest leverage for the action of the springs. It is visible that the work of the springs is very slight in this construction, being limited to separate the cutters, while previous to this invention the duty of the springs was considerably increased by pressing with such force against the set-screwed ends of the cutting-levers that thereby the opposite end was kept tight against the configurations of the acting cam in order to prevent shocks and their resulting consequences on the machine.

The newly-made nail, pointed and cut as described, is thrown down by a knock-off, *n*, adjustable in a lever, N, pivoted substantially central with the axis of the nail, so that the motion of knock off *n* at the point where it strikes the nail is square to the nail. Lever N is pivoted at *n'*, substantially in the center line of the machine, and is actuated by a cam, N^2, on the main driving-shaft. (See Figs. 1 and 2.) The nail being thrown down, the header comes forward gradually, giving the knock-off time to clear the header gradually.

During the cutting and pointing of the wire it is held tightly between dies, which are pressed together by means of a lever, G, as is well known and understood. This lever is actuated by a cam, I. It has been the practice to provide the end from which the lever is actuated with a roller. Such rollers have been made, so far as I know, "zone-shaped," pressing against the straight face of the cam. The round zone-shaped roller, however, would invariably wear the actuating-cam in a short time, while the roller itself was subject to the same early destruction, by reason of the hard usage upon comparatively small surfaces. To overcome this I place a roller, *g*, lever G, and main driving-shaft B all in the same plane and provide the roller *g* and the actuating-cam I with cone-surfaces with wide bearings. Lever G is supported by a support, M, and stopped in its motion by a set-screw, *m*. Spring S^2 keeps lever G against the configurations of cam I.

The feeding of the wire is done during the time the header is on its backward stroke. The feeding must be slower than the motion of the header, yet it has to be ended before the header is so far advanced in its backward motion that the nippers operated by the header would interfere with feeding. I accomplish this by means of a cam, O, Fig. 1, situated in and actuating a yoke, O', Figs. 1, 2, and 3. The cam, the construction of which is well known, completes its motion in less than one hundred and eighty degrees motion of the

driving-shaft. The proper time as well as the amount of motion is to be regulated by the proper proportions of the cam, circumstanced by the work the machine is intended to do. Any other cam different from the one shown in drawings, fulfilling the essential conditions, may be adopted. Cam O, as shown in Fig. 4, dwells during the angle α of the revolution of the driving-shaft, and completes its throw during the angle β (which in accompanying drawings is less than one-quarter revolution) of the shaft B.

The yoke O′ is provided with shields O^2, as shown in Figs. 2 and 4. Said shields not only serve to prevent the yoke from side motion, but also form with the yoke O′ an oil-tight box for the reception of the lubricant for the cam.

The motion of the cam is transmitted to a rocking lever, P, to which it imparts reciprocating motion, which is transmitted to the feed-plate R by means of a rod, Q, connected to feed-plate R and lever P. In order to reduce the motion of lever P upon the feed-plate R to the required quantity, the position of rod Q is made adjustable in lever P by means of screw *p*, whereby that end of rod Q which is connected to lever P may be placed nearer toward or farther from the fulcrum of lever P. The adjustable connections of lever P and rod Q may be made in any well-known and reliable manner; but I prefer the construction shown in the annexed drawings, Figs. 1, 2, 4, and 5, which is fully described in my application for heading-machines now in the office, filed July 7, 1886, bearing Serial No. 207,319. It consists, essentially, in the shouldered and threaded pin V, whereby rod Q and lever P are connected. Rod Q is jawed. The jaw has the width of lever P. Pin V is passed through a widened portion of the slot of lever P and through the jaw of rod Q. The pin, which is flattened the amount of the width of slot in lever P, (see Fig. 5,) is pushed up in the slot of said lever, and is held and fixed in position by a screw, *p*, which passes through the pin V. The screw *p* is locked in position by the lock-nut *p′*, and it is held against endwise motion by pin p^2, all arranged as shown in drawings, Figs. 4 and 5.

The feed-plate R is guided on the machine. It is provided with one or more channeled guideways, and guided and held in position by guide-bars *r* and *r′*, as shown in Fig. 3, both of which, or one at least, engages in this channeled guideway, securing linear motion to the feed-plate in the direction of the feed. (See Figs. 1, 2, and 3.) Upon the feed-plate is fastened a block, r^2, with interchangeable steel piece r^3. Between this steel piece r^3 and the pivoted pawl r^4 the wire is clamped and fed when the plate moves in the direction of the arrow, while the pawl slips over the wire, which is held in the dies for the formation of the nail-head, when the feed-plate moves in the opposite direction. This mode of feeding is not new. However, my construction embraces new features heretofore unknown.

The pawl r^4 is adjustable in a trunnioned block, r^5. This block r^5 is trunnioned on the feed-plate R, between the feed-plate R itself and a bracket, r^6. The pawl r^4 passes substantially through the center of the trunnion, and according to the length it is adjusted to it can be placed at any desired angle with the wire. The most favorable angle for the feed is the one a little short of a right angle, which can be obtained with ease. In this position the pawl will grip the wire eagerly. To prevent the pawl from cutting into the wire too deeply, and further prevent under the strain of feeding a movement of the pawl beyond the right angle with the wire, a shoulder, r^7, is provided on the feed-plate, (or cast on the bracket r^6, as shown in drawings,) which prevents the trunnion from too far a motion. A light spring, r^9, passing by the center of the trunnion, keeps the trunnion in position. On the other hand, when the pawl is to be disengaged from the wire, only a slight movement of the trunnion is required, which places the spring to the other side of the center of the trunnion, throwing the same against a second stop, r^8, where it remains until otherwise desired. One single motion fixes the pawl in either one or the other position. The arrangement possesses also the important advantage of throwing but a very small strain on the wire when the feed-plate goes backward in order to take a new grip, and this fact is highly important for barbed nails, which heretofore have not unfrequently been considerably shaven and practically ruined by the backward motion of the pawl.

Before the wire is gripped by the feed-pawl it goes through a straightener. I have shown the straightener in the accompanying drawings. It consists of two rows of grooved rollers. One row has stationary rollers *t*. The other row of rollers, *t′*, is mounted upon a slide, T′, which is guided much similar to a common slide-rest upon the stationary portions T of the straightening apparatus. The portion T′ can be moved by means of a screw, t^2, and handle t^3, whereby the relative positions of the two rows of rollers are fixed as required.

Previous to this invention it has been the practice to fix the movable rollers in position, each one separately, and to leave them thus when once fixed. The wire was bent between the rollers from above. This, however, is practically impossible for large sizes of wire, while any wire is unnecessarily bent and brought out of shape by the old mode of operation. In my machine I avoid this trouble by simply bringing the movable row of rollers far enough distant from the stationary row that the wire can be placed between the rollers conveniently, and then I advance the two rows of rollers by one single screw and operation by means of a crank, t^3. The two rows of rollers are not set parallel to each other, but diverge in the direction of the wire-feed. The movable slide T′, carrying the rollers *t′*, may be adjusted so that the wire in entering

between the two rows of rollers is first bent beyond the straight line, (the wire, being drawn stiff, is springy, and requires such treatment,) in order to take the initial curvature out. It is gradually bent less, and leaves the last roll perfectly straight. Accuracy is insured by bringing the slide T′ to bear against a stop, t^4, the adjustable set-screw insuring accuracy and variation for different kinds and thicknesses of wire.

Having thus described my invention, I claim—

1. In a wire-nail machine, the combination, with the reciprocating header, of toggle-links $l\ l'$ and levers D D′, as and for the purpose described.

2. In a wire-nail machine, the combination, with crank-shaft B, of connecting-link L, having knuckle k, header H, fitted to receive the knuckle k, straps $s\ s$, encircling the knuckle and attached to the header by bolts b', toggle-links $l\ l'$, and levers D D′, as and for the purpose described.

3. In a wire-nail machine, the combination, with the crank-shaft B, of cam I, lever G, and roller g, said cam I and roller g having cone-surfaces, as and for the purpose described.

4. In a wire-nail machine, the combination of the header H, links $l\ l'$, cutter-levers D D′, and means for operating said header, with a cam, substantially as described, operating working-lever P, rod Q, adjustable in lever P, and feed-plate R, substantially as and for the purpose described.

5. In a wire-nail machine, the feed-plate R, guided on the bed of the machine, provided with a trunnion feed-block, r^5, adjustable pawl r^4, passing substantially through the axis of the trunnion, spring r^9, stops r^7 and r^8, and stationary block r^3, as and for the purpose described.

6. In a wire-nail machine, the combination, with the main bed, of levers F F′, and springs S S′, pressing against said levers above the axis of the fulcrum of levers F F′, as and for the purpose described.

7. In a wire-nail machine, the straightening apparatus consisting of a common slide-rest, T T′, the portion T′ being movable upon portion T by screw t^2 and adjustable thereto by set-screw and stop t^4, each portion T and T′ carrying a row of rollers, t and t', respectively, as and for the purpose described.

8. In a wire-nail machine, a feed mechanism consisting of the following elements: cam O, as described, shielded yoke O′, slotted lever P, with threaded and shouldered pin V and screw p, rod Q, and sliding plate R, substantially as and for the purposes described.

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